Improving the Effective Factors on E-banking System by using Fuzzy TOPSIS in Parsian Bank

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Abstract: Purpose of this study was an investigation and explanation of effective factors on improving e-banking by using Fuzzy TOPSIS in Parsian bank. Based on, it reviewed literature of e-banking in special. Instruments of collecting data were documents and interviews, to explain effective factors on improving the e-banking by emphasize on fuzzy TOPSIS. This method is presenting aiming at solving MCDM problems in which the weights of criteria are unequal. The results are showed in the entire factors; operational, technical and strategic have the most effect on Improving of e-banking. With other words, this bank for endurance in the competitive situation needs to promote e-channel specific marketing, rapid delivery of services, responsive customer service, 24 h availability of services, systems and channels integration, security, having multiple channels, mixed strategy selection of vendors and systematic change management.

Key words: Operational, technical, strategic, e-banking, fuzzy TOPSIS

INTRODUCTION

The area of e-banking has appeared in IS literature since the mid-1990s (Buhl and Will, 1998; Devlin, 1995; King and Liou, 2004, Liao and Cheung, 2002; Scruggs and Nam, 2002; Yan and Paradi, 1998, Yousefzai et al., 2003, 2005). There is a lack of case studies reporting the actual experience of organizations in implementing e-banking. This gap in the research poses problems for banks, because the limitations in relation to this area usually mean difficulties for them in planning and implementing e-banking (Daniel, 1999; Southard and Siau, 2004). The importance of e-banking as a financial services delivery channel is growing because of its wider reach and low cost per transaction. The Internet as a channel for services delivery is fundamentally different from other channels, such as branch networks or telephone banking, because of its interactive nature. Therefore, it brings up unique types of challenges and requires novel solutions (King and Liou, 2004; Southard and Siau, 2004; Yan and Paradi, 1998). Liao and Cheung (2002), Sathy (1999) and Yan and Paradi (1998) have explored the perception of customers about e-banking. King and Liou (2004) and Harden (2002) compared the e-channel with other channels. Some strategic issues such as outsourcing of e-banking initiatives have been discussed by Cantoni and Rossignoli (2000) or competitive advantage of e-banking by Griffiths and Finlay (2004). To succeed in the e-banking arena, companies need to transform their internal foundations to be effective (Franco and Klein, 1999) with strategic factors. The new type of business would consist of finely tuned integration of business, technology and processes (El Sawy et al., 1999, Enos, 2001). Web based services have to be more convenient, easier to use and less expensive than the alternative, to win the loyalty of consumers (Cronin, 1998). Mols (1998) suggested that banks should use the Internet as an additional channel of distribution and must keep their traditional channels such as branches and phone banking, intact. This gives the banks the opportunity for a gentle transition from a branch banking strategy to e-banking strategy and it provides good market coverage. Cronin (1998) proposed branding as a transferable resource across physical and social barriers to entry for customers in a new and perceptibly daunting environment. This point was also stressed by Yousefzai et al. (2005).

Security, which may include protection of consumers personal data and safe transactions to...
prevent misuse, is paramount for the growth of any sort of online trade, including e-banking. Security in this context includes secure transactions as well as secure front end and back up systems. Franco and Klein (1999) stressed the importance of upgrading existing technological infrastructure to bring it up to the speed with the Internet trade. Storey et al. (2000) state that technology failures lead to loss of custom, often forever. Shortcomings in technological infrastructure are often the biggest hurdle in adoption of the e-banking channel and its integration with other channels (Shah et al., 2003).

