Article

Empirical Modeling of Customer Satisfaction for E-Services in Cross-Border E-Commerce

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Abstract: This paper presents an empirical analysis of significant features of the e-service satisfaction model (ESM) as an important element of a sharing economy. Customer satisfaction is regarded as one determining factor in the success of businesses. Therefore, customer satisfaction is considered one of the most critical features that determine the success of activities conducted by online businesses for cross-border e-commerce. Therefore, companies essentially need to measure the interaction and satisfaction level of their customers to improve the performance of their business. In this study, we employed content validity, exploratory factor analysis, constructive testing, and cluster discrimination to examine the survey instrument and test the e-service satisfaction model (ESM) in the context of e-commerce. To ensure the validation of measurement models and the proposed instruments, structural equation modeling was applied through SPSS AMOS software. According to the results of our study, the presented survey instrument is a strong and reliable tool to create customer interaction in cross-border e-commerce by identifying the various key factors affecting customer satisfaction.

1. Introduction

Today, the Internet is recognized as an indispensable tool to transfer data and deliver products or services in relationships among different businesses or in their relationships with their customers. Technological information and communication developments (ICT) have encouraged organizations and individuals to move toward Internet-based relationships [1]. The Internet, as a communication tool, provides the ability to transfer any type of information in an environment that is almost friendly. Many businesses, today, employ the Internet as a favorable platform to present customer services. Customer satisfaction is highly emphasized in a great number of companies because of its critical role in the continuous improvement of businesses [2]. Therefore, it is necessary to consider and evaluate its accomplishment level. The performance of business processes in both product and service organizations is determined by customer satisfaction as one key factor [3].

Organizations can achieve their goals and objectives through reliance on customer satisfaction [4], since the future profitability of firms is highly dependent on their customer satisfaction. Customer satisfaction, as Chen [5] articulates, is one key factor that leads customers to repeat their experience in using an e-service. In addition, it is demonstrated [6] that it is more profitable to make current customers loyal in comparison to attracting new customers. Therefore, it can be concluded that customer satisfaction in using an e-customer is a key factor in achieving customer loyalty objectives [7]. Since customer satisfaction is one determinant factor to specify the failure or success of a business, antecedents and

outcomes of customer satisfaction [8], specifically in information systems [9,10], have been previously investigated in other studies. Customer satisfaction, as a multi-dimensional factor, comprises different aspects, such as technology, behavior, and marketing [1,11]. Businesses need to understand the needs of their customers and assign their resources to respond to those needs. In this case, organizations will be led toward continuous improvement [12]. Some instruments are, indeed, developed by scholars to evaluate users' satisfaction, relying on the features of the system and information [13–16]; however, there is still a necessity to develop tools to measure and analyze customer satisfaction [17]. In addition, despite the application of current tools for the assessment of web-based services, including e-commerce [18–20], there is still an increasing demand to modify existing instruments to provide more accurate tools [21]. However, a set of broadly accepted elements that lead to customer satisfaction is not still provided [22]. To evaluate the factors and processes that influence the success or failure of information technology and identify its value from the customers' perspective, various studies have been conducted on data warehousing [23], general computing [15], and decision support systems [24]. Based on the research by Hoffman and Bateson [25], customers share their experience of using an online service with nine other individuals; thus, one unsatisfactory experience can prevent other potential customers from using the e-commerce, which will eventually lead to the failure of the e-commerce.

Despite the significant importance of customer service satisfaction assessment, a specific and comprehensive method is not provided for managers of companies to measure it. For doing this, it is necessary to define terms such as customer satisfaction, identifying its dimensions and eventually the way of its conceptualization and measurement.

In this study, comprehensive exploratory analysis was employed to collect all the characteristics of customer satisfaction and adapt the comprehensive model of the e-service satisfaction model (ESM), while reviewing the theoretical base of customer satisfaction. The structure of this paper is as follows. The definition of customer satisfaction and its specifications are presented, and its dimensions are determined with the help of prior review articles in the first section. Then, the aspects of satisfaction and the related factors are determined through employing findings of researches that have been conducted on e-commerce users' satisfaction, aiming to develop a survey instrument to assess the customer satisfaction with e-commerce. These factors are then categorized and reduced using exploratory factor analysis. Finally, an e-commerce satisfaction survey is developed. E-commerce satisfaction experts analyzed the validity of the content survey, and exploratory factor analysis was employed to ensure the validity of the instrument through discriminate and constructive tests.

