A Study on the Factors Affecting the Service Quality of Online Transactions Based on Association Analysis

WANG Ye WU Lianqiang WEI Fuxiang CAO Huarui CHENG Huijun
School of Management,
Tianjin Normal University
Tianjin , China
wangyetjcn@hotmail.com

***Abstract*—Through a comparative study of service quality under the traditional and online contexts, this paper extracted the keywords from the verbal descriptions about service quality of online transactions. Major affecting factors of online transaction service quality were refined by the Correlation-based Feature Selection (CFS) standard, based on 25 impact attributes and 1 decision attribute concerning customer complaints and negative emotions. Simultaneously, the association analysis of Apriori algorithm on data mining produced 10 association rules. Corresponding suggestions and managerial implications from the perspective of service recovery are discussed.**

Keywords-online transactions; service quality; data mining; association analysis

I. INTRODUCTION

A. Traditional Service Quality versus Electronic Service Quality

Since the 1980s, extensive assessment researches based on customer perception of service quality (SQ) have been conducted to traditional service, and the classical models and constitutional dimensions have been widely verified and recognized. Grönroos, as a representative of Nordic perspective, first proposed the Customer Perceived Service Quality and the Model of Total Perceived Service Quality, and indicated that functional and technical quality are two main dimensions of the perceived service quality. Rust and Oliver (1994) further promoted a model of three dimensions on service quality that consists of service results(technical quality), service interaction (functional quality) and service environment. Parasuramn, Zeithaml and Berry, as the representatives of the school of North America, introduced the service quality model as the discrepancy between customers' perceptions of services offered by a particular firm and their expectations about firms offering such services and established the assessing model —SERVUQAL—a multiple-item instrument to quantify customers' global (as opposed to transactions-specific) assessment of a company's SQ.

Carman (1990) suggested that consumers are inclined to resolve the dimensions of service quality into different sub-dimensions. Dabholkar, Thorpe and Rentz (1996) differentiated and tested the multiple conceptual model of perceived service quality on retailing business. However, network setting, distinctive from traditional ones, has not merely changed the basic factors of consumers' perceptions and judgments on service quality but also makes it harder to assessment, management and improvement on it for service firms. This mainly embodies the following aspects: first, the Internet surroundings have strengthened the feature of invisibility; second, the function of separation on service has enhanced but the perishability weakened, which fundamentally altered the interaction of service; third, as the heterogeneity and perishability of service has decreased, the stability of perception on product quality improved, and the similarity between the network services of companies likewise; fourth, it has also greatly enhanced the self-service, fundamentally altered the way of value creation. A lot of services cannot be completed without a service provider under the condition of traditional transactions modes; however, customers can accomplish the whole process by themselves with access to Internet.

Although scholars have conducted numerous researches in this field, no widely accepted and applied models, evaluating system and approaches on Internet customer perceived service quality exist yet. Some scholars just use the previous SERVQUAL scale. e.g., Kolesar and Galbraith (2000) directly developed the system of consumers assessment on the online shops' service quality based on the five dimensions of SERVQUAL and pointed out the correspondence relation of SERVQUAL between the condition of traditional transactions and the Internet; Sullivan and Walstrom(2001) also evaluated the service quality of retailing under the condition of Internet using the same approach. Besides, taking the features of Internet into consideration, some researchers modified the scale of SERVQUAL systematical orientated and generated the evaluation system adjusted to perceived service quality on e-commerce websites. Shohreh and Christine(2000) established the "E-QUAL"—an assessment tool developed to evaluate the service quality of electronic commerce businesses from the consumers' perspective. Another school of scholars, different from the above orientation, pay more attention to the customer's experience and satisfaction of online shopping. For instance, Yang et al. (2001) produced six key online service quality dimensions: reliability, responsiveness, competence, ease of use, security, and product portfolio. Yoo and Donthu(2001) developed a nine-item SITE-QUAL scale for measuring site quality on four dimensions: ease of use, aesthetic design, processing speed, and security. One of the founders of SERVQUAL, Zeithaml,

also becomes focusing to the service quality of consumers within the environment of Internet and conducting continuous researches. In 2000, they probed the main factors of online service quality in a series of focus group interviews and put forward the "eleven-dimension theory" quite distinctive from traditional settings(Zeithaml, 2000). This measurement was condensed into the theory of five dimensions (Zeithaml, 2002) and further fused into the four dimensional approaches, i.e. the E-S-QUAL (Parasuraman, et al., 2005) in 2005.

