What can service recovery do in business-to-business service failure? A search-engine-optimization case study

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Abstract
Recovery of Search-Engine-Optimization (SEO) service failures is valuable to SEO providers. By the data mining methods, interactive effects of service failure types, customers' expectation, and recovery strategies on customers' satisfaction with service recovery are analyzed. Furthermore, communication strategy mixed with other ones is more effective in improving customers' satisfaction.

Keywords: search engine optimization, service recovery, FP mining

Introduction
Search engine optimization (SEO) is the process of improving the visibility of a website or a web page in search engines via the "natural" or un-paid search results. In general, the earlier (or higher on the page) and the more frequently a site appears in the search result list, the more visitors it will receive from the search engine's users.

Baidu.com (abbreviated to Baidu) which incorporated on January 18, 2000, is a famous Chinese web services company. It provides an index of over 740 million web pages, 80 million images, and 10 million multimedia files and now it has been the largest Chinese search engine in the Internet, covering 95 percent range of the netizen in the Chinese network. For the customers, the most important service from Baidu is SEO-based search promotion, which optimizes the customer website pages to achieve higher ranking in search results via the process of selecting specific keyword expressions associated to the website.

However, SEO-based search promotion is a premium service with complex management processes, technicals and very high customers' expectations, implying inevitable service failures

(Hart et al. 1990). Service recovery is the process which "recovers" dissatisfied customers by identifying and fixing problems or making amends for the failures in previous service (Kelley et al. 1994). Excellent service recovery programs are an effective tool for retaining customers and improving their satisfaction (Spreng et al. 1995).

Nevertheless, the service recovery mode in SEO is significantly different from the classical service recovery process. First, the service providers are search engine firms and the customers are firms or organizations rather than individuals, who are always called "corporate customers". A special "organization-to-organization" (O2O) bilateral service-offering relationship will be constructed during the service process. Second, the service delivered from a provider to a customer is always bounded by a service contract. It is a continuous consumption process for the corporate customers.

According to the theory of service recovery and customers' satisfaction, this study focuses on the special mode of O2O service recovery activities in SEO. Using the data mining method and statistical analysis, we analyze the correlations of service failure types, customers' expectation, recovery strategies on customers' satisfaction with O2O service recovery activities, and discuss the effectiveness of mixed communication strategies.

Literature review

In the 1980s to 1990s, the research on service recovery mainly focus on the definition of the basic aspects of content, such as the definition of service recovery (Gronroos 1988, Kelley et al. 1994, Tax et al. 1998), the explanation of necessity and significance of service recovery (Bitner et al. 1990), the classification of service recovery (McCollough et al. 2000, Smith et al. 1999, Tax et al. 1998) and so on. Over the past ten years, researchers are more concerned to study consumers' satisfaction, and the impact of remedial issues (Hess et al. 2003, Smith et al. 1999, Weun et al. 2004). The existing literature related to our research can be summarized in three aspects:

- Impacts of service recovery on customer perception and behavior

Some empirical studies showed that service failure itself would not lead to dissatisfaction of customer, and customers' satisfaction is mainly determined by the existence of service recovery system in enterprise (Bitner et al. 1990, Berry and Parasuraman 1991). Andreassen (2000) proposed a continuous service recovery and customer satisfaction framework. His study had a well-known metaphor theory "service recovery paradox" (McCollough et al. 1992), which means that there is no remedy more than customer satisfaction after service failure experienced in customer satisfaction. Other studies provided an empirical support for this view (Michel et al. 2002 2008, Smith 2002).

- The theoretical basis of service recovery

The study of customer expectation on service recovery is mainly based on: (1) *Attribution theory* which means that customers will try to find mistaken reasons after service failure occurs. Attribution will trigger emotional responses, affect customer satisfaction and results in different behavior intentions. (2) Deutsch (1975) firstly proposed *Equity theory* of social interaction also can be applied to the communication between organizations and customers. (3) *Expectation gap theory*: When there is bias between the level of customer expectations and perceived service recovery, the expectation gap will be generated, which thereby affect customer satisfaction in service recovery (Andreassen 2000, McCollough et al. 2000).