Security is mentioned as a very critical factor by Enos (2001), Turban et al. (2000) and Regan and Maehlau (2000). Lack of it, or consumers’ fears about it, is one of the biggest obstacles in the growth of e-commerce. The most common factor cited by many in literature, is good customer service (Liao and Cheung, 2002; Orr, 2004). Legislation has increased customers’ rights while technology and competition have increased their choice of products and providers. The Internet and changes in social behaviors will result in the growth of users with sophisticated needs and new channels are required to serve most of these needs (Jayawardhena and Foley, 2000). Harden (2002) argues that e-channels erode a direct relationship with customers and stresses the need for personalization in customer communication. Stamoulis (2000) saw re-drawing the Internet market map as a vital prerequisite for e-banking strategy, because the Internet requires different marketing methods than other service distribution channels. A similar point has been made by Fruhling and Digman (2000) when they wrote that the Internet is having significant effects on market development strategies. According to Jayawardhena and Foley (2000), banks must continually invent new products and services in light of changes brought by the Internet and also make existing products more suitable for online delivery. Similarly, Riggins (1999) identified a number of critical success factors of Internet banking in the context of the Australian banking industry.

Therefore, to the mentioned subjects describe the importance and role of the e-banking to improve in competitive conditions. In this research, effective factors on improving of e-banking would be study. In the other words, this study focus on improving of e-banking by using Fuzzy TOPSIS in Parsian bank, so it would be try to answer this questions, which factors are most important on improving of e-banking in Parsian bank by Fuzzy TOPSIS approach.

**MATERIALS AND METHODS**

The principal result of any classification process is the interpretation that can improve problem-solving performance in the domain of interest (Ciarapica and Giacchetta, 2008). Therefore, classifying among a set of variables is a complex and common problem even in occupational safety. In this study e-banking refers to e-business factors by using fuzzy TOPSIS approach. The fuzzy TOPSIS is the fuzzy extension of TOPSIS to efficiently handle the fuzziness of the data involved in the decision making (Salehi and Tahvakkoli-Moghaddam, 2008; Bellman and Zadeh, 1970). It is easy to understand and it can effectively handle both qualitative and quantitative data in the Multi-Attribute Decision Making (MADM) problems (Abo-Sinna and Amer, 2005; Hwang and Yoon, 1981; Yoon, 1980; Chen, 2000).

Its area is about banking, especially e-banking. This study was conducted in 2009 and its local domain was Parsian bank (this bank have 200 branches in Iran).

There are three alternatives according to their influence on e-banking includes; strategic, technical and operational that all of them are related to nine criteria encompass multiple channels, mixed strategy selection of vendors, systematic change management, systems and channels integration, Security, e-channel specific marketing, rapid delivery of services, fast responsive customer service and 24 h availability of services.

In order to critically evaluating and validity the used factors (Hult and Ferrell, 1997) in questionnaire, there is some study and tests on factors by the experts, after final modified questionnaire would be used.

**RESULTS**

**Definitions:** Here, some basic important definitions of fuzzy sets are given:

**Fuzzy:** Most of the time gathered information for some reason isn’t very exactly (crisp) and is along with lack of certainty, that can be modeling as Fuzzy model.

- **Membership dependency:** Is a dependency which describe X variable at [0,1]:

  \[
  \mu(x) : [0,1]
  \]

- **Normal fuzzy No.:** \( \tilde{a} \) is told as normal Fuzzy No. which its membership dependency is equally to one in accordance to some points (Amiri, 2008).
- **Fuzzy No.:** A fuzzy No. \( \tilde{a} \) is a fuzzy convex subset of the real line satisfying the following conditions:

  - \( \mu_X(x) \) is piecewise continuous.
  - \( \mu_X(x) \) is normalized, that is, there exists \( m \in \mathbb{R} \) with \( \mu_X(m) = 1 \), where \( m \) is called the mean value of \( \tilde{a} \) (Amiri et al., 2009a, b).
Fig. 1: A triangular fuzzy number \( \tilde{a} \)

- **Triangular fuzzy No. \( \tilde{a} \):** A triangular fuzzy No. \( \tilde{a} \) can be defined by a triplet \((a_1, a_2, a_3)\). Its conceptual schema and mathematical form are shown by equation below:

\[
\mu_i(x) = \begin{cases} 
0, & x < a_1 \\
\frac{x - a_1}{a_2 - a_1}, & a_1 < x \leq a_2 \\
1, & a_2 < x \leq a_3 \\
\frac{a_3 - x}{a_3 - a_2}, & a_3 < x \\
0, & a_3 < x
\end{cases}
\]

A triangular fuzzy number \( \tilde{a} \) in the universe of discourse \( X \) that conforms to this definition has been shown in Fig. 1.

