A Study of Satisfaction for Service Recovery in Novel-Tea by Data Mining Technology

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Abstract. Customers' requirements for tea drinks increase as time goes on. Coupled with the emergence of novel-tea drinks, which are deeply loved by young people, the audience and market size of tea drinks have gradually expanded, and various brands have emerged one after another. However, many problems in tea shops have gradually emerged under this situation. Mistakes made in service and consumer dissatisfaction are the most probable cases. Based on this background, this research applies data mining technology to explore the analysis of novel-tea drinks' satisfaction with service recovery. In order to deeply explore the important attributes and their correlations that affect service recovery satisfaction, this research explores and analyzes the characteristics of customer groups whose responses regarding service recovery satisfaction are dissatisfied. In addition, through the analysis of the association rule model, we describe the characteristics and attributes that often accompany dissatisfaction in the service quality satisfaction as well as the correlations between them, and propose corresponding measures so as to provide reference for novel-tea drinkers.

Keywords: Data mining, novel-tea drinks, service errors, service recovery, satisfaction

1 Introduction

The tea culture of China has a long history, which includes not only the content of material culture but also the spiritual civilization. After thousands of years of development, the tea culture has been given a new meaning and life, and has been extended to the modern cultural life. The tea has become an indispensable part of people's lives, whether it's satisfying the physical needs of thirst or the spiritual pursuit of leisure. Furthermore, the continuous development of the social economy and the emergence of new consumption patterns, drinking tea is no longer just the monopoly of the middle-aged and the elderly, it becomes a new trend for young people. In the context of the new era, the novel-tea drink caters to the young people to drink good tea, interesting tea, and healthy low-fat tea. As a result, many investors have been attracted to

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enter the novel-tea drink industry so as to seek opportunities for development and want to take a share of the spoils

In 2016, the emergence of the novel-tea drinks led to an explosive growth and became a new economic powerhouse. According to the "2022 Novel-Tea Drinks Research Report [1]", the market size of novel-tea drinks market in China in 2020 is 83.1 billion RMB, while it is $100.3 billion in 2021, with a growth rate of 20.6% Year-on-Year. Although the market in 2022 was affected by the epidemic, the growth rate still reached about 3.7%. The rapid rising in the novel-tea drink market is mainly due to the fast development of the economy, the quality of the residents' consumption level, and the upgrading of the consumption structure and other factors. Moreover, the way of consumption generated by the economic situation accompanied by the novel-tea drink not only caters to the young people's pursuit regarding a sense of experience of the leisure way, but also meets their need to live healthily. For example, the topic of "The first cup of milk tea in autumn" has been read 2.4 billion times, dominating the social platforms on the day of Autumn. In addition, the microblog topic "How good is the duck poop flavored milk tea" has reached 150 million reads and views. Therefore, the novel-tea drink has become an indispensable consumer product.

With the increase in the number of stores and market size, the novel-tea drink operators need to think about how to stand out from the highly competitive market. Therefore, they have to strive to improve the quality of service and strengthen consumer satisfaction [2]. For the industry, the ways truly benefit the business are related to increasing consumers' satisfaction and loyalty so as to lead to repeat purchasing behavior. Therefore, for the novel-tea drink stores, it is more important to emphasize the loyalty of customers to themselves, and actively strive to make these customers stay for a long time and establish a good long-term relationship with them [3]. Many studies have presented that customer satisfaction has a crucial effect on loyalty. Next, mistakes made in service may occur at any service contact point, which will not only make consumers have negative feelings, but also cause customers to complain. As for customer complaint handling [2], it is a kind of post-mistake service remedy. The purpose of service recovery is to minimize or compensate for the loss to the customer caused by the mistakes made in service. Therefore, service recovery has a positive impact on customer behavior and can strengthen customer loyalty to the company.

The studies regarding the novel-tea drink industry are abundant. However, they mainly focus on purchasing behavior, marketing strategy, branding, business model [4]. There are few studies focusing on an in-depth analysis of the service recovery, the effectiveness of the service recovery, the impact of their satisfaction on repurchase loyalty and recommendation loyalty. In this study, a data mining technique is employed to analyze the dataset of the novel-tea drinks consumer group so as to understand the effect of service recovery on the satisfaction level of the new style of tea drinking service.