- Dimension and strategy of service recovery

Effective remedial strategies include: apology, correct, sincere understanding,

compensation, follow-up, recognition, and interpretation, etc. (Johnston and Fern 1999, Kelley et al. 1994). However, while Kelley and others thought that "compensation" is the core of service recovery strategy, Johnston stressed that "compensation" is not necessary. We believe that an effective service recovery strategy also depends on the type of service failure, service and compensation levels.

Services recovery in marketing research is still in the fast-growing. A number of mainstream research methods, such as theoretical analysis, empirical research and intelligent data analysis and so on were introduced into such contents and then the results are very abundant. However, the research of data mining on service recovery is still in its infancy. In addition, using common service recovery theory to examine the practice of O2O service failure and recovery activities in SEO along with the evaluation of the effectiveness of service recovery strategies are completely blank.

Data and research design

A pattern that occurs frequently in a data set is called a frequent pattern. To explain the effectiveness of recovery strategy with frequent pattern mining method, we should prepare intensive data for the service recovery for SEO service failure and then construct a method to analyze them.

Data processing for SEO service failure

Data was collected from SEO service failure cases in the Chengdu branch of Baidu.com. This branch has been involved in the typical O2O service for years and has accumulated a lot of service failure cases and service remedial data. First, we need to determine the exact contents of failure types set *F*, customer expectations set *E*, recovery strategies set *S* in SEO service recovery process. So, the data processing for SEO service failure in Baidu.com consists of three parts: service failure types, customer expectations and service recovery strategies (see Table 1-3).

Table 1 –SEO service failure types

Failure classification	Pre-sale services	After-sale service
Failure types	Not satisfied with pre-sale services; Call frequently; Other problems.	Not satisfied with after-sale service; Background operational problems; Not satisfied with website; Service delay; Other after-sale service issues.

Table 2 –Customer expectations for SEO service failure

Expectation classification	Technical expectation	Managerial expectation
Expectations	Solve the problem immediately; Technical Requirements; Stop telephone harassment; Reasonable adjustment; Stop the infringement.	Refund of fees; Required to give a reasonable explanation; Replacement of customer service; Customer service complaints; Claim for damages; Improve management; No expectation.

Table 3 –SEO service recovery strategies

Strategy type	**Strategies**
Communicational strategy	Attribution; Recognition error; Apology; Explanation; Communication; Understanding; Follow-up; Commitment; Interpretation.
Management	Instant response to the failure event; Correct; Make-up; Meet the requirements;

strategy	Preferential treatment; Compensation; Fair solution; Authorization.

Customer satisfaction

There is a simple and common definition about customer satisfaction: when a product or service meets or exceeds a customer's expectation, the customer is usually satisfied (Richard 1993).

According to the expectancy-disconfirmation theory (Oliver 1980), satisfaction outcomes are a function of perceived performance and perceived disconfirmation. Andreassen (2000) pointed out that satisfaction with service recovery may be seen as a function of: Negative affect caused by initial service failure; Expectations of service recovery; Perceived quality of service recovery; Disconfirmation of expectations; and Perceived fairness of outcome of service recovery. He put forward a theoretical model which links the antecedents from disconfirmation theory, equity theory and affect-balance theory to satisfaction with service recovery.

Path analysis of customer satisfaction in SEO service failure

According to the definition of customer satisfaction, the direct impact on customer satisfaction is how the service recovery meets or exceeds a customer's expectations. From the Andreasen's conceptual model, customers tend to evaluate perceived quality of service recovery and compare it to expectations and the corresponding level of disconfirmation within every service encounter. Thus, together with perceptions of service recovery quality, recovery expectations determine customer satisfaction with the recovery and thus recovery effectiveness. Andreassen's model (2000) shows no path from customer's "Expectation" to "Perceived quality of service recovery". In another words, the customer's expectation of the service recovery is independent of the service provider's recovery process.