- **Trapezoidal fuzzy No. \( \tilde{a} \):** A trapezoidal fuzzy number \( \tilde{a} \) can be defined by quadruplet \((a_1, a_2, a_3, a_4)\) (Amiri et al., 2009a, b). Its conceptual schema and mathematical form are shown by equation below:

\[
\mu_i(x) = \begin{cases} 
0, & x \leq a_1 \\
\frac{x - a_1}{a_2 - a_1}, & a_1 < x \leq a_2 \\
1, & a_2 < x \leq a_3 \\
\frac{a_3 - x}{a_4 - a_3}, & a_3 < x \leq a_4 \\
0, & a_4 < x
\end{cases}
\]

A trapezoidal fuzzy number \( \tilde{a} \) in the universe of discourse \( X \) that conforms to this definition has been shown in Fig. 2.

**Fuzzy TOPSIS:** The TOPSIS is widely used for tackling ranking problems in real situations. This method is often criticized for its inability to adequately handle the inherent uncertainty and imprecision associated with the mapping of the decision-maker's perception to crisp values. In the traditional formulation of the TOPSIS, personal judgments are represented with crisp values. However, in many practical cases the human preference model is uncertain and decision-makers might be reluctant or unable to assign crisp values to the comparison judgments (Chan and Kumar, 2007). Having to use crisp values is one of the problematic points in the crisp evaluation process. One reason is that decision-makers usually feel more confident to give interval judgments rather than expressing their judgments in the form of single numeric values. As some criteria are difficult to measure by crisp values, they are usually neglected during the evaluation. Another reason is mathematical models that are based on crisp value. These methods cannot deal with decision-makers' ambiguities, uncertainties and vagueness which cannot be handled by crisp values. The use of fuzzy set theory (Zadeh, 1975) allows the decision-makers to incorporate unquantifiable information, incomplete information; non-obtainable information and partially ignorant facts into decision model (Kulak and Kahraman, 2005). As a result, fuzzy TOPSIS and its extensions are developed to solve ranking and justification problems (Buyukkordu et al., 2008; Chen and Tsao, 2007; Kahraman et al., 2007; Orn et Soner, 2007; Wang and Ellag, 2006; Yong, 2006). This study uses triangular fuzzy number for fuzzy TOPSIS. The reason for using a triangular fuzzy number is that it is intuitively easy for the decision-makers to use and calculate. In addition, modeling using triangular fuzzy numbers has proven to be an effective way for formulating decision problems where the information available is subjective and imprecise (Chang and Yeh, 2002; Chang et al., 2007; Kahraman et al., 2004; Zimmerman, 1996). In practical applications, the triangular form of the membership function is used most often for representing fuzzy numbers (Xu and Chen, 2007).
According to briefly summarized fuzzy theory above, fuzzy TOPSIS steps can be outlined as follows:

**Step 1:** Construct a decision matrix, assume there are \( m \) alternatives \( A_i (i = 1, 2, \ldots, m) \) to be evaluated against \( n \) selection criteria \( X_j (j = 1, 2, \ldots, n) \). The weighting vector \( W = (w_1, w_2, \ldots, w_n) \) and the decision matrix \( X = \{x_{ij}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n\} \), using the linguistic terms. The weighting vector \( W \) represents the relative importance of \( n \) selection criteria \( X_j (j = 1, 2, \ldots, n) \) for the problem. The decision matrix \( X = \{x_{ij}, i = 1, 2, \ldots, m; j = 1, 2, \ldots, n\} \) represents the utility ratings of alternative \( A_i \) with respect to selection criteria \( X_j \). Given the weighting vector \( W \) and decision matrix \( X \), the objective of the problem is to rank all the alternatives by giving each of them an overall utility with respect to all selection criteria (Table 1). The decision matrix and weighting vector can be expressed as follows:

\[
D = \begin{bmatrix}
A_1 & x_{11} & x_{12} & \cdots & x_{1n} \\
A_2 & x_{21} & x_{22} & \cdots & x_{2n} \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
A_m & x_{m1} & x_{m2} & \cdots & x_{mn}
\end{bmatrix}
\]

\[
W = [w_1, w_2, \ldots, w_n]
\]

**Step 2:** The decision matrix needs to be normalized for each criterion \( X_j (j = 1, 2, \ldots, n) \) to obtain the projection value of each criterion.

In triangular fuzzy number (this research used triangular fuzzy number Table 2):

\[
\tilde{s}_i (\ell) = \begin{cases}
\tilde{s}_i (\ell^+) = \left( a_i, b_i, c_i \right) \\
\tilde{s}_i (\ell^-) = \left( a_i, b_i, c_i \right)
\end{cases}
\]

In trapezoid fuzzy number:

\[
\tilde{s}_i (\ell) = \begin{cases}
\tilde{s}_i (\ell^+) = \left( a_i, b_i, c_i, d_i \right) \\
\tilde{s}_i (\ell^-) = \left( a_i, b_i, c_i, d_i \right)
\end{cases}
\]

After normalized the decision matrix, \( D \) convert to \( D' \) (Table 3):

\[
D' = \begin{bmatrix}
A_1 & r_{11} & r_{12} & \cdots & r_{1n} \\
A_2 & r_{21} & r_{22} & \cdots & r_{2n} \\
\vdots & \vdots & \vdots & \ddots & \vdots \\
A_m & r_{m1} & r_{m2} & \cdots & r_{mn}
\end{bmatrix}
\]

**Step 3:** The fuzzy weighted decision matrix, \( \tilde{v}_j \) for fuzzy weighted decision matrix can be obtained.

In triangular fuzzy No. (Table 4):

\[
\tilde{v}_j = \tilde{v}_j (\ell) \tilde{w}_j = \left( a_j, b_j, c_j \right) \times \left( a_i, b_i, c_i \right)
\]

\[
\tilde{v}_j = \tilde{v}_j (\ell) \tilde{w}_j = \left( a_j, b_j, c_j \right) \times \left( a_i, b_i, c_i \right)
\]

In trapezoid fuzzy No.:

<table>
<thead>
<tr>
<th>Factors</th>
<th>( X_1 )</th>
<th>( X_2 )</th>
<th>( X_3 )</th>
<th>( X_4 )</th>
<th>( X_5 )</th>
<th>( X_6 )</th>
<th>( X_7 )</th>
<th>( X_8 )</th>
</tr>
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<tr>
<td>( A_1 )</td>
<td>[7,9,10]</td>
<td>[5,7,9]</td>
<td>[9,10,10]</td>
<td>[0,1,3]</td>
<td>[3,5,7]</td>
<td>[1,3,5]</td>
<td>[0,1,3]</td>
<td>[1,3,5]</td>
</tr>
<tr>
<td>( A_2 )</td>
<td>[1,3,5]</td>
<td>[3,5,7]</td>
<td>[5,7,9]</td>
<td>[9,10,10]</td>
<td>[0,1,3]</td>
<td>[3,5,7]</td>
<td>[1,3,5]</td>
<td>[1,3,5]</td>
</tr>
<tr>
<td>( A_3 )</td>
<td>[3,5,7]</td>
<td>[1,3,5]</td>
<td>[5,7,9]</td>
<td>[3,5,7]</td>
<td>[1,3,5]</td>
<td>[7,9,10]</td>
<td>[7,9,10]</td>
<td>[3,5,7]</td>
</tr>
<tr>
<td>( W )</td>
<td>[0,3,0,5,0,7]</td>
<td>[0,3,0,5,0,7]</td>
<td>[0,5,0,7,0,9]</td>
<td>[0,1,0,3,0,5]</td>
<td>[0,7,0,9,1]</td>
<td>[0,3,0,5,0,7]</td>
<td>[0,5,0,7,0,9]</td>
<td>[0,9,1,1]</td>
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</table>
Table 2: Normalization decision matrix process