There has been various works on the Internet channel abroad and a number of researches have been attended to measure the perceived service quality under the Internet environment. In recent years, scholars in our nation are increasingly concerned about the area of Internet and much progress has been attained. However, most researches are from the perspective of consumers' online shopping risk, only a few involved partly the issues of perceived service quality, not to mention studies based on the online transactions. Other analysis about the online transactions concerning the factors of service quality is still on the stage of describing the subjective feelings of customers qualitatively rather than quantitative efforts to find out the micro-factors that influenced specifically the consumers' perceived value. Without the specific factorial indexes, corresponding precautions to salient problems referred by customers cannot be taken, as a result that the service quality cannot be improved, which may be unfavorable to both our consumers and companies. Thus the question is that the specific factors affecting the service quality of network transactions should be identified through qualitative and objective analysis so as to enhance the precautions to service quality and the perceived quality of consumers, as well as the competitive power of enterprises.

As network transactions contain a huge source of information, taking advantage of the statistic mining technology to filter all the dimensions concerning the service quality of consumers to identify the key drivers of customer service quality during the period of network transactions, is definitely high important to theoretical research. In particular, the qualitative descriptive language of customers for the service quality of network transactions can be transformed into specific qualitative indexes, and a large amount of statistics mining towards the original information of customers will be analyzed so that more objective and regular results can be obtained as well as practical implications.

B. Customer Complaints and Service Recovery

The negative emotion of customers largely affects their mentality and behaviors after experiencing a service failure. Their negative emotion and the expectation for service recovery are largely positive related with the complaining inclination, within which emotion plays a very important role (Du Jiangang, Fan Xiucheng, 2007). When the service faults appear, consumers would regard external causes (companies, employees), internal causes (consumers themselves) or a third party as the reasons of a service failure. Although different service failures cause the same result, the assessment to severity is quite varied, so does the decreasing of satisfaction of customers, willingness to rebuy and positive word-of-mouth willingness. Customers regard that the service faults caused by the external factors are most serious and intolerable (Song Yiping, Wang Xiaoyan, 2005). Once service faults happen and they are not rescued timely, the feeling of distrust for customers towards merchants will intensify instantly, thus, the negative reputation towards suppliers will be spread rapidly through the Internet like virus, which causes the underestimate direct and indirect loss to on-line stores (Zheng Qiuying, Fan Xiucheng, 2007). In view of complaints of customers and negative emotions, the factors of service quality influencing network transactions can be found; some remedies can be taken specifically after a service failure, as well as the service quality of enterprises and merchants.

C. Data Mining (DM) by Using Association Rules

This paper refined the key words by analyzing the records of complaints online, the feedbacks of main websites of e-commerce and complaint data, and assigned specified scores (subjective feelings of customers) about the qualitative description of customers towards service process based on the degree of complaints of customers and negative emotions, in this way the qualitative and subjective feelings can be transformed into specific qualitative indexes. Particularly, these qualitative indexes were selected by using the method of Correlation-based Feature Selection (CFS) to explore the key factors influencing the service quality of network transactions, and then the association rules formed by these factors can be found by the arithmetic method of Apriori. It is from the perspective of customers' complaints and service recovery that the key factors mainly targeted on the association rules that embodied the service quality of network transactions were analyzed and advices were included.

II. METHODOLOGY

The data presented in this paper was processed with the arithmetic of Apriori, proper analysis can be concluded after reaching association rules. Details of the association rules and the arithmetic of Apriori run thus.

A. Association Rules

The mining of association rules is a common task in data mining, first put forward by Agrawal in 1993, whose basic thought is that in relational database, the frequent pattern, relevance and correlation can be found in item sets or object sets by analyzing the interdependence(Association Rules) between data(Xie Qiuli, 2008). Association rules is just like the implication of $A \Rightarrow B$. In rule $A \Rightarrow B$, the supporting level $s(A \Rightarrow B)$ is the percentage of $A \cup B$ items occurred in set D. It represents the probability of $A \cup B$ appeared in set D. The confidence of rule $A \Rightarrow B$, c, is defined as the items ratio of $A \cup B$ to A in set D, which means when the set A appeared, the probability of B appears. And the confidence above the min-confidence referred by users is reliable. The example of Market Basket Analysis is a

classical one of association rules, first explored from the large amount of information — original transactions data of Wal-Mart's all stores. The following is an example of association rules:

Computer=>antivirus

(Support degree=2% confidence coefficient=60%).

This association rule refers that when the support degree is 2%, it represents that 2% of customers purchase both the computer and the antivirus; when the confidence is 60%, it stands for the fact that 60% of customers who buy computers also buy the antivirus.

B. Apriori Algorithm

A specific association rule is achieved by the arithmetic of association rules. For now, the commonly used arithmetic contains Apriori, Partition-based clustering and F-frequency. This thesis adopts the classic method—Apriori. Apriori, based on the frequent itemsets, is mining the Boolean Association Rule: the first step is to find all frequent itemsets in source database by using interactive method if the occurrence frequency of the itemset is greater or equal to min-support set by users; the second step is to generate strong association rules from the frequent itemsets that satisfy both a minimum support threshold and a minimum confidence threshold.