However, in SEO, the corporate customer will not end the service relation soon after the event of service failure. Instead, the corporate customer will immediately state its recovery expectations to the SEO service provider. From the real survey data of Baidu.com in 2011, only 13 corporate customers in service failure cases have not clearly expressed their recovery expectations, which accounted for 5.4% (total of 239 cases). Actually, in SEO, the service recovery process and the customer expectations are no longer independent, but closely related. It is a management process under the influence of customer expectations. Therefore, the path of the process of customer satisfaction can be described as Fig. 1:

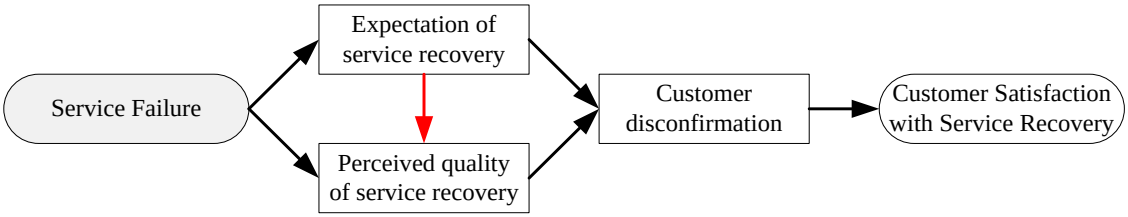

Figure 1 –Path diagram of the customer satisfaction model in SEO Service Recovery

Analyzing method and validity

Let $F=\{f_1, f_2,\ldots,f_m\}$ be a set of service failure types (SFT), $E=\{e_1, e_2,\ldots,e_n\}$ a set of customer expectations (CE), $S=\{s_1, s_2,\ldots,s_q\}$ a set of service recovery strategies (SRS), and $C=\{Yes, No\}$ two kinds of customer satisfaction (CS).

We can conclude that Fig. 1 shows that service failure will affect the customer and recovery strategies (perceived quality of service recovery); customer expectations will also affect recovery strategies; customer expectations together with the perceived quality of service

recovery will impact on customer satisfaction eventually. Thus, there are two main problems facing by SEO service recovery managers.

One question is that given a $f \in \boldsymbol{F}$, how to know the $E \subset \boldsymbol{E}$ of a customer and then which $S \subset \boldsymbol{S}$ is effective to meet the customers' recovery expectations? That means people need to know all the effective combination of $\{f, E, S, c\}$, which will result in customer satisfaction as $\{c=Yes\}$. One efficient solution can be obtained by introducing the association rule analysis method. Association rule reveals some general information about the relations among objects. Association rule mining is to find some interesting associations in large amount of transaction data, relational data or other types of data, and then search frequent patterns (modes), relations between, correlations or causal structures which exist in collection of data itemsets or objects. The frequent patterns (FP) are itemsets that appear in a data set frequently. By thinking each combination of $\{f, E, S, c\}$ as an item set X, FP mining is an appropriate method for the basic needs of question 1.

Let t_{id} be a identifier of data record t, a *transaction* is a couple $t=(t_{id}, I)$ where I is an *item set* in which the failure type, customer expectations, recovery strategies and customer satisfaction of a case of SEO service recovery are recorded. A *transaction database* $\boldsymbol{D}$ is a set of transactions and the *support* of an item set X in $\boldsymbol{D}$ is the number of transactions in which X is contained:

$$support(X, \boldsymbol{D}) := |\{ t_{id} | (t_{id}, I) \in \boldsymbol{D}, X \subseteq I\}|. \quad (1)$$

Further, the frequency of an item set X in $\boldsymbol{D}$ is the probability of X occurring in a transaction $t \in \boldsymbol{D}$:

$$frequency(X, \boldsymbol{D}) := P(X) = support(X, \boldsymbol{D})/|\boldsymbol{D}|. \quad (2)$$

Thus, the task of FP mining is to find out all the frequent itemsets $X \subseteq I$ in $\boldsymbol{D}$. Since our goal is to discover the potential correlations of SFT, SRS, CE and CS, any found frequent item set X must satisfy the condition that

$$X \cap (\boldsymbol{F} \cup \boldsymbol{E} \cup \boldsymbol{S}) \neq \Phi \text{ and } X \cap \boldsymbol{C} \neq \Phi. \quad (3)$$

