Fuzzy Comprehensive Evaluation of E-bank Service Failure Remedy—Based on Comparing Xi’an Bank with ICBC in Xi’an
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Abstract. After randomly research the e-bank service failure remedy of ICBC and Xi’an bank in Xi’an, Shaanxi province, we summarize the common existing service failure of online payment, and service remedy strategies for service failure. Using our preliminary study of building hierarchical analysis model of e-bank service failure remedy and the calculation results, this article further evaluates these two commercial banks’ service remedy condition with fuzzy comprehensive evaluation. Based on the contrast with ICBC, we are trying to put forward some feasible suggestion for Xi’an bank, in order to promote its further development.

Introduction
With the matured development of internet, a lot of banks gradually extend their traditional business to online. The emergence of e-bank breaks the limit of space and time of the traditional banks [1]. But due to the virtualization of banking business, the security problem of e-bank is taken more and more seriously, although banks have taken some effective technical tools to ensure the security of e-bank accounts, such as, mobile digital certificate, dynamic password card, files digital certificate and so on. The operation of these High-tech information security products is complicated, and the convenience of e-bank is sure to be influenced, if the service results cannot meet customers’ expectations, it means that service failure has happened [2], customer satisfaction will be reduced, at this moment, e-bank must take some effective measures to remedy their service failure, in order to avoid loss of customers.

In this article, we summarize the situation about service failure remedy of ICBC and Xi’an bank, through opening e-bank, experiencing it personally, and surveying at banks in Xi’an. Based on the data collected and processed after survey, and previous study about choices of service remedial tactics of e-bank, and corresponding calculated evaluation weight, we evaluates the service remedy of ICBC and Xi’an bank with fuzzy comprehensive evaluation. This article also conclude the advantages of e-bank service failure remedy of ICBC, and put forward some corresponding service remedial tactics for Xi’an e-bank.

Service Failure Remedy of E-Bank

Service Failure of E-Bank
Service failure cannot be avoided, it is decided by the characteristics of the service [3]. After investigating, we summarize the service failure of e-bank: (1) The installation of U aegis.
Including the installation of controls, drivers and download for all kinds of certificates, because of the computer operating system and browser type and version is varied, and considering compatibility problem, it will bring some trouble during installation, such as Safari does not support e-bank assistant temporarily. (2) The use of U aegis. Because the information level of some customers is not high, there will exist many problems when they use it. (3) The U aegis need to be updated, some U aegis can be updated through e-bank self-help to prolong the validity of the certificate, but if exceed the time limit or cannot download normally, you have to go to bank branches to update, it will make many customers feel inconvenient, and may reduce the amount of customers of using U aegis. And there are some customers, who are limited to their ability of expression or not familiar with the new products, so they cannot explain their problems accurately, and the result is their problems cannot be solved timely. (4) Some e-bank has real-time interactive program, like Weibo, WeChat and BBS (Bulletin Board System), but others do not.

Hierarchical Analysis Model of E-bank Service Remedial Tactics Choices

As show in Fig. 1, that model contains three parts: The first part is target layer, it refers to the ultimate goal of the research, here it means service failure remedy of security products on e-bank; The second part is rule layer, it refers to strategies of service failure remedy of e-bank; The last part is schematic layer, it refers to specific measures below those strategies.

![Hierarchical Analysis Model of E-bank Service Remedial Tactics Choices](image)

Figure 1. The hierarchical analysis model of service remedial tactics choice of e-bank information security products.[4]

The Evaluation Weight of Service Failure Remedy Choices

Table 1 respectively show the total evaluation weight of first grade indexes and the secondary indicators relative to the target layer. And the importance of each measure of schematic layer is different to the target layer, among them the contribution of all the real-time interactive columns is the biggest, accounting for 37%. And contribution of the education of customers’ information is the smallest, just accounting for 4%.

It tell us that e-bank can focus more on measures which contribution is larger than others, but this is not to say that it can give up those measures which contribute less, the right way is to use the limited resources mainly on important measures, and combined with other measures for service remedy.
Table 1. Results of e-bank information security products service remedy strategies choice of hierarchical analysis. [4]

<table>
<thead>
<tr>
<th>Target layer</th>
<th>Rule layer (The first level indicators)</th>
<th>Schematic layer (The secondary indicators)</th>
<th>The weight of the secondary indicators relative to the target layer $W_2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>The service failure remedy of security products on E-bank</td>
<td>Encouraging and tracking complains 0.318 All real-time interactive columns of E-bank</td>
<td>0.373</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Quick action 0.226 Center of solving questions at traditional branches of banks</td>
<td></td>
<td>0.270</td>
</tr>
<tr>
<td></td>
<td>Providing adequate explanation 0.172</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Be fair to customers 0.118 Solving questions through the phone</td>
<td></td>
<td>0.162</td>
</tr>
<tr>
<td></td>
<td>Developing relationship with customers 0.073 The training of the employees’ information service awareness</td>
<td></td>
<td>0.110</td>
</tr>
<tr>
<td></td>
<td>Learning from service remedy experiences 0.045</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Learning from the lost customers 0.016 The information education of customers</td>
<td></td>
<td>0.040</td>
</tr>
<tr>
<td></td>
<td>Avoiding service failure 0.032 Service commitment</td>
<td></td>
<td>0.045</td>
</tr>
</tbody>
</table>