2 Literature Reviews

2.1 The Novel-tea Drink

The novel-tea drink industry is different from the traditional tea beverage industry in China, which has lasted for thousands of years. The novel-tea drink is a ready-to-drink tea beverage made by using high quality tea leaves and products as the main raw materials, mixed with fresh milk or milk products (eau de vie, etc.), fruits or fruit juices, sugar, spices, grains, herbs, beans, wine, carbon dioxide and other raw ingredients. They are extracted and blended on-site [4]. On the basis of traditional tea consumption and industrialized beverages, the tea beverage has been developed to meet the new demands for natural, healthy, fashionable and convenient consumption in the new era, featuring natural materials, fashionable design, on-site production and instant drinking convenience.

2.2 Data Mining

Knowledge Discovery in Database (KDD) is a process of discovering patterns in relatively large datasets through cross-cutting methods of machine learning, statistics and databases. It was first defined by Frawley et al. [5] as the process of mining potential, explicit, and very useful information from a database. Han et al. [6] categorized data mining methods into four main groups, namely association analysis, classification and prediction, clustering analysis, and evolution and deviation analysis.

With the advent of the intelligent era and the popularization of the Internet concept, the Internet of things (IoT) integration of big data is also widely used in various fields. Due to the combination of the Internet and technological devices, the volume of information has been multiplied, and the application of big data in e-commerce has been taken seriously. The enterprises build user feedback systems based on big data and through the analysis of big data, they can understand the needs of customers and recommend products that are likely to be of interest to them, so that their competitiveness is enhanced [7].

2.3 Service Recovery

Service recovery is a set of remedial measures for customers to maintain or rebuild customer satisfaction and loyalty after a mistake made in service. This is crucial to the operation and development of a business. As a result, more and more studies on service recoveries are conducted. For example, Gronroos believes that service recovery is a function and an activity adopted by an enterprise to improve service quality in order to save customer satisfaction and minimize customer defection after a mistake made in service. The purpose is to rectify and make up any errors made in the course of the service [8]. Namely, when a customer feels dissatisfied, the business owner has to do something to calm the customer's dissatisfaction [9]. Parasuraman et al. [10] considered service recovery as a way of correcting mistakes made by a company in response to customer complaints or in case of mistakes made in service in order to

restore customer satisfaction, loyalty and goals. Tseng also pointed out that this is a process in which service providers try to correct service failures, and the goal of service recovery is to transfer customers from a dissatisfied state to a satisfied state, and then establish a strong relationship with customers [11]. As a whole, there are many factors affecting customer satisfaction such as the influence of the external environment, contact with service staff, service quality and service recovery, etc [12]. However, the service recovery still has its effects which, more or less, is reflected in customer satisfaction or loyalty [13].

3 Research Method and Procedure

3.1 Research Procedure

The dataset used in this study was the data collected from consumers who purchased tea-based beverages through a questionnaire. The types of novel-tea drinks consumed by the respondents meeting the target of this study include Teayanyue, NAIXUE, HEYTEA, CHAGEE, and several other new drink stores. 388 valid questionnaires were retained for this study after a preliminary filtering process to remove some invalid data.

In order to examine the effectiveness and impact of service recovery for mistakes made in service, this study employed the data mining technique as the analytical tool, and the results of the analysis can be further utilized for the development of marketing strategies for beverage stores. The flowchart of the study is shown in Figure 1. In order to meet the analysis requirements, the data must be pre-processed before the exploration. There are basic preliminaries such as removing unnecessary data, coding, and formatting so that the data can be loaded into the mining software. In the processing stage, this study applies the association rule technique for mining analysis based on the characteristics of the problem and uses WEKA software to find out the correlation between the items.

Fig. 1. The research procedure

3.2 Association Rules

Data mining is an important part of the process of Knowledge Discovery in Database (KDD). The objective of data mining consists of both prediction and description. That is, predicting unknown or future values of the attributes of interest and describing the data in a manner understandable and interpretable to humans.