The most significant feature of the present study is to provide an integrated theoretical service instrument by considering a range of factors, such as distinctive features of electronic commerce, aspects of satisfaction about e-commerce, and features that are common in e-commerce and traditional commerce that influence e-commerce satisfaction and application of the ESM in the context of e-commerce as a subsection of e-service. Contrary to different definitions of satisfaction that have been previously presented in the field of information systems [5,13–17,26–31], this article defines satisfaction is as the extent of users' belief in meeting their needs and expectations.

2. Research Methods

The research process that was followed in the development of a survey to evaluate the user satisfaction with e-commerce is summarized in Figure 1. As this figure shows, a comprehensive literature review was initially needed for the extraction of different aspects of customer satisfaction. Then, some dimensions of the affecting factors that are reduced through a conceptual model and exploratory factor analysis (EFA) were proposed. An online survey questionnaire was developed for data collection. Moreover, the validity of the measurement instruments and correlations among variables were assessed by calculating Cronbach's alpha and Kaiser–Meyer–Olkin (KMO) indexes, respectively.

Along with adapting some items from the ESM survey, a comprehensive literature review was then undertaken with the purpose to extract items that already exist as different constructs of satisfaction in e-commerce, too. In the next step, to carry out the content validity of the survey, 12 experts [32–34] were recognized based on their experience in the e-commerce field to determine important measures that should be included in the ultimate questionnaire and remove items below the level of a content validity ratio (CVR) of 0.05. Then, by conducting a pilot study on 35 students, the response rate, heterogeneity, and understandability [35] of the questions were examined. Next, e-commerce users in Malaysia were chosen for data collection purposes through surveys, and Cronbach's alpha and KMO and Bartlett tests were carried out to measure reliability and sampling adequacy. Afterward, factor analysis was employed through PCA, aiming to evaluate discriminant and convergent validity (the construct validity). Structural equation modeling was then applied to carry out causal relations among different constructs and the credibility of the ESM model, and finally, the fit of the model was evaluated.
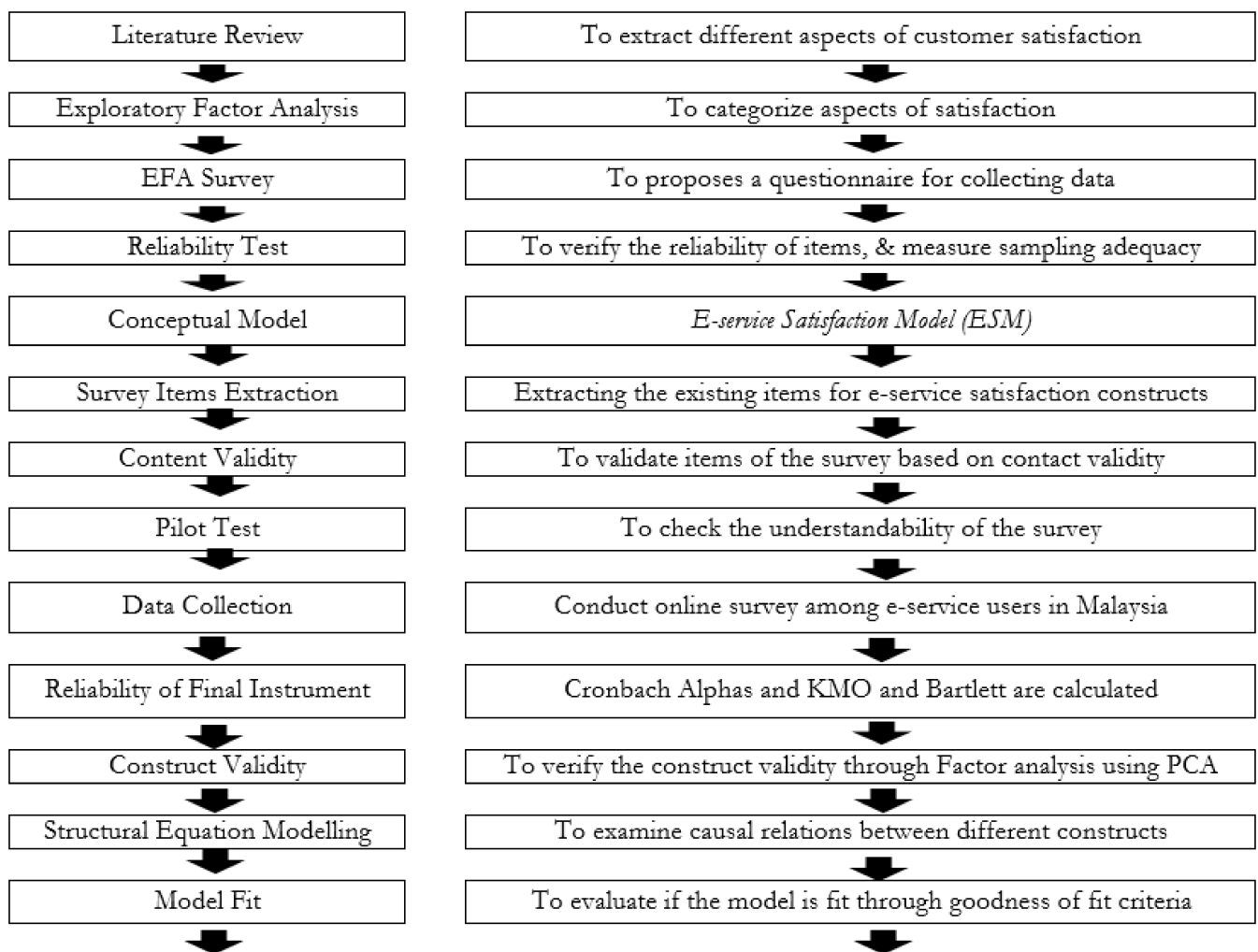
Literature Review	To extract different aspects of customer satisfaction
Exploratory Factor Analysis	To categorize aspects of satisfaction
EFA Survey	To proposes a questionnaire for collecting data
Reliability Test	To verify the reliability of items, & measure sampling adequacy
Conceptual Model	*E-service Satisfaction Model (ESM)*
Survey Items Extraction	Extracting the existing items for e-service satisfaction constructs
Content Validity	To validate items of the survey based on contact validity
Pilot Test	To check the understandability of the survey
Data Collection	Conduct online survey among e-service users in Malaysia
Reliability of Final Instrument	Cronbach Alphas and KMO and Bartlett are calculated
Construct Validity	To verify the construct validity through Factor analysis using PCA
Structural Equation Modelling	To examine causal relations between different constructs
Model Fit	To evaluate if the model is fit through goodness of fit criteria

