



Effects of Electronic Banking Services Adoption on Banks' Performance via Balanced Scorecard Approach Using Fuzzy TOPSIS

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ABSTRACT

The aim of this research is Investigation to present a conceptual model to demonstrate the effects of electronic banking services on banks' performance with balanced scorecard (BSC) approach and scoring the criteria of e-banking services using fuzzy TOPSIS method. Today, one of the biggest challenges (yet opportunities) with which organizations are dealt is the use of modern technologies to provide their customers with high quality services. Among other organizations, banks have succeeded to utilize such technologies within the framework of e-banking to supply their customers with fast yet secure, high quality services which are now more of a necessity rather than an advantage. In terms of its objectives, this is an applied research which is conducted via a descriptive – survey methodology. Required information are gathered via library and field studies. Quantitative data is collected via questionnaire distribution. Collected data is analyzed via BSC approach followed by a scoring process undertaken by fuzzy TOPSIS and fuzzy AHP methods leading to output results. E-banking criteria studied in this research included ease, usefulness, stability, security, fastness, reliability and attractiveness of using systems providing banking services, advertisement, and variety of provided services, all of which have contributions into the bank performance. The research results indicated the ease criterion to have the highest score among other criteria, followed by security, fastness, stability, attractiveness, reliability, usefulness, advertisement, and variety of provided services, respectively. Furthermore, the following order of scores was found when the criteria were financially investigated: fastness, ease, usefulness, security, attractiveness, advertisement, variety of provided services, and reliability. In addition, the following order of scores was found from the customer perspective: ease, fastness, usefulness, security, stability, attractiveness, advertisement, variety of provided services, and reliability. When internal processes were concerned, the following order of scores was obtained: fastness, ease, stability, security, usefulness, attractiveness, variety of provided services, and reliability. Finally, when growth and learning aspect was considered, the criteria were found to have the following order of priorities in terms of scores: fastness, ease, usefulness, security, reliability, attractiveness, advertisement, stability, and variety of provided services.

Keywords: electronic banking, organizational performance management, balanced scorecard, fuzzy TOPSIS.

1. Introduction

Recent developments achieved in modern technologies accompanied by the introduction of powerful computers into virtually every arena including that of financial affairs have made a basis for providing further facilities to store and maintain larger deals of information in such a classified manner that have made them easily accessible within electronic systems. In the recent years, various electronic services emerged in banks and financial institutions have boosted the pace yet the accuracy of financial and banking services leading to further wellness of users of these services – customers, bank staff and bank managers. Among other such electronic services one may refer to telephone banking, mobile banking, and internet banking. This research has attempted to present a conceptual model to demonstrate the effects of e-banking services on banks' performance via a BSC approach. Highly accelerated evolutions in the course of Information and Communication Technologies (ICT) have brought about wide political, economic and social changes. Increased public access to the Internet has provided a distinctive position for the possibility to use information technologies. On the other hand, numerous features and advantages offered by Internet banking (such as loosening of time and space limitations in enjoying banking services, easy access to the required information, saving some time for customers, significant reduction in banking services costs, and the possibility to enjoy various services fitted to the customer needs) have largely promoted the application of Internet-based banking services (Divandari, 2013). Application of electronic banking results in reduced banking costs across the country, which in turn translates into lower fees for banking services, so that the government may easier achieve its objective – single-digit interest rates. Muller (2008) defined electronic banking as the use of the Internet by banks to provide the customers with banking services and also the use of the Internet by the customers to organize, control, and put in place transactions on their bank accounts. Generally speaking, the reason to undertake this research is the fact that, in spite of ever increasing use of electronic banking services, no regular assessment of the effects of such services on banks' performance is conducted. Therefore, we are to conduct such an assessment where not only the importance and necessity of e-banking services are indicated, but also the factors influencing and the contributions from the use of e-banking services (Internet banking) into the bank's performance are investigated via BSC approach. Then, e-banking services criteria were scored with a fuzzy TOPSIS methodology. The main challenge was seen to be the use of e-banking services by banks; however, we are focused on the potential effects of the assessment of e-banking services performance on the performance of the bank itself – a subject matter on which, to the best of our knowledge, no significant study has been reported.

2. Literature Review

Considering the title of this research, the researcher provides a general as well as a comprehensive description of the research field and utilizes the existing theoretical foundations, via a systematic ordered approach, to either “more reliably implicate the research claim” or

“better describe the research topic” (Pourezzat, 2014). Accordingly, we begin with a description of the existing literature along with the required background for the present research.

2.1 Electronic banking

First utilized in USA back in 1995, e-banking represents a type of banking services which was rapidly promoted in the developed countries and then in the developing ones (Wendy W.N. *et al.*, 2005). It possesses numerous advantages such as further increase in the number of customers and lower cost of bank transactions. Furthermore, banks can utilize such services to provide more efficient services at lower costs, so as to maintain and even boost their market shares (Saeidi, 2003). According to conducted researches on electronic fund transfer, the most important features offered by electronic fund transfer systems are seen to be the security, fastness, ease and simplicity, lower cost, reduced human errors, enhanced productivity and efficiency, improved fund and cash management, and enhanced customer relations. Furthermore, establishing an electronic payment system based on the Internet, one can generate opportunities to create new sets of national and global trading relationships (Crede, 1996).