Another question, is how to evaluate the effectiveness of the found frequent pattern X. $frequency(X, \boldsymbol{D})$ in association rules mining reflects the frequency of occurrence and the importance of X in database $\boldsymbol{D}$. So, we can use *frequency* as the evaluation of effectiveness of strategy $s \in X$ for the failure $f \in X$ and expectation $e \in X$. Given a basic effectiveness threshold φ_0 of recovery strategy s, then strategy s is effective if the following criterion is satisfied:

$$frequency(X, \boldsymbol{D}) \geq \varphi_0. \quad (4)$$

Now, the problem of service recovery management can be specified as: given a basic effectiveness threshold φ_0, how to find all the FPs that appear in a data set with frequency no less than a user-specified threshold.

Results

A program to find frequent itemsets with the fpgrowth algorithm (Han et al 2000), which represents the transaction database as a prefix tree enhanced with pointers that organize the

nodes into lists referring to the same item.

Results of dissatisfaction cases
The objective of analyzing the dissatisfaction cases of SEO service recovery is to find some frequent itemsets as

$X=\{ f, E, S, c \}$, where $c =$'*No*' and $\{ f \} \cup E \cup S \neq \Phi$. (5)

Some interesting frequent itemsets found by FP mining method (φ_0=10%) are related to customer expectation *e*='Claim for damages' (Table 4):

Table 4 –Frequent itemsets for customer expectation of 'Claim for damages'

Frequent itemset *X*	Frequency (%)
{ *e*='Claim for damages', *c* ='*No*'}	40
{ *e*='Claim for damages', *s*='Communication', *c* ='*No*'}	24
{ *e*='Claim for damages', *s*=' Explanation', *c* ='*No*'}	20
{ *e*='Claim for damages', *s*=' Communication, Explanation', *c* ='*No*'}	12

Table 4 shows that about 40% of service recovery dissatisfaction are related to customer expectation *e*='Claim for damages'. Since we take both strategy of "Communication" and "Explanation" as "Communication strategy" (Table 3), we can obtain that the communication strategies have been no use for about 80% SEO customer expectation of "Claim for damages". The trend of service recovery dissatisfaction of customer with expectation of "Claim for damages" is declining while some communication strategies are introduced into the recovery process (Fig. 2). Two conflicts doubt about the above results: The communication strategies are useless for SEO customer expectation of "Claim for damage"? Or most SEO customer expectations of "Claim for damages" were met with wrong implementation of communication strategies?

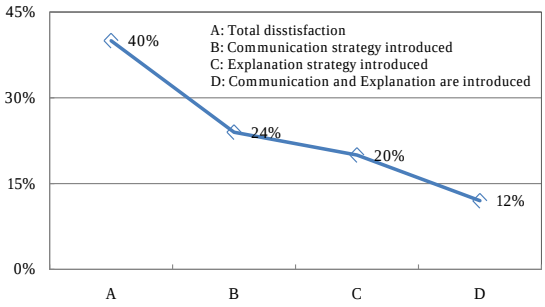

Figure 2 –The trend of service recovery dissatisfaction of customer with exp. of "Claim for damages"

Results of satisfaction cases
Analyzing the satisfaction cases of SEO service recovery is to find some frequent itemsets as

$X=\{ f, E, S, c \}$, where $c =$'*Yes*' and $\{ f \} \cup E \cup S \neq \Phi$. (6)

Since all the mining results are concerned with how and why customers are satisfied with

the service recovery offered by SEO provider, then the effectiveness of each strategy $s \in \boldsymbol{S}$ can be demonstrated by their different frequency in various itemsets. Here is a general comparison of frequency of each common strategy in SEO service recovery (φ_0=2.5%). (Fig. 3)

