Research on Customer Satisfaction Measurement of Online Tourism Platform Based on Value Chain- Take Company X for example

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Abstract. With the vigorous development of the economy and Internet, improving customer satisfaction has become an important issue faced by online tourism platform providers. How to scientifically evaluate customer satisfaction is the key factor to accurately define the impact of customer satisfaction, and also the premise and basis to effectively improve customer satisfaction. This paper decomposes the value chain of Online Travel Agency (OTA) and constructs OTA customer satisfaction model from the perspective of OTA value chain activities. According to the characteristics of OTA value chain flow; this paper puts forward OTA customer satisfaction measurement scale, and takes Company X as an example to make an empirical analysis. Entropy weight method calculates the weight of all levels of indicators. Fuzzy comprehensive evaluation method is used to determine the level of customer satisfaction of all levels of indicators. Through the analysis of empirical results, countermeasures and suggestions are put forward to improve the overall service quality of OTA and customer satisfaction, which can provide reference for the service quality of online tourism industry in China.

1. Introduction
With the stable development of the national economy, the number of resident tourists has increased year by year. The index of domestic residents’ travel capacity reached 17.8% in the whole year of 2018\cite{1}. Online tourism has become an indispensable part of modern residents’ life. According to the statistics of China Tourism Research Institute, the number of domestic tourists in 2018 was 5.539 billion, up 10.8% from the same period last year; the total number of inbound and outbound tourists was 291 million, up 7.8% from the same period last year. With the rapid development of tourism industry, along with the Internet tide, online tourism platform as a new service mode has also developed rapidly. In 2017, 334 million users used the Internet platform to purchase tickets, book hotels and order and group tours, which is 11.5% increase over the end of 2016. Therefore, Online Travel Agency (OTA) has a huge space for growth. However, in recent years, many online tourism enterprises have received more and more complaints because of bundling sales, deceiving consumers, false propaganda and other acts, customer satisfaction has been declining and the reputation of online tourism enterprises have declined. These reasons have affected the stable development of the tourism market, and even brought negative effects to the online tourism industry and the whole tourism industry.

Therefore, this paper is to integrate customer satisfaction theory and value chain theory into online tourism platform satisfaction evaluation, construct online tourism platform customer satisfaction
evaluation system, explore key indicators, which affect OTA enterprise customer satisfaction, and provide relevant policy recommendations to strengthen enterprise competitiveness.

2. Theoretical basis and the value chain analysis of online tourism platform

2.1. Theoretical Basis of Customer Satisfaction Evaluation on Online Tourism Platform

With the rapid development of tourism industry and the rise of the Internet, as a new service way, online tourism platform has also developed rapidly, which also triggers scholars to discuss the quality of electronic services in tourism industry and customer satisfaction.

Oliver believed that the essence of customer satisfaction is a subjective feeling. When customers are provided with services beyond their expectations, they will be satisfied [2]. Kim, W. G., Lee, H. Y. believed that online tourism platform can affect customer satisfaction, mainly because of the integrity and timeliness of website information, the security of website construction, the beauty of website, the convenience of website use, and whether the website can help customers solve problems [2]. In addition, Mills and Morrison, Chi-Shiun Lai and Ho, C.I., Lee, Y.L also put forward the factors of customer satisfaction of online tourism platform from different aspects [4-6]. According to S-O-R theory and structural equation model. Lai Lingling and Peng Lifang used factor analysis to determine the weight level of indicators at all levels, and finally reached the conclusion that the factors affecting customer satisfaction of online tourism platform mainly include: platform reliability, information reliability, reflective speed, ease of use, interactive ability and targeted service level [7].

The current research on OTA customer satisfaction evaluation is mainly focused on customer's own use experience, and seldom analyses the factors of customer satisfaction from the perspective of enterprise's overall value flow comprehensively. Customer satisfaction is the ultimate effect of enterprise value chain operation and value transfer. Therefore, it is necessary to systematically put forward the influence factors of customer satisfaction based on the overall flow analysis of enterprise value chain [8]. As an internet tourism service platform, OTA can not only provide customers with hotel booking, ticket booking, travel route inquiry and sharing travel experience and other tourism services [9], but also build an information sharing platform for tourism service enterprises, tourism product suppliers and final customers directly. Therefore, from the perspective of value chain, this paper will have an in-depth analysis on the influence factors of OTA customer satisfaction and use scientific methods to evaluate systematically.