<table>
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<tr>
<th>Factors</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>X7</th>
<th>X8</th>
</tr>
</thead>
<tbody>
<tr>
<td>a1</td>
<td>0.596, 0.529, 0.454</td>
<td>0.559, 0.467, 0.387</td>
<td>0.529, 0.455, 0.385</td>
<td>0.603, 0.515, 0.321</td>
<td>0.378, 0.287, 0.138</td>
<td>0.097, 0.058, 0.024</td>
<td>0.097, 0.058, 0.024</td>
<td>0.113, 0.083, 0.025</td>
</tr>
<tr>
<td>b*</td>
<td>[7.9, 10]</td>
<td>[5.7, 9]</td>
<td>[9.10, 10]</td>
<td>[9.10, 10]</td>
<td>[9.10, 10]</td>
<td>[7.9, 10]</td>
<td>[7.9, 10]</td>
<td>[7.9, 10]</td>
</tr>
<tr>
<td>ε</td>
<td>[1, 3.5]</td>
<td>[1, 3.5]</td>
<td>[3.5, 7]</td>
<td>[3.5, 7]</td>
<td>[3.5, 7]</td>
<td>[3.5, 7]</td>
<td>[3.5, 7]</td>
<td>[3.5, 7]</td>
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</tbody>
</table>

Table 3: Normalized decision matrix

<table>
<thead>
<tr>
<th>Factors</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>X7</th>
<th>X8</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>1.1</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>A2</td>
<td>0.14</td>
<td>0.35</td>
<td>0.5</td>
<td>0.67</td>
<td>0.71</td>
<td>0.74</td>
<td>0.76</td>
<td>0.79</td>
</tr>
<tr>
<td>A3</td>
<td>0.42</td>
<td>0.55</td>
<td>0.67</td>
<td>0.55</td>
<td>0.67</td>
<td>0.55</td>
<td>0.67</td>
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Table 4: The fuzzy weighted decision matrix

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<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
<th>X7</th>
<th>X8</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
<td>[0.3, 0.5, 0.7]</td>
</tr>
<tr>
<td>A2</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
<td>[0.4, 0.6, 0.8]</td>
</tr>
<tr>
<td>A3</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
<td>[0.5, 0.7, 0.9]</td>
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</tbody>
</table>

Table 5: PIS A+ and NIS A-

<table>
<thead>
<tr>
<th>Factors</th>
<th>X1</th>
<th>X2</th>
<th>X3</th>
<th>X4</th>
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<th>X6</th>
<th>X7</th>
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<tbody>
<tr>
<td>A1</td>
<td>0.500</td>
<td>0.500</td>
<td>0.700</td>
<td>0.060</td>
<td>0.461</td>
<td>0.187</td>
<td>0.116</td>
<td>0.321</td>
</tr>
<tr>
<td>A2</td>
<td>0.187</td>
<td>0.187</td>
<td>0.382</td>
<td>0.300</td>
<td>0.867</td>
<td>0.411</td>
<td>0.411</td>
<td>0.321</td>
</tr>
<tr>
<td>A3</td>
<td>0.259</td>
<td>0.259</td>
<td>0.526</td>
<td>0.167</td>
<td>0.283</td>
<td>0.706</td>
<td>0.547</td>
<td>0.867</td>
</tr>
</tbody>
</table>