An association rule is represented by A→B, where A and B are sets of items. The rule means that if item A is purchased, then item B will be purchased with a high

probability [14]. Agrawal et al. proposed a mining algorithm based on the concept of large itemsets to find association rules in transaction data [15-16]. They divided the mining process into two phases. In the first phase, candidate itemsets were generated and counted by scanning the transaction data. If the number of an intemset appearing the transactions is larger than a predefined threshold value (called minimum support), the itemset is considered a large itemset. Itemsets containing only one item were processed first. Large itemsets containing only single items are then combined to form candidate itemsets containing two items. This process is repeated until all large itemsets are found. In the second phase, association rules are induced from the large itemsets found in the first phase. All possible association combinations for each large itemset are formed, and those with calculated confidence vales larger than a predefined threshold (called minimum confidence) are the output as association rules. Association rules are applied in fields such as market strategy planning and crime prevention and prediction.

4 Research Results

4.1 The Sample Characteristics

The dataset used in this study is 388 questionnaires which are retained as the dataset analyzed in this study after a preliminary filtering process to remove some invalid data. The main basic attributes of the respondents' data contain attribute variables such as gender, age, occupation, education level and monthly income.

Based on the characteristics of the samples, male accounts for 40.0% of the respondents, while that for female is 60.0%. The largest age group, i.e. the 18-25 age group, takes about 46.6% of the total, followed by the groups of “under-18 age” and “26-35 age group”, which take 26.5% and 13.4%, respectively. In terms of occupation, 65.5% of the respondents are students. This is in line with the fact that the novel-tea drink is popular among young people. This is the reason why the largest age group in the dataset is the group of 18-25 years old. As for other occupations, 12.6% of the respondents are freelancers, and 10.6% for enterprises and institutions. In the item of educational level, the largest proportion is in “Colleges and Universities”, whose value is 46.9%. The groups of “High school” has 42.0%, while 11.1% for “Above graduate school”. In addition, the largest group in the monthly disposable income is “Below 2K”, which is composed of 60% of the respondents. This outcome may be related to the “Student” population. As to other three income groups, i.e. “2-4K”, “4-6K”, and “Above 6K”, which possess 24.7%, 7.2%, and 8.1%, respectively.

4.2 Loyalty Analysis

4.2.1 Repurchase Loyalty and Recommendation.

This study employs two attributes in the dataset, namely, “I would choose this tea store next time to purchase the same drink” and “I would like to use this store’s drink or service”, to define the “repurchase loyalty” in the sample. If a respondent’s re-

sponse to both questions is “agree” or “strongly agree”, the sample will be regarded as “repurchase loyalty”. If the respondent shows “no comment”, “disagreed" or “strongly disagreed” to any of the questions, the sample is regarded as the “non-repurchase loyalty” sample. The results are summarized shown in Table 1 below. As shown in Table 1, 63.9% of the dataset belongs to the repurchase loyalty group, while 36.1% belongs to the non-repurchase loyalty group. This shows that there is still room for improvement in the repurchase loyalty of the novel-tea industry. As for the non-repurchase loyalty group, female accounts for 62.1%, which is slightly higher than the 37.9% of male.

Table 1. The statistics on the ratio of repurchase loyalty in gender.

Repurchase loyalty	Gender	Percentage of (non-) repurchase loyalty	Percentage of total sample
Repurchase loyalty	Male	52.4%	33.5%
	Female	47.6%	30.4%
Non-repurchase loyalty	Male	37.9%	13.6%
	Female	62.1%	22.5%

In addition, we adopt the variables, “I would take the initiative to introduce this tea store to my friends” and “I would recommend my friends to purchase drinks or services from this tea store”, to define recommendation loyalty in the sample. If a respondent’s response to both questions is “agree” or “strongly agree”, the sample will be regarded as a “recommended loyalty” sample. Otherwise, the sample will be regarded as “non-recommended loyalty”. It is shown that 68.3% of the group belongs to the recommended loyalty group, while only 31.7% belongs to the non-recommended loyalty group. As for the recommendation loyalty group, males accounts for 53.2%, which is significantly higher than that of females (46.8%). The statistics are presented in Table 2.

Table 2. The statistics on the ratio of recommended loyalty in gender.