2.2. Value chain analysis of online tourism platform

According to the characteristics of online tourism service industry and the unique internal operation mode of online tourism platform, this paper deconstructs the internal value chain of OTA platform and summarizes a suitable internal value chain for OTA platform; check the details in Table 1. In the internal value chain of online tourism platform, marketing activities, production, operation and service activities are closely related to customers, and their quality directly affects the feeling of customers. Purchasing activities and technology development activities also have a far-reaching impact on customer satisfaction.

| Table 1. Internal value chain activities of OTA |
|-----------------------------------------------|
| **Support activities** | **purchase** | Purchasing Hotel Services, Tourism Products, Traffic Tickets |
| Procurement, Travel Agency Service Procurement |
| Technical development | Search engine design optimization, platform design optimization, precision marketing based on large data, platform security and stability optimization |
| Human resource | Training and Assessment of Employees in Enterprises |
| Foundation facilities | Technical Facilities、Laws and Regulations, Financial Accounting, Network Reservation Platform |
### Internal Value Chain of OTA Platform

The internal value chain of OTA platform is a closed loop, which is formed by "internal R&D, product procurement, marketing, after-sales service, internal R&D". First of all, the platform analyze customer buying behaviour through big data, field survey and other ways, and design a suitable product mix for users according to customer demand. Purchase from upstream suppliers according to the product plan. The products on the platform are displayed in the scope of customers’ sight through various marketing means, which plays a promoting role in realizing the transfer of products to customers. According to customer feedback, product improvement and internal R&D activities are carried out again.

### 3. Establishment of OTA Customer Satisfaction Evaluation Index System

According to the related theory of customer satisfaction research, this paper argues that the SERVQUAL service quality assessment scale proposed by PZB (1988) has wide applicability and is suitable for service industry satisfaction assessment. Therefore, this paper intends to improve on this basis, and put forward a satisfaction scale suitable for OTA platform.

#### 3.1. Preliminary Establishment of OTA Customer Satisfaction Index System

This paper constructs a customer satisfaction evaluation index system from the perspective of industrial value chain and internal value chain, as shown in Figure 1. Firstly, it constructs a first-level index based on industrial value chain theory and a second-level index based on internal value chain theory. The dimension of industrial value chain affects customer satisfaction mainly including five related services: online tourism platform service, traffic ticketing service, Hotel service, tourist attractions service, travel agency service and so on. Among them, marketing activities, production and operation activities, technology development activities, internal service activities and purchasing activities between suppliers are the main activities that affect customer satisfaction.

![Figure 1. Key Activities Affecting Customer Satisfaction of OTA](image-url)
3.2. Refinement and determination of OTA customer satisfaction index system
According to the key value chain activities of OTA affecting customer satisfaction, this chapter divides the customer evaluation system of OTA into five levels. Each level has secondary indicators. The setting of secondary indicators refers to SERVQUAL service quality measurement model and six elements theory of tourism. Check the details in following Table 2.

Table 2. OTA Customer’s Satisfaction Assessment Scale

| Target Layer | First-level indicator | Secondary indicator | Tertiary indicator |
|--------------|-----------------------|---------------------|-------------------|
| Online tourism platform Service U1 | Safety Y1 | Property security | Privacy Security Y12 |
|  | Informatics quality Y2 | Accuracy of product information Y21 | Timeliness of product information Y22 |
|  |  | Comprehensibility of website information Y23 |
| Responsibility Y3 | Event processing speed Y31 | Service website responds fast Y32 |
|  | Usability Y4 | Clear navigation Y41 | Time-saving online trading Y42 |
|  |  | Convenience of Service Reservation Change |
|  | Empathic Y5 | Attitude of Customer Service Staff Y51 |
|  |  | Satisfaction of problem-solving results Y52 |
| Tangible Y6 | Beautiful design of website Y61 | Rich content of the products provided by website Y62 |
| Reliability Y7 | The website transaction system runs steadily Y71 |
|  | Platform can provide services at the promised time Y72 |
| Traffic Ticketing Service U2 | Ticket grabbing rate Y8 | The success rate of ticket grabbing is acceptable. Y81 |
|  | Richness Y9 | The platform provides a wide range of tickets |
|  | Price Y10 | Volatility of Ticket Price Y101 |
|  |  | Rationality of Ticket Price Y102 |
| Hotel Service U3 | Tangible Y11 | Hotel hygiene cleanliness Y111 |
|  |  | The hotel has modern equipment Y112 |
|  | Reliability Y12 | Be able to provide services at the promised time Y121 |
|  | Responsibility Y13 | Hotel staff can provide timely service Y131 |
|  |  | Hotel staff will accurately inform when to provide service Y132 |
|  | Guaranteed Y14 | The behaviour of hotel staff can provide customers with confidence Y141 |
|  |  | During the rest of the hotel, customers feel safe Y142 |
|  | Empathic Y15 | Hotel attendants provide individual care Y151 |
|  |  | Hotel attendants understand individual needs Y152 |
| Tourist scenic spots service U4 | Scenic spots Y16 | Whether it has ornamental value Y161 |
|  |  | Reasonable ticket prices Y162 |
|  | Catering Y17 | Dining environment health Y171 |
|  |  | Reasonable price Y171 |
|  | Transportation Y18 | Convenient transportation Y181 |
|  | Entertainment | Rich entertainment facilities Y191 |
4. Calculating method of customer satisfaction index system based on OTA of value chain