C. Attribute Selection

Attribute selection, also called feature selection, the relevant feature subsets can be selected by deleting the irrelevant and redundant features of data to improve the interpretability of the model.

Given a feature subset $F=\{f_1, f_2, \cdots, f_N\}$, N is the quantity of the set, a feature subset can be presented by binary vector: $S=\{s_1, s_2, \cdots, s_N\}$, $s_i \in \{0, 1\}$, $i=1, 2, \cdots, N$, $s_i=1$ stands for the feature of i— f_i —is chosen , otherwise, it isn't. Taking the evaluation function of its biggest performance $G(S)$ in feature subset as the target function, then the problem of attribute selection turned into the improving problems (Chen You et al., 2007):

$$\max_{s} G(S) \tag{1}$$

This paper ran attribute selection through CFS; the most typical is the Pearson Correlation (Hall MA，2000), which calculates the correlation of a feature subset. The formula is as follows:

$$Merit_{S_k} = \frac{k\overline{r}_{cf}}{\sqrt{k + k(k-1)\overline{r}_{ff}}} \tag{2}$$

Where S_k is the heuristic "merit" of a feature subset S containing k features, $\overline{r}_{cf}$ the average feature-class correlation, $\overline{r}_{ff}$ the average feature-feature intercorrelation. Good feature subsets contain features highly correlated with the class, yet uncorrelated with each other. Interacting (2) into (1), Thus we define CFS as below:

$$\max_{S_k} = \left[\frac{r_{cf_1} + r_{cf_2} + \cdots + r_{cf_k}}{\sqrt{k + 2(r_{f_1 f_2} + \cdots + r_{f_i f_j} + \cdots + r_{f_k f_1})}} \right]$$

Due to the existence of numerous possible feature subsets, it is unrealistic to evaluate all of them, CFS gives us three searching methods, they are forward selection, back selection, best first respectively. Forward selection is the feature subset starting from an empty set, the subset with the highest evaluation is chosen and expanded in the same manner by adding single features; conversely back selection refers that it begins from the entire feature subset space and deletes a feature per time that will not decrease the highest evaluation; best first can start from either an empty set or entire set. This paper applies a best first search.