Recommended loyalty	Gender	Percentage of (non-) recommended loyalty	Percentage of total sample
Recommended loyalty	Male	53.2%	36.3%
	Female	46.8%	32.0%
Non- recommended loyalty	Male	30.9%	9.8%
	Female	69.1%	21.9%

4.2.2 The Associative Analysis for Service Recovery Satisfaction, Service Quality Satisfactions and Repurchase Loyalty.

In this study, we employ the association rule to find out the association between satisfaction and repurchase loyalty of the novel-tea service recovery. For the setting of parameter values, the value of the minimum support is set to be 10% and that for the minimum confidence is 50%. Four association rules are summarized in Table 3. As shown in Rule 1, the support of those who are dissatisfied with the service recoveries

of this novel-tea drinking and belong to the group of non-repurchase loyalty is 42.6%, For those who are dissatisfied with the service recoveries of the novel-tea, 92.1% of them would not purchase the product again. Overall, there is only one rule relating to the repurchase loyalty. In addition, there exists rules of association between the non-repurchase loyal and those who express very dissatisfied, dissatisfied, or even no comment regarding the novel-tea service recovery, and the confidence are as high as 70% or above.

The association analysis between the satisfaction of service quality and repurchase loyalty are examined and the results are presented in Table 4. Dissatisfaction or no comment with the overall service quality of the novel-tea can be associated with non-repurchase loyalty. As for the overall service quality of this novel-tea, they are satisfied with it and have loyalty rules for repurchase, but the support and confidence are slightly lower. This shows that the group characteristics of non-repurchase loyalty caused by dissatisfaction with service quality satisfaction is more clear than that for the repurchase loyalty group.

Table 3. The association rules for service recovery satisfactions and repurchase loyalty.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	Dissatisfaction with the service recoveries for the novel-tea drink	Non-repurchase loyalty	42.6%	92.1%
2	Satisfied with the service recoveries for the novel-tea drink	Repurchase loyalty	15.6%	85.3%
3	Very dissatisfied with the service recoveries for the novel-tea drink	Non-repurchase loyalty	11.4%	100%
4	No comment with the service recoveries for the novel-tea drink	Non-repurchase loyalty	23.1%	70.1%

Table 4. The association rules for service quality satisfactions and repurchase loyalty.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	Dissatisfied with the overall service quality provided by the novel-tea drink.	Non-repurchase loyalty	36.2%	92.1%
2	Satisfied with the overall service quality of the novel-tea drink.	Repurchase loyalty	15.1%	80.0%
3	No comment on the overall service quality of the novel-tea drink.	Non-repurchase loyalty	17.5%	84.3%

4.2.3 The Associative Analysis for Service Recovery Satisfaction, Service Quality Satisfactions and Recommendation Loyalty.

Similarly, based on the minimum support and confidence being 10% and 50%, respectively, we try to find out the association between the satisfaction of the novel-tea service recovery and the loyalty of the recommendation. The results are shown in Table 5. Regarding Rule 1, the support of those who are dissatisfied with the service recovery of the novel-tea with non-recommended loyalty is 42.6%. Among those who are dissatisfied with the service recovery of the novel-tea, 94.5% of them possess the

non-recommended loyalty. In addition, those who are very dissatisfied, dissatisfied, or even no comment with the service recovery for the novel-tea drinking are associated with non-recommended loyalty.

Table 5. The association rules for service recovery satisfactions and recommended loyalty.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	Dissatisfied with the service recovery provided by the novel-tea drink.	Non- recommended loyalty	42.6%	94.5%
2	Satisfied with the service recoveries of the novel-tea drink	Recommended loyalty	12.6%	70.6%
3	Very dissatisfied with the service recovery provided by the novel-tea drink.	Non-recommended loyalty	11.4%	100%
4	No comment on the service recoveries for the novel-tea drink	Non-recommended loyalty	25.5%	81.7%

The results of the association rules of service quality satisfaction and recommendation loyalty are shown in Table 6. Those who were dissatisfied and no comment on the overall service quality of the novel-tea drinks are able to associate with non-recommendation loyalty with confidences of 90.3% and 85.0%, respectively. Although satisfaction with the overall service quality of the novel-tea drink also generates recommendation loyalty, it only reaches 63.4% in terms of confidences, which is just a little better than the set value.

Table 6. The association rules for service quality satisfactions to recommended loyalty.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	Dissatisfied with the overall service quality of the novel-tea drink	Non-recommended loyalty	31.8%	90.3%
2	Satisfied with the overall service quality of the novel-tea drink	Recommended loyalty	13.6%	63.4%
3	No comment on the overall service recoveries of the novel-tea drink	Non-recommended loyalty	20.1%	85.0%

4.3 The Association Rules for Dissatisfied Groups

In this study, the dissatisfied groups are also discussed in depth. By the association rules, we try to find out the common characteristics for the group that the satisfaction of the service recovery is unsatisfactory. In the conditions that the minimum support and confidence are set to be 30% and 80%, respectively. The results are summarized in Table 7. There is only one rule generated under the set conditions. The rule represents that “I do not think the handling result of the tea store is fair” and “I do not think the way the tea store handled my complaint can calm me down” often generate the outcome of “satisfaction degree of the service recovery is unsatisfactory”.