4.1. Entropy weight method
The determination methods of index weight are divided into subjective weighting method and objective weighting method. Subjective weighting method includes expert scoring method, AHP hierarchical analysis method, and objective weighting method includes principal component analysis method, entropy weight method, etc. This paper argues that objective empowerment method can directly determine the weight of indicators at all levels based on questionnaire data, and eliminate the interference of subjective factors. Therefore, this paper uses the entropy weight method to determine the weight level of OTA customer satisfaction index system at all levels. The calculation steps of the entropy weight method are as follows:

- **Data standardization**: Assuming that there are m evaluation objects, n evaluation indexes, and the evaluation index values of each evaluation object form a matrix \( X = \begin{bmatrix} x_{11} & \cdots & x_{1n} \\
\vdots & \ddots & \vdots \\
x_{m1} & \cdots & x_{mn} \end{bmatrix} \), \( X_j \) represents the jth evaluation index value of the ith evaluation object, \( X_i = \{x_{i1}, x_{i2}, x_{i3}, \ldots, x_{in}\} \). The value of each index data after standardization is set.

\[
Y_j = \frac{X_{ij} - \min(X_j)}{\max(X_j) - \min(X_j)} \quad (4.1)
\]

- Calculate the entropy values of the indicators at all levels: Let \( p_{ij} = Y_j \div \sum_{i=1}^{n} Y_j \), if \( p_{ij} = 0 \), then define \( \lim_{p_{ij}\to 0} \ln p_{ij} = 0 \), then the entropy of a set of data is:

\[
E_i = -\ln(n)^{-1} \sum_{j=1}^{n} p_{ij} \ln p_{ij} \quad (4.2)
\]

- Calculate the weights of indicators at all levels: Calculating the entropy value of indicators at all levels \( E_1, E_2, E_3, \ldots, E_k \), then the index weight at all levels

\[
w_i = \frac{1-E_i}{k-\sum E_i} (i = 1, 2, \ldots, k) \quad (4.3)
\]
4.2. Fuzzy comprehensive evaluation method

Based on the principle of fuzzy mathematics and maximum membership degree, the method of fuzzy comprehensive evaluation can transform the unrelated fuzzy factors into evaluation vectors, which is helpful for quantitative analysis of the impact of evaluation index system. The calculation steps are as follows.

- Firstly, determine the evaluation set \( U = \{u_1, u_2, \cdots, u_p\} \), \( U_i (i = 1, 2, \cdots, p) \) to indicate the evaluation indicators at each level.
- Establish language standard set \( V = \{v_1, v_2, \cdots, v_p\} \), \( V_i (i = 1, 2, \cdots, p) \), to indicate the standards at each level.
- Establish Fuzzy Relation Matrix

After establishing the standard set, the evaluation indexes are quantified from each factor \( U = \{u_1, u_2, \cdots, u_p\} \), \( U_i (i = 1, 2, \cdots, p) \), and then establishes the fuzzy relation matrix.

Determine the Weight Vector of Evaluation Factor; Determine weight vector based on entropy weight method; Determine fuzzy comprehensive evaluation vector.

Multiply the weight vector \( W \) and each evaluated object \( R \), and obtain the evaluation vectors of each evaluation index, in which the degree of membership of the pairs is indicated.