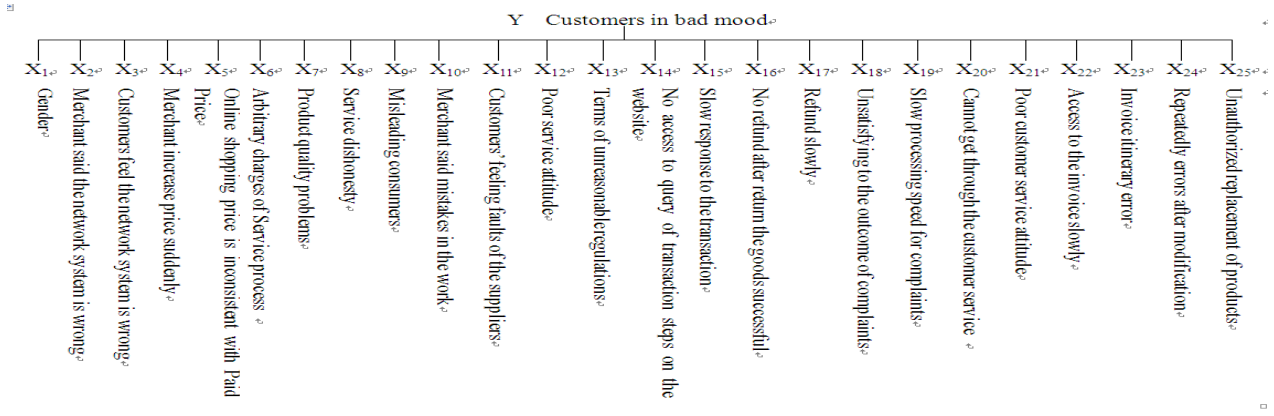

Figure 1. Customer's perception indexes for network transactions

III. DATA COLLECTION AND PROCESSING

A. Data Collection

The first step, using the searching engine—"Baidu"—with "online shopping complaints", "complaints of e-commerce" and other key words to search and download 1688 reports involved content of complaints of online shopping and service by the end of June 30th in 2011. The specific URL, complaining number, complainant appellation, time, title and content were recorded. All of these contents were checked carefully and deleted those messages concerning deception, after that, 1366 consumers complaints were retained. Then the contents were coped by content analysis and items were extracted. The content analysis is a systematic, objective and qualitative analytic method. At first, the theme of each sentence of content disputing should be considered as a basic unit, then four doctors and four postgraduates majored in service marketing refined categorical items to each complaint's content independently, where the non-statistic cluster analysis was applied. After reading each category by 20 graduates of marketing majors who often do shopping online, those items with the same meaning were combined together, we integrated the categories that more than half of raters regarded the items should be combined, at last 31 analysis categories were obtained, thus the coding schedule was developed to identify each category accordingly as well as coding schemes. Then these above 8 persons were divided into 4 groups and coded the content of each dispute back to back; then we checked and tested through inter-rater agreement (the coefficient of inter-rater agreement was 87%). Here is the formula:

$$\text{Inter-rater agreement} = \frac{2M}{N1 + N2}$$

$$\text{Reliability coefficient} = \frac{N \times \text{the average value of inter-rater agreement}}{1 + [(N-1) \times \text{the average value of inter-rater agreement}]}$$

First calculating the aggressiveness between per two coders, we then gained the average value of inter-rater agreement and reliability coefficient according to the formula. The result is satisfying if the coefficient reaches 85%, and people will doubt it if it is below 80%, it is the ideal state that it attains 90%. M represents the amount of totally agreement, N_1 represents the approval number of the first encoder, N_2 represents that of the second coder, N is the number of coders. These 8 coders had a good knowledge of service quality, complaints of customers and the purpose of this research; hence it had a higher surface validity and content validity. After discussing the difference and attaining an agreement of content coding, we deleted 20% of the complaints and finally, 29 disputing categories were gained and their data coded. At last, 4 similar disputing categories were deleted and 25 factors affecting the customers' perception of service were gained. Meanwhile, customer's mood was acted as the decision factor reflecting the overall perception of service. These 25 factors were coded from the number one to twenty- five, the coded number Y stands for the decision factor—emotion of customers, as is shown in Fig. 1.

TABLE I. SOME SAMPLES OF CUSTOMERS' SCORES ON THE PERCEPTION OF SERVICE QUALITY OF NETWORK TRANSACTIONS

No.	X_1	X_2	X_3	…	…	X_{25}	Y
1	2.0	0.0	0.0	…	…	0.0	1.5
2	2.0	0.0	0.0	…	…	0.0	2.5
3	2.0	0.0	0.0	…	…	0.0	2.5
…	…	…	…	…	…	…	…
…	…	…	…	…	…	…	…
1365	1.0	0.0	0.0	…	…	0.0	1.5
1366	1.0	0.0	0.0	…	…	0.0	0.5

Notes:1.0 on index X_1 stands for "male"; 2.0 stands for "female".

In order to find out the key dimensions among the 25 factors that lead to bad mood, we employed the CFS (best first) to run attribute selection and analyzed association rules by undertaking the Apriori Algorithm.

The second step, judgments and scores were given according to the service process descriptions, 0 to 3 was assigned in terms of the degree of occurrence and the emotion of customers, and the first number of decimal point should be kept, zero is none, three the maximum, which indicates that the reaction is stronger as the index grow. All customers' descriptions should be scored on 26 indexes respectively; zero would be assigned if there was no reaction to one.

Third, the collected data were aggregated and sorted into a sample of Tab.2 for subsequent data processing. Eventually, these language descriptions of network transactions were translated into the qualitative data (see Tab. 1 as a sample).

B. Data Discretization

Apriori algorithm is Boolean association rules mining, thus the data of Tab. 1 would be processed —— score zero to three would be discretized and transformed into the four Boolean a, b, c and d. Here is the rule: if the attribute is 0, then it will be altered for a; if it is above 0 but below 1, then it is b; if it is above 1 but below and equal to 2, then it is c; if it is above 2 but equal and below 3, it is d. If there are data missing, then it will be filled with null, just like the Tab.2 shows, and the column of serial number was eliminated.

C. Data Processing and Association Rules Generation

According to the Apriori algorithm of association rules, the association rules of X_1—X_{25} to Y can be found among 1366 examples. We took the tool of Weka3.6 to deal with the data processing and association rules generation(the full name of Weka is Waikato Environment for Knowledge Analysis, it is a platform of public data mining developed by

TABLE II. SCORE DATA AFTER DISCRETIZATION

X_1	X_2	X_3	…	…	X_{25}	Y
c	a	a	…	…	a	c
c	a	a	…	…	a	c
c	a	a	…	…	a	d
…	…	…	…	…	…	…
…	…	…	…	…	…	…
b	a	a	…	…	a	c
b	a	a	…	…	a	b

New Zealand scholars, and the Apriori algorithm would be utilized in the data processing.).

Two steps are needed when applying the Weka platform.