Figure 1. Research process for survey development.

Due to the change in the channel of communication from human–human interaction in traditional services to human–machine interaction in the e-service [36] and people's shopping behavior, it is necessary to introduce a new measurement method to measure customer satisfaction.

Accuracy, accessibility, adequacy, assurance, assistance, availability, attentiveness, communication, completeness, commitment, credibility, convenience, efficiency, delivery,

currency, ease of use, expectation, format, flexibility, integration, fulfillment, product information, price, precision, product offerings, relevancy, quality, reliability, user-friendliness, security, accountability, pace, training, timeliness, website design, and usefulness are 36 aspects that have been previously extracted from reviewing the comprehensive literature in the information systems field [37–43]. Thus, EFA [44,45], which is mainly recognized as a procedure to generate theory, is employed, aiming to lessen the number of main aspects by identifying the basic factors that illustrate the majority of variance [46].

Since the questionnaire is highly flexible [47], this instrument was used for data collection, and students with knowledge related to the field of study were selected for the online survey. According to previous studies [48–50], students are well suited for research related to e-services and e-commerce since they use technology more in comparison to the older generation, and also, the Internet is regarded as an essential part of their routine life.

According to Hair's study [51], the size of the sample that is determined for EFA should be around 100 or greater. This study filtered data and eliminated invalid answers from 205 questionnaires obtained; likewise, the size of the sample was mainly chosen by a group of researchers [52,53]. A 5-point Likert scale that includes a range of strongly disagree, disagree, neutral, agree, and strongly agree was considered for each item of the survey [54].

The reliability of a measurement instrument should be evaluated to ensure its consistency across different parts [55], and in the case of using the Likert scale, the most appropriate criteria are Cronbach's alpha. In this paper, Cronbach's alpha classification suggested by Nunnally [56] was used in the analysis. According to this classification, Cronbach's alpha values from 0.80 to 0.95, 0.70 to 0.80, and, subsequently, 0.60 to 0.70 are labeled as very good, good, and fair in reliability, respectively. The value of Cronbach's alpha in our study ranged from 0.931 to 0.941. Thus, it can be concluded that the measuring instrument is reliable.

According to Leech's study [57], the value of KMO criteria should be greater than 0.7. According to our result, the KMO measure was 0.831. Therefore, many variables have a common degree of variance. Then, the number of factors for retaining should be determined for investigation. For doing this, a criterion named Kaiser [58] that is highly preferable because of its ease of use [59,60] was employed and relevant factors with eigenvalues greater than 1 were chosen. Consequently, eight constructs were retained, which is in accordance with constructs of E-Service Satisfaction Model.