The evaluation result vector \( B \) is:

\[
B = W \times R = (w_1, w_2, w_3, \cdots, w_R) \times \begin{bmatrix}
\hat{r}_{11} & \hat{r}_{12} & \cdots & \hat{r}_{1m} \\
\hat{r}_{21} & \hat{r}_{22} & \cdots & \hat{r}_{2m} \\
\vdots & \vdots & \ddots & \vdots \\
\hat{r}_{p1} & \hat{r}_{p2} & \cdots & \hat{r}_{pm}
\end{bmatrix}
\]

Comprehensive evaluation

\[
E_i = B \times H^T
\]

Among them, \( H = (1, 2, 3, 4, 5) \) represents dissatisfied, less satisfied, generally satisfied, very satisfied. \( E_i \) represents the customer satisfaction score of the first indicator.

5. Empirical analysis- Take company X for example

5.1. Background information of company X

Company X has branches in 96 cities in China and 21 cities abroad. Its business scope covers three places across the Straits, India, North America, Southeast Asia, etc. It has cooperative relations with 200 countries, nearly 800,000 hotels around the world. Company X’s service system is very advanced; it includes booking overseas hotel service system, booking ticket system, customer service system, hotel room quantity control system, order processing system and so on. Now the company X’s various businesses are in the leading position in the industry, it is the most comprehensive service function, the largest company.

5.2. Questionnaire design and data collection

This questionnaire is divided into two parts, basic information of the respondents and the evaluation of customer satisfaction. With regard to customer satisfaction evaluation, this paper transforms 26 secondary indicators into 50 items which are easy to be understood by the respondents. The Level 5 Lickert Scale is used to measure the satisfaction level of the respondents with the services provided by Company X. 1, 2, 3, 4 and 5 respectively express "very dissatisfied, not satisfied, general, satisfied, very satisfied". A total of 197 questionnaires are collected, and 30 paper questionnaires are retrieved. 43 invalid questionnaires are removed. The actual effective questionnaires are 184.
5.3. Questionnaire test

5.3.1. Reliability analysis
In order to test the rationality and validity of the questionnaire, the reliability of the questionnaire was tested according to Cranach's Alpha coefficient. According to the reliability analysis results of this paper, the overall coefficient and the five dimensions coefficient of the questionnaire are all more than 0.9, which shows that the internal consistency and overall reliability of the questionnaire are relatively high, and the next test can be carried out.

5.3.2. Validity analysis
Firstly, the design of this scale is improved on the basis of SERVQUAL scale, the scale is widely used in many scholars' research. Therefore, the scale in this paper has good content validity. In addition, the KMO value of the questionnaire is more than 0.9, the cumulative variance of the main factors is 71.11%. This shows that the questionnaire’s validity level is good.

5.4. Calculation and analysis of customer satisfaction index

5.4.1. Determining Index Weight Based on Entropy Weight Method
Firstly, the entropy value of each index is calculated according to formula (3.1) - (3.2), and the weight of each index is calculated according to formula (3.3). The importance of the first-level indicators ranks from high to low as U2 (29.05%), U3 (20.95%), U5 (18.62%), U1 (18.25%) and U4 (13.11%). As we all know, U2 and U3 are the main profit sources of OTA, which are the main purposes of customers using the platform, so they have a high degree of correlation with customer satisfaction. However, the scenic spot is a non-self-operated project of OTA, and the quality of tourist scenic spot is not controlled by the online tourism platform, so it has a low degree of correlation with customer satisfaction. This paper argues that the results calculated by the method of entropy weight are in good agreement with the objective facts.

5.4.2. First-level Fuzzy Comprehensive Evaluation
Firstly, by multiplying the weight coefficient matrix of the third-level index corresponding to each second-level index with the second-level index fuzzy matrix, the evaluation vector of the second-level index (representing the evaluation vector of the second-level index) and the satisfaction score of the second-level index (representing the satisfaction score of the second-level index of the second-level index) can be obtained.

5.4.3. Secondary Fuzzy Comprehensive Evaluation
Secondly, by multiplying the weight coefficient vector of each first-level index corresponding to the second-level index with the first-level index fuzzy matrix, the first-level index (representing the evaluation vector of the first-level index) can be obtained.