The Fuzzy Comprehensive Evaluation

Research Design of Fuzzy Comprehensive Evaluation

The survey sites were selected in north, south, east, west, and central region of Xi’an, and we chose 20 Xi’an Bank, 30 ICBC randomly, in order to get the single factor evaluation set $t_i$ and comprehensive evaluation matrix $T$, making survey data more objective and persuasive. During the process of investigation, we found that there is a higher similarity between various branches of the bank, so 20 Xi’an bank and 30 ICBC are representative. After visiting these banks, we finally got some data we want, and it is the original data of our fuzzy comprehensive evaluation.

The Fuzzy Comprehensive Evaluation Based on Hierarchical Analysis Model

According to the design of our research, we did fuzzy comprehensive evaluation [5] about the situation of service failure remedy of ICBC and Xi’an bank. Take every secondary indicators (from Table 1) as the single factor evaluation index $u_i$ ($i=1, 2, \ldots 6$), six single factors constitute factors set $U=\{u_1, u_2, u_3, u_4, u_5, u_6\}=\{\text{All real-time interactive columns of E-bank, Center of solving questions at traditional branches of banks, Solving questions through the phone, The training of employees’ Information service awareness, The education of customers’ Information, Service commitment}\}$, set comment set of every single factor like $V=\{v_1, v_2, v_3, v_4\}=\{\text{Excellent, Good, Middle, Poor}\}$, and for comments, we also give a specific number standard: Excellent(100), Good(80), Middle(60), Poor(40), so the comment set also can be
\[V=\{100, 80, 60, 40\}\]. From Table 1, the vector of total evaluation weight of the secondary indicators relative to the target layer can be obtained, that is \[W=(w_1, w_2, w_3, w_4, w_5, w_6)= (0.373, 0.270, 0.162, 0.110, 0.040, 0.045)\].

**The Fuzzy Comprehensive Evaluation of E-bank’s Service Failure Remedy Situation of ICBC**

From 30 pieces of the survey, we got every secondary indicators’ membership degree \(t_{ij}\) to four kinds of comment. Thus, we can get the single factor evaluation set of the \(i\)th element: \(t_i=\{t_{i1}, t_{i2}, t_{i3}, t_{i4}\}\), and can also get a comprehensive evaluation matrix, as shown in the Table 2.

**Table 2. Evaluation matrix of E-bank service failure remedy condition of ICBC.**

<table>
<thead>
<tr>
<th>Target layer</th>
<th>The secondary indicators</th>
<th>The weight of the secondary indicators relative to target layer (W_2)</th>
<th>The single factor evaluation set of the secondary indicators relative to target layer (t_i)</th>
<th>Comment set (V)</th>
</tr>
</thead>
</table>
|              | All real-time interactive columns of E-bank                 | 0.373                                                               | \(t_1\)                                                                         | Excell 100  
|              | Center of solving questions at traditional bank branches    | 0.270                                                               | \(t_2\)                                                                         | Good 80  
|              | Solving questions through the phone                          | 0.162                                                               | \(t_3\)                                                                         | Middle 60  
|              | The training of employees’ information service awareness    | 0.110                                                               | \(t_4\)                                                                         | Poor 40  
|              | The information education of customers                       | 0.040                                                               | \(t_5\)                                                                         |                  |
|              | Service commitment                                          | 0.045                                                               | \(t_6\)                                                                         |                  |

From Table 2, we can know that comprehensive evaluation matrix is:

\[
T=(t_{ij})_{6\times4}=
\begin{pmatrix}
1.00 & 0.00 & 0.00 & 0.00 \\
0.97 & 0.00 & 0.30 & 0.00 \\
0.70 & 0.20 & 0.10 & 0.00 \\
0.73 & 0.20 & 0.07 & 0.00 \\
0.00 & 0.00 & 0.80 & 0.20 \\
0.00 & 0.00 & 1.00 & 0.00
\end{pmatrix}
\]
According to $Q = W \cdot T$, we can work out fuzzy comprehensive evaluation set $Q$. $Q = (0.828, 0.054, 0.110, 0.008)$. And we can know that the service remedy condition of ICBC in each grade (Excellent, Good, Middle, Poor) respectively accounting for 82.8%, 5.4%, 11%, 0.8%. Using the principle of maximum membership degree, the highest score in $Q$ is 0.828, and its corresponding rating is excellent, so, e-bank service recovery level of ICBC is optimal, the result of the comprehensive evaluation is excellent.

Based on comment set $V = (100, 80, 60, 40)$, we can get the fuzzy comprehensive evaluation of quantitative score: $0.828 \times 100 + 0.054 \times 80 + 0.110 \times 60 + 0.008 \times 40 = 94.051$. This score is high, so from the overall, the service failure remedy condition of e-bank of ICBC is excellent.