In addition, due to the high value of the first dimension (performance), it is essential to examine the common method variance (CMV). According to our results in using SPSS, only in one factor, a total variance explained of 29.26% was calculated. Based on the study by Podsakoff and MacKenzie [61], in the case of the total variance having a value less than 50%, no CMV problem will be witnessed within factors. Then, the varimax rotation method [62] for EFA was used, and based on the obtained results, 12 items were eliminated. It should be noted that the loading factor value of 0.4 is the threshold that is recommended for studies in information systems [63,64], and cross-loading that is greater than 0.4 in value is omitted [65,66].

3. Customer Satisfaction Measurement Development

The conceptual model of e-service satisfaction [41] that was applied in the context of e-commerce is shown in Figure 2. To extract different items that form the constructs of an e-service satisfaction model and to develop the proposed survey, a comprehensive literature review was performed.
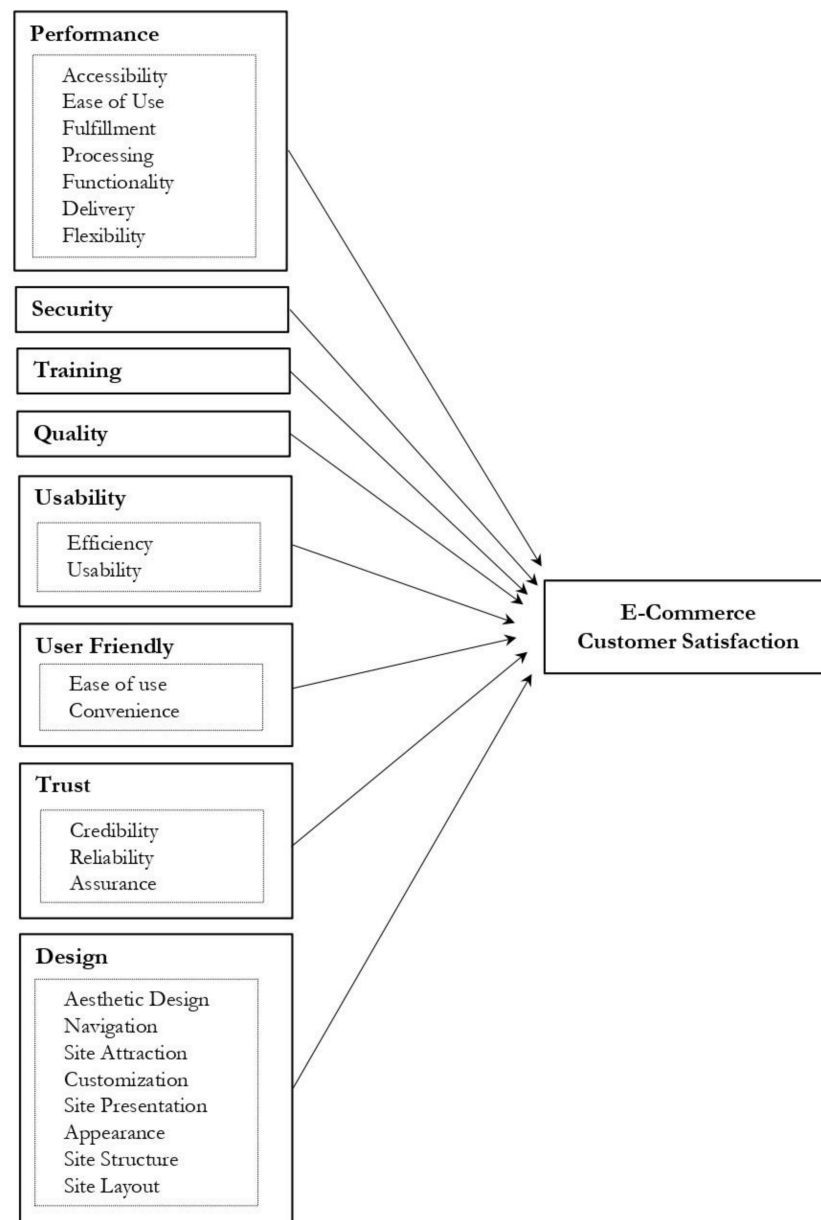
Figure 2. E-service satisfaction model (ESM).