\[
\tilde{v}_i = \Big[ \frac{a_i}{c_i} - b_i - c_i \bigg/ \bigg\{ \frac{a_i}{c_i} - b_i - c_i \bigg\} \Big] \times \alpha_i \beta_i
\]

\[
\tilde{v}_i = \Big[ \frac{a_i}{c_i} - b_i - c_i \bigg/ \bigg\{ \frac{a_i}{c_i} - b_i - c_i \bigg\} \Big] \times \alpha_i \beta_i
\]

Step 4: Determine the positive ideal solution (PIS) A+ and the negative ideal solution (NIS) A-. Sort the weighted normalized values for each criterion adapted to Leeandidi.

In triangular fuzzy No. (Table 5):

\[
M(x_i) = \frac{a_i^2 + c_i^2 - a_i b_i + c_i b_i}{3(a_i + c_i)}
\]

In trapezoid fuzzy No.:

\[
M(x_i) = \frac{a_i^2 + b_i^2 + c_i^2 + d_i^2 - a_i b_i + c_i d_i}{3(c_i - b_i - c_i - d_i)}
\]

Step 5: Calculate the distance from the positive ideal solution and the negative ideal solution for each alternative.

According to Zadeh definition about distance between two fuzzy numbers is:

\[
D_i^+ = 1 - \sup_{x} \min \left\{ \alpha_i(x), \alpha_j(x) \right\}
\]

\[
D_i^- = 1 - \sup_{x} \min \left\{ \alpha_i(x), \alpha_j(x) \right\}
\]

Step 6: Calculate the closeness coefficient. And rank each closeness coefficient of each alternative in descending
Table 6: The distance from the positive ideal solution

<table>
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<th>Factors</th>
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<th>$X_4$</th>
<th>$X_5$</th>
<th>$X_6$</th>
<th>$X_7$</th>
<th>$X_8$</th>
<th>$X_9$</th>
<th>Total</th>
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<tbody>
<tr>
<td>$A_1$</td>
<td>2.5</td>
<td>2.5</td>
<td>1.5</td>
<td>8.0833</td>
<td>2.2</td>
<td>4.545454</td>
<td>4.79769</td>
<td>4.00</td>
<td>3.5</td>
<td>33.62648</td>
</tr>
<tr>
<td>$A_2$</td>
<td>4.54545</td>
<td>3.4322</td>
<td>2.32143</td>
<td>3.5</td>
<td>1.0</td>
<td>2.5346</td>
<td>2.5346</td>
<td>4.00</td>
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<tr>
<td>$A_3$</td>
<td>3.40314</td>
<td>4.5</td>
<td>1.59375</td>
<td>4.25</td>
<td>3.1739</td>
<td>2.5</td>
<td>1.5</td>
<td>3.08</td>
<td>1.0</td>
<td>24.99773</td>
</tr>
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</table>

Table 7: The distance from the negative ideal solution

<table>
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<th>$X_4$</th>
<th>$X_5$</th>
<th>$X_6$</th>
<th>$X_7$</th>
<th>$X_8$</th>
<th>$X_9$</th>
<th>Total</th>
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<tbody>
<tr>
<td>$A_1$</td>
<td>0.4545</td>
<td>0.21845</td>
<td>0.5</td>
<td>0.31818</td>
<td>0.36</td>
<td>0.44586</td>
<td>0.1099</td>
<td>0.0</td>
<td>0.08537</td>
<td>2.49229</td>
</tr>
<tr>
<td>$A_2$</td>
<td>0.04459</td>
<td>0.17176</td>
<td>0.33582</td>
<td>0.5</td>
<td>1.5</td>
<td>0.1628</td>
<td>0.0517</td>
<td>0.0</td>
<td>0.08537</td>
<td>3.651968</td>
</tr>
<tr>
<td>$A_3$</td>
<td>1.354749</td>
<td>0.5315</td>
<td>2.3089</td>
<td>0.15789</td>
<td>0.14005</td>
<td>0.4545</td>
<td>1.51429</td>
<td>0.66038</td>
<td>1.68852</td>
<td>8.810823</td>
</tr>
</tbody>
</table>