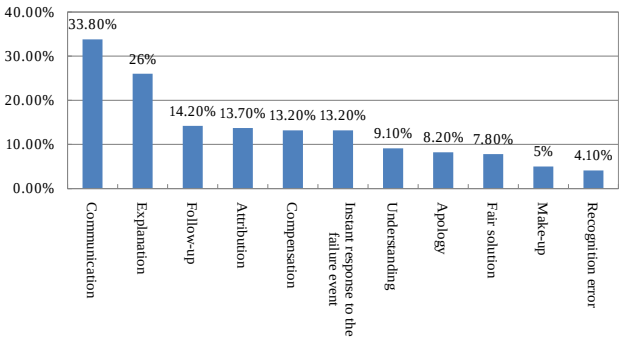

Figure 3 –A general comparison of frequency of each common strategy

Fig. 3 shows that the strategy of "Communication", "Explanation", "Follow-up", "Attribution", "Compensation" and "Instant response" are more effective than the classic recovery strategies such as "Understanding", "Apology", "Fair solution" and so on. In SEO service failure, the corporate customers have practical needs for the SEO service and remedial activities after service failure. For example, the SEO service failure will have both economic and reputational impacts on the future business of corporate customers. Thus, in comparison with individual customers, the corporate customers are more willing to communicate with the service provider after the SEO service failure. The corporate customers trend to attribute the main reason of SEO service failure to the service provider after service failure occurs. Since we obtain the effectiveness of the common recovery strategy in SEO service failure, we need to know why and how these strategies work effectively in SEO service recovery.

Effectiveness of communication strategies

We already know that the 'Communication' strategy is the most effective strategy for recovery process of SEO service failure. The main mined frequent itemsets are shown in Table 5.

Table 5 –Frequent itemsets related to 'Communication' strategy

Frequent itemset X	Frequency (%)
{ f='Not satisfied with after-sales service', e=' Replacement of customer service', s='Communication', c ='*Yes*'}	13.2
{ f='Not satisfied with after-sales service', s='Communication', c ='*Yes*'}	16.9
{e=' Replacement of customer service', s='Communication', c ='*Yes*'}	15.5
{ f='Not satisfied with after-sales service', c ='*Yes*'}	29.7
{ e=' Replacement of customer service', c ='*Yes*'}	31.5

Table 5 shows that 56.9% of service failure "Not satisfied with after-sales service" and 49.2% of customer expectation "Replacement of customer service" can be well solved with "Communication" strategy. Also, the high frequency of item set X={f='Not satisfied with after-sales service', e='Replacement of customer service', s='Communication', c='*Yes*'} is 13.2% means that the "Communication" strategy is very effective for the "Not satisfied with after-sales service" caused by customer expectation of "Replacement of customer service".

In Fig. 3, there are another two important strategies of “Explanation” and “Follow-up” that we do not discussed in detail. In fact, we can regard the top-3 strategies “Communication”, “Explanation” and “Follow-up” as a set of “Communicational” strategies (Table 3). Then, these strategies can satisfy up to 59.5% customers in SEO service failure recovery. These results suggest that the ongoing communication between service provider and corporate customers is very important for the successful implementation of SEO service recovery.

Especially, the frequent itemsets show us that the “Communicational” strategies are also effective for the customer expectation of “Technical Requirements”. For the corporate customers, the lack of understanding for SEO technology (even misunderstanding) may lead to service failure. The top-3 “Communicational” strategies can satisfy up to 90% of the customers’ expectation of “Technical Requirements” in SEO service failure recovery. The same situation also occurred in satisfying the customer expectation of “Refund of fees”. 37.9% of corporate customers with expectation of “Refund of fees” are satisfied with the “Communication” strategy.

Effectiveness of compensation strategy

“Compensation” is a classic strategy in the traditional service recovery management, many service failures often come with “Compensation” requirements. Now, we will analyze its effectiveness with FP mining method under the case of SEO service failure.

The customers’ satisfaction rate of “Compensation” is 13.2%, not particularly high. We should pay attention to the rule X={e=’Claim for damages’, s=’Compensation’, c=’*Yes*’}, *Frequency* = 8.7%. It shows that although the “Compensation” strategy is not the most common SEO strategies. However, once the customer expectation is “Claim for damages” then 79.1% of the customer expectations must be met, or the customers would not be satisfied with the remedial effects provided by SEO service providers. It is noteworthy that the question whether “Compensation” is an effective service recovery strategy is more non-uniform among scholars. From this point of view, “Compensation” is an effective strategy but it is not as important as “Communication” for the recovery of SEO service failures.