4. Content Validity Test

Based on the literature review, 175 items were extracted for eight e-commerce satisfaction constructs. Then, a questionnaire to validate content that included how these constructs were defined originally and items associated on a 3-point scale was generated and sent to 12 experts [33,34], and their answers were collected. According to our results for the CVR of each item, only 33 items eventually remained to be included in the final survey at the level of 0.05. In addition, it was suggested by experts to use a 7-point scale to examine whether the proposed instrument is valid, since its values are broadly spread compared to the 5-point scale. A 7-point scale also offers a more subjective selection for respondents [54].

5. Pilot Study and Data Collection

By conducting a pilot study on 35 postgraduate students in Malaysia [67], the response rate, heterogeneity, and understandability of the questions were examined. Based on the answers of the majority of the students, the questionnaire was easy to understand and

15–20 min was enough to complete it. To collect data, the survey website was presented to 2075 users of e-service in Malaysia. The response rate was around 18.5%, which was close to the one of Abreu and Oliveira [68] (16%), Taherdoost and Madanchian [41], and Fryrear [69]. After eliminating improper responses, to investigate the effect of the nonresponse bias on the results, the data that were collected using the questionnaire were divided into two main categories, early and late responses (50 responses were considered to be early, and the remaining 50 responses were considered to be late) [70]. The mean and standard deviation for the first 50 responses were, respectively, 3.9833 and 0.513 and for the last 50 responses, 3.9863 and 0.486, respectively. The T-test between groups was 0.119 for the sign of 0.741. The data that were collected from the sample can be generalized to the broader population. It should be noted that according to the collected data about the demographic information of participants, the majority of the respondents were female (58% females compared to 42% males). In addition, the age range of the participants was as follows: half the participants were aged 20–29 years and labeled as the young generation, and one-third of the respondents were aged 30–39 years. All respondents were e-commerce users at least once, and two-thirds of the respondents were using e-commerce more than once daily. Furthermore, almost half of the respondents were those users who have been dependent on using e-commerce for different purposes for more than 5 years.

6. Reliability Assessment

Cronbach's alpha is regarded as the fittest measure to evaluate reliability, and its values are shown in Table 1 [71]. According to the results for the Cronbach's alpha range (0.921 to 0.927), the constructs have good reliability. In addition, based on the results of the KMO and Bartlett tests that were employed to investigate the adequacy of sampling, the value of KMO was 0.872. Thus, its value was greater than 0.60, which is mainly regarded as the conventional cut-off point, and the Bartlett test showed a significant value. Therefore, the observed correlations between variables were mutual in terms of their variance, and it seems that data were properly factored.

The results of the PCA applied with SPSS software version 25 showed that the eigenvalues of all nine factors were greater than 1. This was also supported by the Scree test. As shown in Figure 3, the curve of the line ended at the ninth factor, and it was evident on the Scree plot [66]. Therefore, according to a study that was conducted by Straub and Gefen [63], all factors should be considered for further analysis. In addition, any extracted new factor that consists of an eigenvalue greater than 1 is not included in the analysis.
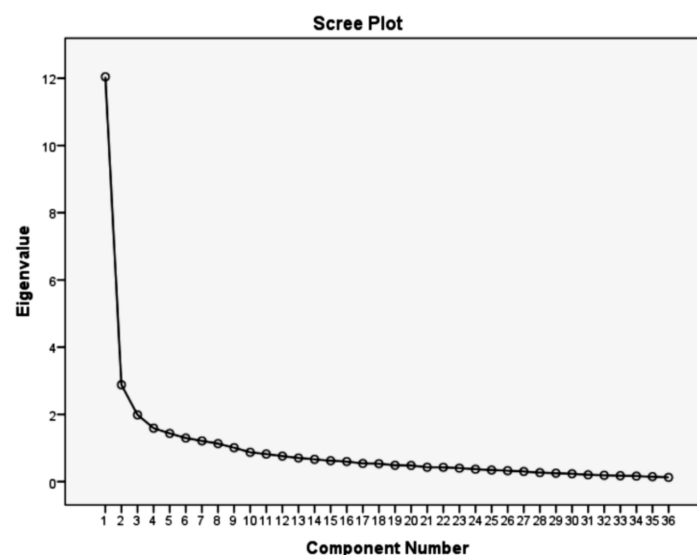

Figure 3. Scree plot.

Table 1. Statistics for the final e-commerce satisfaction survey.