- First, attribute selection. "CfsSubsetEval" should be chosen in the options of "Attribute Evaluator", and "Best First"should be chosen in the options of "Search Method", in this way, 6 main factors were selected among 25 factors: X_8, X_{11}, X_{12}, X_{14}, X_{15}, *and* X_{21}.
- Second, the association rules should be obtained by Aprior algorithm. The setting of parameter was "car" as "True", the min-support is 0.1 which means that at least 137 examples will be included in each association rule; the min-confidence is 0.7, that the result should be above 0.7. Here are the ten association rules.

① X_8=d X_{21}=d 160 ==> Y=d 145 conf:(0.91)
② X_{11}=d X_{21}=d 154 ==> Y=d 139 conf:(0.90)
③ X_8=d X_{11}=d X_{12}=d 184 ==> Y=d 166 conf:(0.90)
④ X_8=d X_{12}=d 200 ==> Y=d 178 conf:(0.89)
⑤ X_{11}=d X_{12}=d 195 ==> Y=d 173 conf:(0.89)
⑥ X_{21}=d 193 ==> Y=d 165 conf:(0.85)
⑦ X_{12}=d 226 ==> Y=d 193 conf:(0.85)
⑧ X_8=d X_{11}=d 241 ==> Y=d 203 conf:(0.84)
⑨ X_{11}=d 304 ==> Y=d 226 conf:(0.74)
⑩ X_8=d 332 ==> Y=d 238 conf:(0.72)

These ten association rules can be transformed into the recount of language:

① among 1366 customers, 160 of them did not show a positive attitude towards dishonesty and poor customer service attitude, which led to 145 customers in a bad mood and not satisfied with the service quality.

② 154 people thought it was the faults of suppliers and poor customers' service quality, 139 of them did not show a good mood.

③ 184 people regarded service dishonesty, faults of suppliers and poor service attitudes, 166 of them had a bad mood.

④ 200 people showed a negative attitude toward honesty and service attitude, 178 of them were not in good mood.

⑤ 195 people dislike the errors of suppliers and service attitude, the mood of 173 people were not good.

⑥ 165 among 193 people did not have a good mood because of the poor service attitude.

⑦ 193 among 226 people had bad mood because of the poor service attitude of suppliers.

⑧ 203 people did not have a good mood among 241 people owing to the dishonesty and the faults of merchants.

⑨ 226 people have a bad feeling among 304 people as a result of the faults of merchants.

⑩ 238 among 332 people do not have a good mood in terms of dishonesty to their service.

IV. RESULTS AND ANALYSIS

Six most eminent factors and ten association rules have been found in the 25 factors of service quality on network transactions by the Apriori algorithm and the platform Weka.

As is shown in the Fig. 2, there are two regular pillars, the left one shows the level of affecting factors, the right shows the level of decision (bad mood of customers) factor; the confidence is the value of right pillar to that of left one. At the same time, the table under the figure represents the factors of each rule, for example, the factor of rule one is dishonesty and customer services' poor attitude.

There are two factors that did not appeared in the ten association rules, they are "No access to query of transaction steps on the website" and "Slow response to the transaction". The confidence was decreased to 0.3 for a further exploration, but the result did not change. We aggregated the frequency of occurrence of these six factors in the 1366 examples when they were in the period of "d". Here is the result, 18 times of "No access to query of transaction steps on the website" happened, "Slow response to the transaction" occurred 118 times, which were all below the min-support, required in the association rules, 137 times, while other four factors were above the threshold value. Thus these two factors were deleted. In this way, when customers are in a bad mood that they are not satisfied with the service quality, these four causes should be paid more attention: "Service dishonesty", "Customers' feeling faults of the suppliers", "Poor service attitude" and "Poor customer service attitude". These four factors are the ones that enterprises should focus on.

In order to find out importance of the key four factors, these quantity relations of ten association rules were ordered according to different standards and they were assigned a score one to four, the first had score 4 and the fourth 0, and then an importance order was concluded. Four factors' labels were still applied for convenience(X_8, X_{11}, X_{12}, X_{21}), and the confidence is equal to percentage of the four factors in each association rule. The following are different orders:

First: it has an order in terms of the times of four factors accumulated in ten association rules. X_8 appeared 1117 times, X_{11} 1078 times, X_{12} 805 times, X_{21} 507 times, the rank is: X_8, X_{11}, X_{12}, and X_{21}.