The Fuzzy Comprehensive Evaluation of E-bank Service Failure Remedy Situation of Xi’an Bank

There are 20 pieces of the survey of Xi’an bank, and the steps of evaluation are same with ICBC. From 20 pieces of the survey, we can get each secondary indicators’ membership degree $t_i$ to four kinds of comment, can also get a comprehensive evaluation matrix, as shown in the Table 3.

Table 3. Evaluation matrix of e-bank service failure remedy condition of Xi’an bank.

<table>
<thead>
<tr>
<th>Target layer</th>
<th>The secondary indicators</th>
<th>The weight of the secondary indicators relative to target layer $W_2$</th>
<th>The single factor evaluation set $t_i$</th>
<th>Comment set V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service remedy of security products on E-bank</td>
<td>All real-time interactive columns of E-bank</td>
<td>0.373</td>
<td>$t_1$</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Center of solving questions at traditional branches of banks</td>
<td>0.270</td>
<td>$t_2$</td>
<td>0.10</td>
</tr>
<tr>
<td></td>
<td>Solving questions through the phone</td>
<td>0.162</td>
<td>$t_3$</td>
<td>0.20</td>
</tr>
<tr>
<td></td>
<td>The training of employees’ information service awareness</td>
<td>0.110</td>
<td>$t_4$</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>The information education of customers</td>
<td>0.040</td>
<td>$t_5$</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>Service commitment</td>
<td>0.045</td>
<td>$t_6$</td>
<td>0.00</td>
</tr>
</tbody>
</table>

From Table 3, we can get comprehensive evaluation matrix:
According to \( Q = W \cdot T \), we can work out fuzzy comprehensive evaluation set \( Q \). \( Q = (0.136, 0.468, 0.325, 0.071) \). And we can know that the service remedy condition of Xi’an bank in each grade (Excellent, Good, Middle, Poor) respectively accounting for 13.6\%, 46.8\%, 32.5\%, 7.1\%. Using the principle of maximum membership degree, the highest score in \( Q \) is 0.468, and its corresponding rating is good. And the second score is 0.325, its corresponding rating is middle. So the result of the comprehensive evaluation is mainly focused on good and middle.

Based on comment set \( V = (100, 80, 60, 40) \), we can get the fuzzy comprehensive evaluation of quantitative score: 
\[
0.136 \times 100 + 0.468 \times 80 + 0.325 \times 60 + 0.071 \times 40 = 73.404,
\]
this score is lower than the score of ICBC. And at the level of poor, the ICBC just accounts for 0.8\%, but the Xi’an bank accounts for 7.1\%. Thus, we can draw a conclusion that the service failure remedy condition of Xi’an bank is inferior to ICBC, and there is plenty of room to improve for Bank of Xi’an.

Service Remedial Strategies of Xi’an Bank and ICBC

The Advantage of ICBC Service Failure Remedy

From the above research, we know that ICBC has done a good job at service failure remedy. And its success lies in: ICBC set channels tracking customer complaints; it explains or troubleshoots customer’s problem quickly and sincerely; the training level about the ability and professional quality of their employees is high; traditional branches have self-service machine of e-bank, it is convenient for customers who cannot use e-bank self well.

Strategies of Service Failure Remedy of Xi’an E-bank

The fuzzy comprehensive evaluation of quantitative score of Xi’an e-bank is just 73.4. Learn from ICBC, there are some useful suggestions for Xi’an bank: (1) Setting the real-time interactive columns, to provide customers with channels of complaints. Xi’an bank should set more channels to interact with customers, such as BBS, Weibo, WeChat and online customer service, etc. (2) Reinforcing the training of staff, to improve the staff’s service consciousness and their information level. (3) Strengthening the guidance of e-bank experience at the traditional outlets, to make customers feel convenient. When customers have some trouble with e-bank, and they cannot explain their trouble clearly on the phone, then they can take their U aegis to Xi’an bank, with the guidance of staff, the problem will be solved on the spot, it will really enhance customer satisfaction for e-bank services.

Summary

According to our preliminary study of build hierarchical analysis model of e-bank service failure remedy and the calculation results, this article further evaluates e-bank service remedy condition of Xi’an bank and ICBC with fuzzy comprehensive evaluation. The results show...
that e-bank service failure remedy condition of ICBC is much better than that of Xi’an bank. Through summarizing advantages of e-bank service failure remedy of ICBC, we put forward some useful suggestion for Xi’an bank.

E-bank has largely changed the traditional business model of commercial banks, but in the strong impact of third party payment and the internet financial innovation pattern, e-bank should improve its convenience drastically, under the premise of guaranteeing certain security. Especially in the use of the entrance of e-bank, it is necessary to provide customers with various ways of login and payment, in order to let them to choose the way they want. And it also should pay more attention to the user’s experience, to constantly find and identify service failures and remedy them timely, and this will further improve their service quality. With the think of internet way, ‘Brand + The free service + Traffic + Converting into cash’, to maintain existing customers and develop potential customers, and convert traffic into cash timely, finally improve the market share of e-bank.

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References