	Scale Mean	Scale Variance	Squared M-Correlation	Cronbach's Alpha if Item Deleted
UserFriendly 1	116.44	261.409	0.193	0.923
UserFriendly 2	116.43	261.699	0.264	0.923
UserFriendly 3	116.49	262.273	0.188	0.923
Performance 1	116.45	256.319	0.311	0.924
Performance 2	116.33	252.945	0.442	0.922
Performance 3	116.32	255.285	0.356	0.922
Performance 4	116.35	254.171	0.463	0.922
Performance 5	116.34	254.534	0.426	0.921
Performance 6	116.28	252.549	0.425	0.921
Performance 7	116.22	257.051	0.328	0.923
Quality 1	116.57	257.694	0.317	0.922
Quality 2	116.63	260.483	0.253	0.923
Quality 3	116.62	261.325	0.213	0.923
Security 1	116.57	260.294	0.257	0.922
Security 2	116.62	262.004	0.266	0.922
Security 3	116.65	261.116	0.307	0.923
Security 4	116.59	262.167	0.219	0.923
Training 1	116.29	264.436	0.073	0.926
Training 2	116.35	264.855	0.071	0.926
Trust 1	115.93	268.056	0.063	0.927
Trust 2	115.93	268.999	0.049	0.927
Trust 3	116.16	271.136	0.018	0.927
Usability 1	116.48	260.362	0.263	0.923
Usability 2	116.44	259.115	0.288	0.923
Usability 3	116.51	258.282	0.317	0.922
Usability 4	116.49	259.942	0.235	0.922
Design 1	116.22	255.828	0.338	0.922
Design 2	116.22	255.994	0.311	0.923
Design 3	116.22	254.585	0.368	0.921
Design 4	116.33	257.123	0.241	0.922
Satisfaction 1	116.57	260.592	0.333	0.923
Satisfaction 2	116.61	258.597	0.440	0.921
Satisfaction 3	116.58	259.819	0.403	0.921

The loadings factor for all nine factors is presented in Table 2. Due to the loading factor being above 0.40, all nine components remained in the survey instrument, and the baseline criteria in research in the field of information systems are met by both discriminant and convergent validity.

Table 2. Final survey evaluation through rotated component matrix.

	Component								
	1	2	3	4	5	6	7	8	9
UserFriendly 1						0.876			
UserFriendly 2						0.771			
UserFriendly 3						0.836			
Performance 1	0.763								
Performance 2	0.841								
Performance 3	0.811								
Performance 4	0.817								
Performance 5	0.829								
Performance 6	0.796								
Performance 7	0.848								

Table 2. *Cont.*

	Component								
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
Quality 1								0.766	
Quality 2								0.775	
Quality 3								0.829	
Security1			0.772						
Security2			0.832						
Security3			0.747						
Security4			0.779						
Training 1									0.925
Training 2									0.919
Trust 1					0.938				
Trust 2					0.942				
Trust 3					0.891				
Usability 1		0.859							
Usability 2		0.792							
Usability 3		0.872							
Usability 4		0.816							
Design 1				0.783					
Design 2				0.705					
Design 3				0.785					
Design 4				0.833					
Satisfaction 1							0.737		
Satisfaction 2							0.777		
Satisfaction 3							0.784		

7. Validating the E-Service Satisfaction Model

To test the conceptual model, SEM, a second-generation multivariate modeling technique, was applied. The procedure has two important characteristics: illustration of the common processes that are investigated after a range of structural equations (i.e., regression) and modeling of those relationships to provide a more obvious conception of the theory. In addition, confirmatory factor analysis and path analysis were integrated [72] to form SEM, which, in turn, performed multiple regression analyses and evaluated whether the model is fit by relying on statistical methods, such as the chi-square test [73]. Furthermore, to provide a better judgment about the model's fit, there were several goodness-of-fit indexes. In addition, path analysis was employed using SPSS AMOS version 24 to evaluate and test the proposed model.

Analyzing the results of CFA led to a dataset that was used in this case, aiming to fit the structural equation model with the values of the sample. Figure 4 shows the output of analyzing the structural equation modeling using SPSS AMOS version 24.

Based on the estimated path coefficients, customer satisfaction affects all aspects positively. The coefficients of training, performance, user-friendliness, trust, usability, security, quality, and design were all significant.