Table 7. The association rules for service recovery satisfactions.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	(I do not think the handling result of the tea store is fair) and (I do not think the way the tea store handled my complaint can calm me down)	Dissatisfaction with service recovery	33.4%	83.1%

Similarity, the values of the minimum support and confidence are set to be 30% and 80%, respectively. The common characteristics for the group that the satisfaction of the service recovery is unsatisfactory together with the association of these attribute are examined. The results are presented in Table 8.

Table 8. The association rules for service quality satisfactions.

ID	Association rules		Support	Confidence
	Antecedent parts	*Consequent parts*		
1	(Disagreeing that the staff's attitude in handling complaints can calm me down) and (I don't think the drink store shows empathetic care when dealing with problems)	Dissatisfaction with service quality	31.2%	80.4%
2	(I don't think I felt respected when the staff was dealing with the problem.) and (I don't think the drink store shows empathetic care when dealing with problems)	Dissatisfaction with service quality	30.9%	83.1%
3	(I do not think the handling result of the tea drink is fair) and (disagreeing that the staff's attitude in handling complaints can calm me down)	Dissatisfaction with service quality	32.3%	82.0%
4	(Staff are unable to provide the appropriate treatment according to demand) and (I don't think the drink store shows empathetic care when dealing with problems)	Dissatisfaction with service quality	35.6%	80.9%

Taking Rule 1 in Table 8 as an illustration, "Disagreeing that the staff's attitude in handling complaints can calm me down" and "I don't think the drink store shows empathetic care when dealing with problems" occur together very often. This means that 80.4% of customers who feel that "Disagreeing that the staff's attitude in handling complaints can calm me down" and "I don't think the drink store shows empathetic care when dealing with problems" will respond "Dissatisfied" with the service quality when mistakes made in service occur. These association rules can be used to describe the associations of these characteristics, and also indicate the existence of these referential associations in the consumer group of the novel-tea drink.

Additionally, among the four association rules in Table 8 above, three of them reveal that the characteristic of "I don't think the drink store shows empathetic care when dealing with problems" is associated with "Dissatisfaction with service quality", and there are two rules indicate that there exists an association between the characteristics "Disagreeing that the staff's attitude in handling complaints can calm me down" and "Dissatisfaction with service quality". This phenomenon evidences that these two characteristics have a significant influence on consumer dissatisfaction with service quality of the novel-tea drink. Therefore, if staffs can improve their behavior and handling problems, it would effectively enhance customer satisfaction, which in turn increase the loyalty to the novel-tea drink.

5 Conclusions

With the rapid development of the domestic economy and the improvement of people's living levels, the novel-tea drinks gradually go into people's lives, and become an essential daily consumption in the social life of young people. Due to the changes in the market environment, the service quality of the novel-tea drink store has to be continuously improved. Because of the fact that it is a service industry, the occurrence of mistakes made in service cannot be completely avoided. Therefore, service recovery is an important issue for the operators. In order to understand the impact of consumers' satisfaction with service recovery on loyalty, this study employs data mining techniques to analyze this problem and uses the results as a representation of knowledge description.

Based on our results, we can see that less than 40% of the group belongs to the loyal group in both repurchase loyalty and recommendation loyalty. Therefore, there is a lot of room for improvement for each drink store. Furthermore, this study describes the relationship between recovery satisfaction and loyalty by the association rule. It can be seen that the results of "I do not think the handling result of the tea store is fair" and "I do not think the way the tea store handled my complaint can calm me down" are often generated together with "Satisfaction degree of the service recovery is unsatisfactory". In addition, the characteristics of "Disagreeing that the staff's attitude in handling complaints can calm me down" and "Satisfaction degree of the service quality is unsatisfactory" have a considerable influence on customers' dissatisfaction with the service quality of novel-tea drinks. If the staffs' attitude can be improved, it will effectively increase customer satisfaction as well as their loyalty to the novel-tea drinks.

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