Second: on the basis of order one and confidence as a weight, the times would be recalculated and reordered. For example, the frequency of X_8 happened in rule 1, rule 3, rule 4, rule 8, rule 10 were 0.91, 0.90, 0.89, 0.84 and 0.72

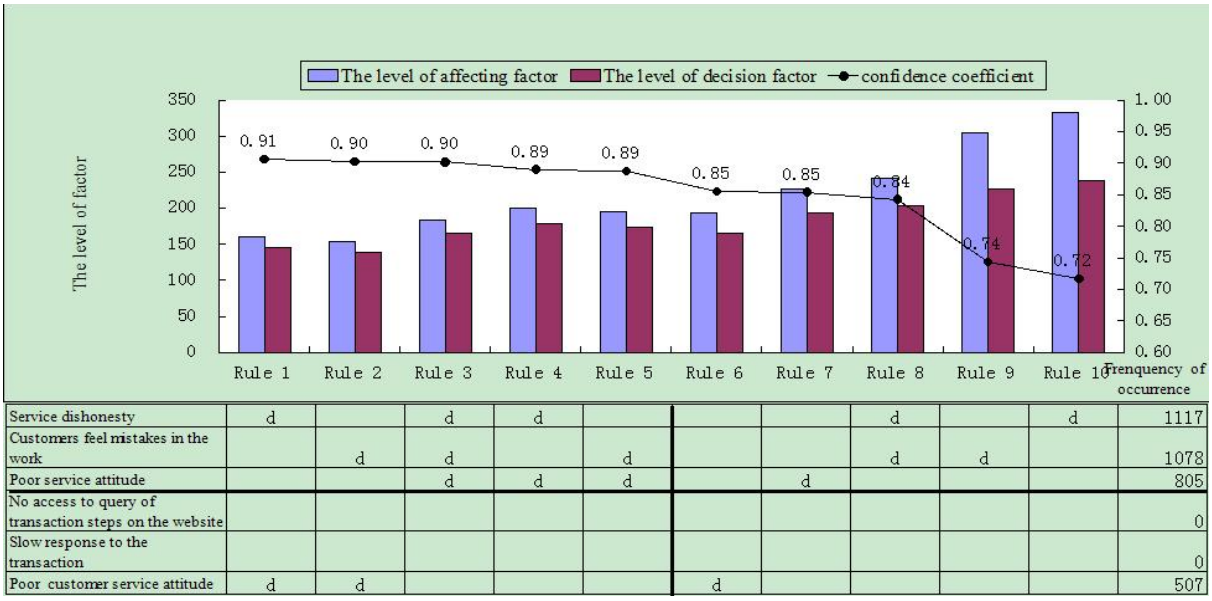

Figure 2. Diagram of ten association rules.

respectively, the total times was 931(160 × 0.91+184 × 0.90+200×0.89+241×0.84+332×0.72). X_{11} happened 905 times, X_{12} 709 times, X_{21} 448 times, and the rank is: X_8, X_{11}, X_{12}, and X_{21}.

Third: according to the average confidence of each factor in the association rules, like the average value of X_8 in five association rules was 0.852((0.91+0.90+0.89+0.84+0.72)/5), X_{11}, X_{12}, X_{21} were 0.854, 0.883 and 0.887 respectively, the rank is： X_{21}, X_{12}, X_{11}, and X_8.

The average confidence of ten association rules was 0.849, those rules with confidence below 0.849 were deleted and rule one to rule seven kept, then we obtained new rank 4, 5, and 6 by undertaking the methods referred above.

Fourth: the times of X_8, X_{11}, X_{12}, X_{21} happened respectively were 544, 533, 805, 507, thus the rank is: X_{12}, X_8, X_{11}, and X_{21}.

Fifth: the times of X_8, X_{11}, X_{12}, X_{21}were 489, 478, 709, and 448 respectively, the rank is X_{12}, X_8, X_{11}, and X_{21}.

Sixth: the average confidence of X_8, X_{11}, X_{12}, and X_{21} respectively were 0.9, 0.897, 0.883 and 0.887, so the rank is X_8, X_{11}, X_{21}, and X_{11}.

Seventh: according to the occurrence of each factor in the ten association rules, the times of X_8, X_{11}, X_{12}, X_{21} occurred were 5, 5, 4 and 3 respectively, hence the result is X_8, X_{11}, X_{12}, X_{21}, and the score of X_8 and X_{11} were both 3.5.

Eighth: we found that rule five was a turn point by underlining the "d" distributions of Fig. 2, there were 11 "d" spread on the left of the vertical lines. At the same time, we also found that 0.89 was the turn point of confidence in view of the fold line of confidence, and the confidence deviation changed from 0.02(0.91-0.89) to 0.17(0.89-0.72), which matched rule 5 exactly. The probability of "d" in X_8, X_{11}, X_{12}, X_{21}, before rule 5,were 0.6(3/5), 0.6(3/5), 0.75(3/4), and 0.66(2/3) respectively, so the sequence is： X_{12}, X_{21}, X_8, and X_{11}, within which X_8 and X_{11} both scored 1.5 points.