Table 3 shows the value of the composite reliability of all the constructs that were employed for the assessment of the measurement model. It can be concluded from the results that the value of this parameter for all constructs is higher than the level proposed by Chin [74], which is 0.7. In addition, discriminant validity and convergent validity were verified by the variance that was extracted in average, and its value was more than 0.5 suggested by Fornell and Larcker [75] and through the cross-loads measure, the factor load is greater compare to other constructs.
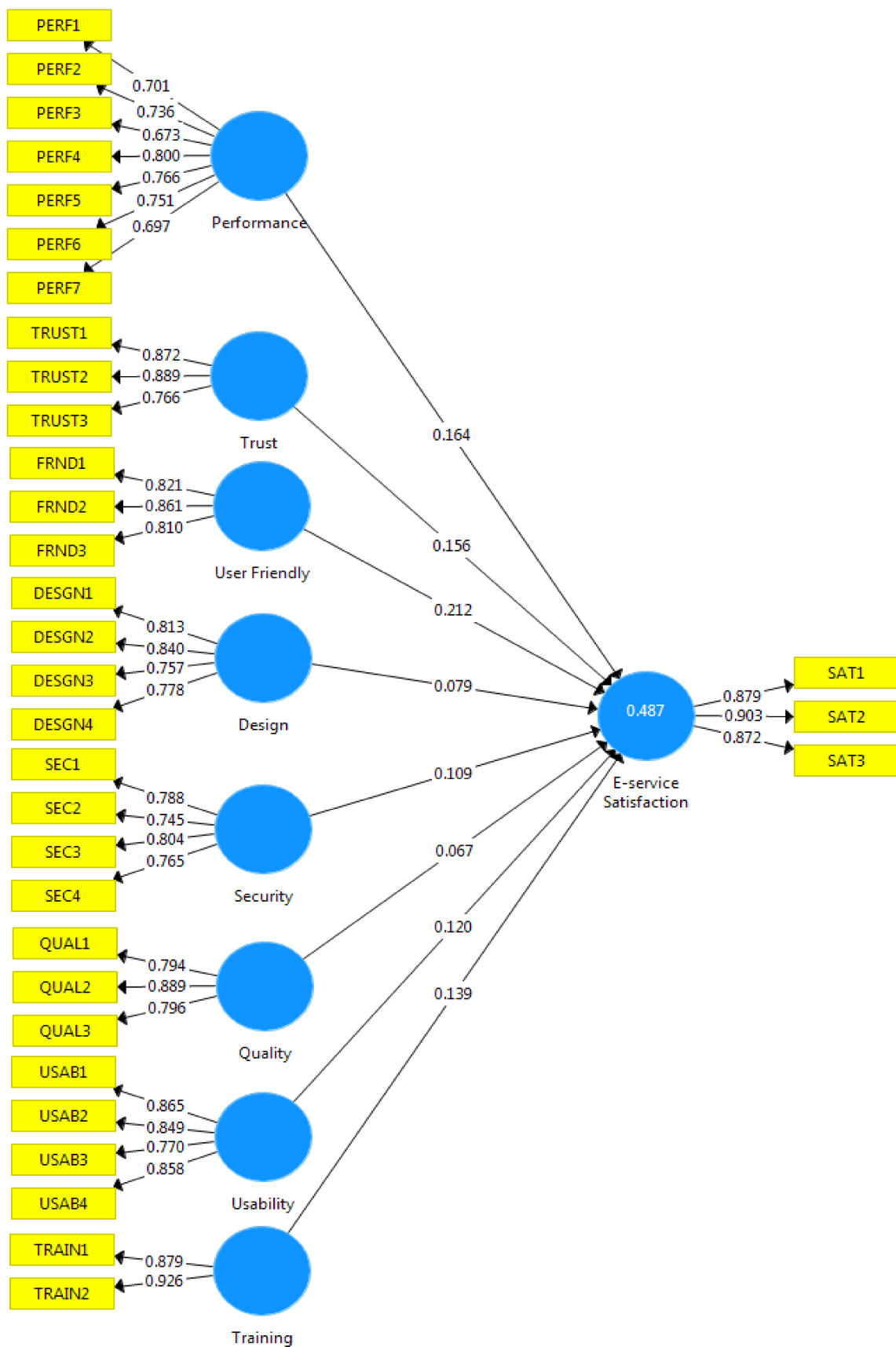
Figure 4. Results of structural equation modeling for the model.

Table 3. Summarized statistics of reliability.

	Cronbach's Alpha	Reliability	Variance Ext. in Average
Appearance and design	0.888	0.852	0.603
E-commerce satisfaction	0.882	0.834	0.586
Performance	0.941	0.933	0.654
Quality	0.863	0.854	0.632
Security	0.851	0.876	0.623
Training	0.846	0.909	0.853
Trust	0.896	0.938	0.848
Usability	0.916	0.943	0.696
User-friendliness	0.874	0.898	0.692

Furthermore, the goodness-of-fit index (GFI) and the adjusted goodness-of-fit index (AGFI) were both calculated to identify the overall degree of the model fit. The calculated values were 0.91 and 0.87, respectively. According to previous studies, these values should be greater than 0.90 [76] and preferably greater than 0.80 [77], respectively. Thus, the model fit on the sample data is acceptable. However, the value of the normed fit index (NFI), which hat is a measure of the fit for the suggested model versus the null model [78], and the comparative fit index (CFI), as a criterion of the overall fit [79] of our model, were 0.92 and 0.97, respectively. Thus, due to the higher values compared with the recommended thresholds (0.9 for both indexes presented by Fornell and Larcker [75] and Bentler [80], respectively), the proposed model is completely reliable. Table 4 summarizes the results of the model fit.