Table 8: Closeness coefficient

<table>
<thead>
<tr>
<th>Factors</th>
<th>Values</th>
<th>Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A_1$</td>
<td>0.0690026</td>
<td>3</td>
</tr>
<tr>
<td>$A_2$</td>
<td>0.1177288</td>
<td>2</td>
</tr>
<tr>
<td>$A_3$</td>
<td>0.2600693</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 9: A comparative taxonomy of critical success factors on e-banking in the Persian

<table>
<thead>
<tr>
<th>Factors in literature</th>
<th>References</th>
<th>Factors in the Persian</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strategic factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integrating different</td>
<td>Franco and Klein (1999),</td>
<td>Having multiple channels</td>
</tr>
<tr>
<td>channels</td>
<td>King and Liou (2004)</td>
<td></td>
</tr>
<tr>
<td>Treating e-commerce</td>
<td>Fruhling and Digman (2000)</td>
<td>Systematic change management</td>
</tr>
<tr>
<td>as a business project (not</td>
<td></td>
<td></td>
</tr>
<tr>
<td>just a technological</td>
<td></td>
<td></td>
</tr>
<tr>
<td>project)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internally and</td>
<td>Turban et al. (2000)</td>
<td>Mixed strategy selection of</td>
</tr>
<tr>
<td>externally</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operational factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Simplifying and</td>
<td>Enos (2001)</td>
<td>Rapid delivery of services 24 h availability of services</td>
</tr>
<tr>
<td>integrating basic</td>
<td></td>
<td></td>
</tr>
<tr>
<td>services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical factors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration of</td>
<td>El Sawy et al. (1999)</td>
<td>Systems and channels integration</td>
</tr>
<tr>
<td>technology</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The alternative with the highest closeness coefficient value will be the best choice (Table 8).

\[ C_t^* = \frac{S_t^*}{S_t^* + S_t} \]

Finally, with attention to Table 8, the value of each alternative for final Ranking will be:

$A_3 > A_2 > A_1$

**DISCUSSION**

E-banking in the Persian is summarized and compared with other found in literature (Table 9). Franco and Klein (1999) and King and Liou (2004) focus on integrating different channels. Fruhling and Digman (2000) survey on treating e-commerce as a business project (not just a technological project); Turban et al. (2000) investigation of electronic commerce on internally and externally condition that their founding were similar to strategy factor.

Jayawardhana and Foley (2000) and Orr (2004) studies of good customer services and Enos (2001) scrutiny on simplifying and integrating basic services in online banking; that their founding were similar to operational factor.

Enos (2001) and Turban et al. (2000) focus on systems security in e-commerce and e-banking. So, El Sawy et al. (1999) surveys to integrating of technology that their founding were similar to technical factor.

**CONCLUSION**

This study has presented an exploratory case study of Persian bank. The Persian which has been successful in implementing e-banking. This research aimed to explore how this bank went about managing successful adoption of their e-banking channel by emphasize on fuzzy TOPSIS, what were the criteria's to their success and what key lessons came out of their experience. We concluded the banks need to improve operational, technical and strategic factors by sort as keys component of their business strategy, because they would need to implement considerable multiple channels, change management, channels integration, e-channel, rapid delivery of services, fast responsive customer service and etc. in order to web-enable themselves. They also would need to promote e-commerce within the organization, which helps in its acceptance by their staff.

According to this study, these themes are as direction to further research: studying the other criteria's of effect on e-banking by new techniques, priority and identify impediment of e-banking by other methods.

**REFERENCES**