Combination-strategy for SEO service failure recovery

Combination-strategy means using multiple remedial strategies for a specific SEO service failure to expect a higher customer satisfaction. Obviously, as the number of strategy for a remedial activity has been increased, it will greatly increase the management costs. Thus, there must be a balance between the customer recovery satisfaction and the recovery cost.

Has the combination-strategy been effective to increase customer recovery satisfaction? Fig. 4 illustrates and reflects the combination of various strategies in Chengdu branch. It shows that combination-strategy has been widely used in various service recovery activities. The most common combination-strategies used in SEO service recovery are in Table 7.

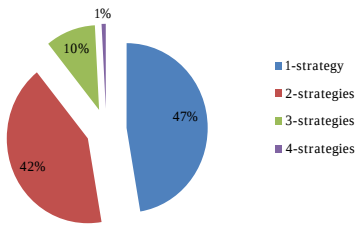

Figure 4 –Combination strategies used in Chengdu branch of Baidu.com

Table 7 –The most common combination-strategy

Frequent itemset *X*	Frequency (%)
{*s*=' Compensation' and 'Recognition error', *c* ='*Yes*'}	3.2
{ *s*=' Understanding' and 'Communication', *c* ='*Yes*'}	3.2
{ *s*=' Compensation' and 'Communication', *c* ='*Yes*'}	3.2
{ *s*=' Attribution' and 'Explanation', *c* ='*Yes*'}	4.6
{ *s*=' Attribution' and 'Communication', *c* ='*Yes*'}	3.7
{ *s*=' Follow-up' and 'Explanation', *c* ='*Yes*'}	2.7
{ *s*=' Follow-up' and 'Communication', *c* ='*Yes*'}	5.9
{ *s*=' Explanation' and 'Communication', *c* ='*Yes*'}	5.9

Correlation analysis shows that: the effect of improving the customer satisfaction for service recovery is obvious by using the mixed "Communication" strategies. Clearly, in the case of SEO, the main function of combining strategies with "Communication" class strategy is to strengthen and enhance customer perception in the remedial process. Moreover, this result also shows the importance of communication in SEO service recovery. For example, using solo strategy of "Compensation" in SEO service recovery, the remedy effectiveness is not so obvious. Combining "Communication" with the "Compensation" strategy, it is an important channel not only promoting further mutual understanding between SEO service providers and corporate customers, but also strengthening the remedy effects of "Compensation" strategy.

Conclusion

SEO has become the focus of information services applications and service research. As a form of O2O information service model, like other service relationship between service providers and consumers, the service failure is inevitable for SEO companies. Service recovery is an effective means used to improve business service level and the customer satisfaction. A new challenge for SEO service recovery is that service consumers are no longer individuals, but other companies or organizations. Thus, the effectiveness of traditional service failure recovery strategies will also be changed in SEO environment.

In this study, based on the basic theory of service recovery and focusing on the special mode of O2O service failure and recovery activities, we discuss the topics by FP mining method and statistical analysis: correlations of service failure types, customers' expectation, and recovery strategies on customers' satisfaction with O2O service failure and recovery activities; the effectiveness of different communication strategies mixed with other ones is discussed.

Some main results can be concluded: First, in line with the service recovery system, corporate customers are similar to individual customers, so the service provider can find a set of most suitable service recovery strategies to treat service failure. Second, data mining can help managers find a large number of new law and rules implied in the service recovery management activities, which can be used to explain management phenomenon, discover new management perspectives, and then better understand and improve the performance of decision-making. Third, customer complaint is an inevitable business problem for the service-oriented enterprises and mixed "Communication" is a very important remedy strategy which strengthens the customer perception in the remedial process and finally enhances customers' satisfaction.

In this study, the theoretical system of service recovery is enriched by the study of O2O service recovery, while for data mining method in the study of service recovery provides a real case. The analysis results play an important role in guiding both the services recovery and SEO

service recovery operations.

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