Ninth: according to the average confidence before rule 5, the average of confidence of X_8, X_{11}, X_{12}, X_{21} were 0.9, 0.897, 0.893, and 0.905, and the order is X_{21}, X_8, X_{11}, and X_{12}.

We acquired an overall importance sequence according to the above ninth ranks aggregation in Tab. 3. In light of the final scores, the rank of four main factors is X_8, X_{12}, X_{11}, and X_{21}, i.e. "Service dishonesty", "Customers' feeling faults of the suppliers", "Poor service attitude" and "Poor customer service attitude".

TABLE III. SCORE SUMMARY OF NINE ORDERS

	Rank 1	***Rank 2***	***Rank 3***	***Rank 4***	***Rank 5***	***Rank 6***	***Rank 7***	***Rank 8***	***Rank 9***	***Total Points***
X_8	4	4	1	3	3	4	3.5	1.5	3	27
X_{11}	3	3	2	2	2	3	3.5	1.5	2	22
X_{12}	2	2	3	4	4	2	2	4	1	24
X_{21}	1	1	4	1	1	1	1	3	4	17

V. DISCUSSION

Because the network transactions are restricted to time and space for both parties, they cannot accomplish a business face to face. Therefore, some factors among these 25 factors are different from the traditional one, like the system aspects (X_2, X_3, X_{14}), which cannot be handled without Internet, the response of transactions (X_{15}, X_{17}, X_{18}, X_{22}), not exist to traditional transactions, the inconsistence of prices(X_5), while the traditional transactions are instantaneous ones and do not have this problem etc.. Through the attribute selection of 25 factors, 6 main factors were obtained, and the factors happened in ten association rules are service dishonesty, poor service attitude, customers' feeling faults of the suppliers and poor customer service staff's attitude. These four factors are independent of those objective factors but the subjective perceived service, and they also exist in the traditional transactions. As a consequence, We should implement concrete measures from the perspective of customer's perception rather than focus on the hardware system aspects alone. This paper owned a conclusion about the specific influencing factors of network transactions on service quality. With the upgradation of network technology and improvement of function, when considering the service quality, merchants and enterprises should also pay attention to the subjective emotion of customers. Considering the above analysis and the combination of complaints and service recovery, we propose the following suggestions:

Firstly, it is very important to pay attention to these six factors influencing service quality: service dishonesty, poor service attitude, customer feeling faults of suppliers, poor customer service staff's attitude, searching difficulties for online transaction steps and the slow response of transactions, the first four factors should be focused on and controlled before band.

Secondly, focus on the subjective aspects of customer's complaints caused by enterprises and merchants. These four factors of six in network transactions are all triggered by the faults of subjective errors of suppliers and merchants, instead of the objective technology. Honest, service attitude, feelings faults and customer service's attitudes and the like are all subjective indexes that companies should control so as to improve service quality.

Thirdly, some training on service attitude should be targeted on the frontline employees, especially the staff of customer's service. Network transactions are different from face-to-face transactions, customers do not contact merchants directly, and instead the frontline service staffs are representatives of service firms. Satisfaction to purchasing process will boost sales when the service staff shows a good attitude and professional quality whether it is before or after buying act or not, so it is essential for the first-line employees to have a professional and attitudes training.

Fourthly, importance to the combined effect of different factors should be attached. There are altogether four single rules (rule 6, rule 7, rule 9 and rule 10) that lead to negative emotions of customers from the analysis of 10 association rules in data mining. Five rules (rule 1, rule 2, rule 4, rule 5 and rule 8) are caused by two-factor combination and only rule 3 caused by three-factor combination. Therefore, when we found that customers are in a bad mood and begin to complain, multiple factors should be taken into consideration to find out the real causes of negative emotions of customers, in this way, proper precautions and remedies can be conducted.

From the above analysis, we may conclude that when customers are in a bad mood, and they are not satisfied with the service quality of network transactions, we should focus on priorities to enhance the service quality. It is important to form a trustful relationship and good service attitude. Efforts should be made to rectify those shortages and avoid some faults as well as strengthen the customers' service attitude. As a preventive measure, these four factors of dishonesty, poor service attitudes, customer feeling faults of suppliers and poor customers' service attitudes should be paid attention which lead to negative emotion of customers when entering into the field of network transactions, so as to avoid work mistakes and improve service.