5.4.4. Evaluation vectors of online tourism platforms
\[ B_{v1} = \begin{bmatrix} 0.0246 & 0.1325 & 0.3244 & 0.3956 & 0.1228 \\ 0.0016 & 0.0312 & 0.2691 & 0.5394 & 0.1586 \\ 0.0122 & 0.0812 & 0.3200 & 0.4728 & 0.1138 \\ 0.0050 & 0.0387 & 0.2586 & 0.5626 & 0.1299 \end{bmatrix} \times \begin{bmatrix} 0.0067 & 0.0461 & 0.2950 & 0.5229 & 0.1294 \end{bmatrix} = \begin{bmatrix} 0.0067 & 0.0461 & 0.2950 & 0.5229 & 0.1294 \end{bmatrix} \]
U1 Customer Satisfaction Score= \( \left( 0.0067, 0.0461, 0.2950, 0.5229, 0.1294 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.7226 \)

U2 Customer Satisfaction Score= \( \left( 0.0037, 0.0793, 0.03738, 0.5120, 0.0312 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.4875 \)

U3 Customer Satisfaction Score= \( \left( 0.0021, 0.0401, 0.3503, 0.5056, 0.1019 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.6652 \)

U4 Customer Satisfaction Score= \( \left( 0.0205, 0.1127, 0.3262, 0.4379, 0.1026 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.4893 \)

U5 Customer Satisfaction Score= \( \left( 0.0043, 0.0512, 0.3697, 0.4760, 0.0989 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.6142 \)

Overall Customer Satisfaction Score= \( \left( 0.0062, 0.0642, 0.2095, 0.1311, 0.1862 \right) \times \frac{1}{\binom{1}{2} \binom{3}{4} \binom{5}{5}} = 3.5918 \)

In summary, the comprehensive score of customer satisfaction of Company X is 3.5918, which is between general satisfaction and comparative satisfaction.

5.4.5. Analysis of evaluation results

According to the calculation results, the comprehensive score of customer satisfaction is equal to 3.5918, which is between general satisfaction and comparative satisfaction, and closer to general satisfaction. This shows that OTA platform's customer satisfaction still has some space to rise. The five first-level indicators of customer satisfaction of Company X are U1 (3.7226), U3 (3.6652), U5 (3.6142), U4 (3.4893), U2 (3.4875) in order of satisfaction from high to low. Among them, the satisfaction degree of U2 traffic ticketing service is the lowest, and the satisfaction degree of U1 online tourism platform itself is the highest. Therefore, the company should focus on how to improve the service quality of traffic ticketing service.

5.5. Policy recommendations for improving customer’s satisfaction of OTA

5.5.1. Improvement recommendations of online tourism platform service

Online tourism platform should strengthen the construction of backstage network and improve the response speed of pages. Optimize the platform operation process and staff handling process; timely fulfill the commitment to customers, check past customer dishonesty events and take relevant remedial measures; website design should pay more attention to beautify and the richness of products displayed; strengthen the difficulty coefficient of website verification code and password, strengthen the daily maintenance of servers, pay attention to the security of payment transaction links, It is forbidden to
disclose users' privacy in the platform, especially the user's name, contact information, family address and other private information, and to strengthen the convenience of the website in terms of service reservation and order cancellation.

5.5.2. Improvement recommendations of traffic tickets service
Platform should not blindly promise the probability of successful ticket scrambling, let customers believe that the promises may not be fulfilled, this behaviour will make customers strongly dissatisfied, at the same time, strengthen the platform technology construction within the scope permitted by law; strictly control the fluctuation of air ticket prices, and control the fluctuation of air ticket prices throughout the year in the acceptable standard of customers. In addition, try to control the premium of tickets, reduce the bundling sales when issuing tickets, and reduce the additional handling fees required for ticket grabbing.

5.5.3. Improvement recommendations of tourist attraction service
The platform should pay more attention to the consumption level of tourist regions when providing tourism products so as to select shopping places with high quality and low price for customers. When designing tourist products, importance should be attached to the investigation of the infrastructure of tourist attractions in order to choose those with completed infrastructure for customers. The problem of high catering price of tourist attractions will be made up for if the tourism products can cover three meals since the catering price level is beyond the control of enterprises. The platform should choose tourist attractions with convenient transportation to reduce the time and energy spent by customers on the road, and choose the ones with good reputation that are worth visiting and whose ticket price is reasonable.

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