Table 4. E-service satisfaction model fit results.

Criteria	Acceptable Value	Obtained Value
Goodness-of-fit index (GFI)	>0.90	0.91
Adjusted goodness-of-fit index (AGFI)	>0.80	0.87
Normed fit index (NFI)	>0.90	0.92
Comparative fit index (CFI)	>0.90	0.97

8. Discussion and Recommendations

In this paper, the definition of customer satisfaction and its specifications were presented and its dimensions were determined with the help of previous review articles. Then, the aspects of satisfaction and the related factors were used based on the findings on e-commerce and e-service satisfaction in different studies to form a survey instrument that is practical for the evaluation of customer satisfaction with e-commerce. To achieve this, 36 aspects of customer satisfaction were extracted from studies that were previously conducted in the information systems field, and then, their aspects were categorized and reduced using exploratory factor analysis. Consequently, eight main factors were determined as constructs to measure how customers are satisfied with e-commerce, as articulated in ESM [41]. As a result, an e-commerce satisfaction survey was developed. For this purpose, related items for each factor were investigated through a literature review, a new questionnaire was created, 12 experts helped to validate the content of the survey, the content-validity survey was conducted with the aid of 12 experts, the statistical significance level to calculate CVR was considered as 0.05, Cronbach's alpha was calculated since it is considered the fittest internal consistency measure, factor analysis was performed since it is regarded as a statistical method to verify the construct validity by using principal component analysis with the method of varimax rotation, and subsequently structural equation modeling and path analysis were applied with the aid of SPSS AMOS version 24. The final survey instrument after performing the above-mentioned steps comprised solely 28 main items. In addition, it was approved that eight constructs, namely training, performance, user-friendliness, trust, usability, security, quality, and design, have a direct and significant influence on e-commerce satisfaction.

With the rapid improvement of e-commerce, customer satisfaction has been introduced as an important managerial aspect that needs to be assessed by the service provider in customers' behavior [81]. Performance that includes delivery, flexibility, availability, ease of use, fulfillment, processing, and being functional in practice; trust that mainly includes reliability, assurance, and credibility; usability that comprises web usability and efficiency; user-friendliness that is originally made of convenience and ease of use; a design that includes aesthetic design, navigation, customization, the appearance of the website, site attraction, site presentation, and layout and structure; security; quality and training are the most critical characteristics that determine the level of e-commerce satisfaction and that should be considered to offer a higher level of customer satisfaction with e-commerce. Findings indicated that performance, trust, usability, user-friendliness, design, training, security, and quality are the most important characteristics of e-commerce satisfaction that should be taken into consideration in order to have high customer satisfaction with e-commerce. Therefore, the e-service satisfaction model (ESM), which is presented in Figure 2, was verified and approved through a systematic statistical procedure and can be applied to evaluate customer satisfaction with e-commerce and e-service environments. However, the e-service satisfaction model (ESM) could be considered for the evaluation and assessment of customer satisfaction in other electronic version services, too, including e-banking, e-business, e-ticketing, e-gaming, and e-finance.

Although the conclusions of this research may be more attractive for service-centered firms, IT experts, e-service users, and other audiences can also find suitable information in sub-clusters of each section to assess service maturity. Therefore, identifying the customer expectation and filling the gaps will help to identify the level of customer satisfaction, and the findings of this research will be helpful for e-service policymakers as well as its users to improve customer satisfaction. The findings of this research lead to a platform that is beneficial for e-commerce providers to understand how to satisfy e-commerce users. The generated knowledge can be used by e-commerce service providers as a platform for how to increase the customer satisfaction with their service. Although attracting new customers is crucial for all marketing and sales managers, in some cases, strategies to make loyal and regular customers receive more attention among researchers and practitioners because the cost is one-fifth [82]. With careful strategy implementation by policymakers, agencies, and system developers, high-quality and secure e-services can be successfully implemented to increase customer satisfaction [41].

For future studies, it is suggested that this study be performed in other countries, since it was limitedly conducted in Malaysia. In addition, it is recommended that this study be conducted with a larger sample size in order to provide more reliable statistical findings.

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