VI. SUMMARY

Internet transactions are growing prospectively. But due to the virtuality of the cyberspace, both parties of transactions cannot contact each other face to face, which lead to difficulties towards the evaluation of service quality. With the condition that the judgment of traditional service quality are not adaptable to the network transactions, this paper utilized the Apriori Algorithm, mining for association rules to find out 6 key factors and 10 association rules from 26 indexes extracted from the qualitative descriptions based on the complaints and negative emotions of consumers, furthermore, 4 factors importance are listed via sort criteria and proper precautions are proposed in terms of service recovery. The analysis employed in this paper has offered a new approach to the factors exploration of service quality on network transactions on the basis of objective indexes, which will be a guide for further research, especially the qualitative research about the service quality in the circumstances of Internet. Finally, four main factors that influenced the quality of network transactions have been identified by the qualitative analysis: dishonesty; poor service attitudes; the feeling of customers towards the mistakes of suppliers and poor customer's service attitudes. All of these factors are affected by the subjective service attitudes rather than the objective factors (i.e. the instability of network system), which supports the viewpoint from the perspective of empirical qualitative analysis that service quality is a perception of quality along with subjective attitude, and the research result of this paper coincides with the current theories.

ACKNOWLEDGMENT

This work was supported by grants from National Science Foundation of China (no.70972095) and Philosophy and Social Science Foundation of Tianjin (TJGL08-057).

REFERENCES

[1] GRÖNROOS C., "A service quality model and its marketing implications," European Journal of Marketing, no. 1984, 18(4), pp.37-45.

[2] RUST R.T., OLIVER R. L., "E-service and the consumer," International Journal of Electronic Commerce, vol.5, no.3, 2001, pp.85-101.

[3] PARASURAMAN A., ZEITHAML V. A., and BERRY L., "SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality," Journal of Retailing, 1988, vol.64, no.1, pp.12-40.

[4] KOLESAR M. B., and GALBRAITH R. W., "A service-marketing perspective on e-retailing: implications for e-retailers and directions for future research," Internet Research: Electronic Networking Applications and Policy, vol.10, no.5, 2000, pp.424-438.

[5] SULLIVAN J. R., WALSTROM L. A., "Consumer perspectives on service quality of electronic commerce websites," Journal of Computer Information Systems, vol.41,no.3, 2001, pp.8-14.

[6] SHOHREH A. K., CHRISTINE B. I. "A proposal to assess the service quality of online travel agencies: An exploratory study," Journal of Professional Services Marketing, vol.21, no.1, 2000, pp.63-88.

[7] YANG Z., PETERSON R. T., and HUANG L., "Taking the pulse of Internet pharmacies," Marketing Health Service, vol.200, pp.5-10.

[8] YOO B., DONTHU N. "Developing a scale to measure the perceived quality of an Internet shopping site (SITEQUAL)," Quarterly Journal of Electronic Commerce, vol.2, no. 1, 2001, pp.31-46.

[9] ZEITHAML V. A., "Service Quality, profitability, and the economic worth of customer: what we know and what we need to learn," Journal of the Academy of Marketing Science, vol.28, no.1, 2000, pp.67-86.

[10] ZEITHAML V. A., PARASURAMAN A., and MALHOTRA A., "Service quality delivery through web sites: A critical review of extant knowledge," Journal of the Academy of Marketing Science, vol.30, no. 4, 2002, pp.362-75.

[11] PARASURAMAN A., ZEITHAML V. A., and MALHOTRA A., "E-S-QUAL: a multiple-item scale for measuring consumer perceptions of service quality," Journal of Retailing, vol.64, no.1, 2005, pp.12-40.

[12] Dong D.H., Li G.H., Yang Y., "Research of the Perceived Risk Facets by Consumers in Internet Shopping," Chinese Journal of Management,vol.2, no.1, Jan.2005,pp. 55-60.

[13] Du J.G., Fan X.C., "The Effect of Emotion on Customers' Satisfaction and Behavior in Service Recovery," Management World, vol.10, no.6, 2007, pp.4−10.

[14] Song Y.P., Wang X.Y., "Service Failure Attributions and its Impact on Service Recovery Effects," Nankai Business Review, vol. 8, no. 4, 2005, pp.2−17.

[15] Zheng Q.Y., Fan X.C., "Service Recovery Management in On — line Retailing: Integration of Justice Theory and Expectation Theory," Management Review, vol.19, no.10, 2007, pp.17−23.

[16] Xie Q.L., "Data Mining in Teaching Quality Evaluation Based on Association Rules," Modern Computer, vol.285, June 2008, pp.25−27.

[17] Chen Y., Cheng X.Q., Dai L. "Lightweight Intrusion Detection System Based on Feature Selection," Journal of Software, vol.18, no.7, July 2007, pp.1639−1651.

[18] M. Hall, Correlation-Based Feature Selection for Discrete and Numeric Class Machine Learning Proc. 17th Int'l Conf. Machine Learning (ICML2000), 2000.