Commonly used across Iran, different ports used to receive electronic services are summarized in the following figure.

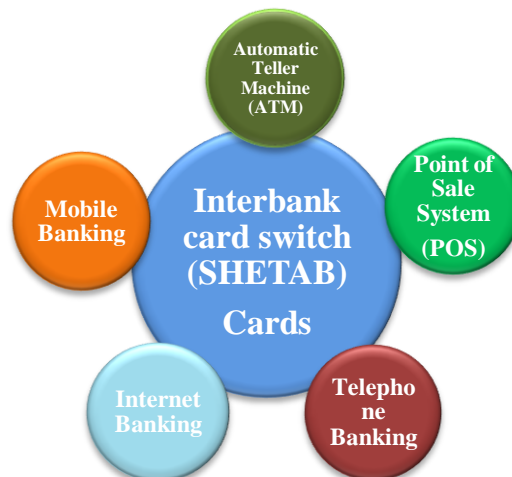


Figure 1: Different ports of e-banking services.




2.2 Organizational performance management

One of the novel topics in the field of management, in general, and human resource management, in particular, is the performance management concept. It was introduced once traditional performance appraisal approach proved to be of low efficiency, particularly when the organization’s strategic objectives were concerned. According to Deming, the reason for many failures in the course of performance enhancement plans is seen to be the policy, not an individual. He has strongly criticized traditional criteria used for performance appraisal (Waite, Mellissa stites& Susan, 2000). Rather than enhancing the performance, the results of many performance appraisals contribute to reduced performance (Latham, Almost, Mann & Moore, 2005). Performance management represents a strategic, integrated process where performance enhancement and promotion of individual and team capabilities bring about sustainable success

for organizations. Performance management is a strategic concept, in that it is related to the business's macro issues and the business general attitude towards achieving the long-term objectives. Performance management can be investigated in two aspects: 1) vertical integration, which refers to the linkage between organizational, team and individual objectives and core competences; and 2) horizontal integration, which refers to the linkage among various processes within human resource management, particularly human resource development, organizational development and compensation, to achieve an integrated approach to the management and human resource development (Michel Armstrong, 2000).

As the organizations were getting formed throughout different periods of time, they have used numerous patterns and models to appraise their performance. Depending on their needs, organizations initially used limited number of indexes and criteria for performance appraisal. However, as their activities and organizational performance scope extended, the environment became dynamic and such novel managerial issues and topics as customer satisfaction, social responsibility, etc. emerged, the organizations were motivated not to be confined to a limited set of indexes. As such, comprehensive, multi attribute models were developed, and then gradually evolved, to appraise different organizations. Such models appraise the organization in multiple aspects and consider multiple indexes to provide modern organizations with well-suited tools for performance appraisal. Used in modern performance appraisal patterns are quantitative models such as productivity measure with value added approach, efficiency measure with effectiveness and performance approach, and profitability measure with performance audition approach, as well as such qualitative models as descriptive and valuation measure with organizational commitment and organizational ethics approaches and other multiple objectives (Kim, Price, Muller and Watson, 2009). Reported in Table 1 are different performance appraisal models.

Table 1: Different performance appraisal models

Different performance appraisal models			
Time and cost-based models	Organizational excellence and self-assessment models	Levelling (integrated) models	
Half-life diagram	Deming model	SMART criteria	
Score model	Quality auditing model (ISO)	Performance prism model	
	Malcolm Baldrige quality model (BALDRIGE)	Benchmarking model	
	The EFQM Excellence Model	Management by Objectives (MBO) model	
			HOSHIN management system model
			Balanced scorecard model (BSC)
			
Emphasizes on the assessment of financial affairs and production process based on time and cost control		Emphasizes on the assessment of management and production process based on the results and process quality promotion	Emphasizes on all assessment dimensions within the fields of management, production and financial operation process and human force based on strategy implementation and enhancement

Traditional Performance Appraisal	Balanced Scorecard Methodology
Emphasizes on individual performance appraisal	Emphasizes on processes performance appraisal
Emphasizes on the assessment of the organization's financial affairs	Emphasizes on the assessment of different dimensions of the organization
Emphasizes on control	Emphasizes on improvement and training
Emphasizes on performance appraisal only	Emphasizes on the understanding of the organization's objectives and strategy prior to performance appraisal
Emphasizes on isolated events (event-oriented)	Emphasizes on the alignment of operations with the strategy (strategy-oriented)
Emphasizes on the convergence to final result (result-oriented)	Emphasizes on the convergence to final result as well as the process to get there (trend-oriented)
Retrospective indexes	Retrospective and prospective indexes
Promotes an atmosphere of distrust	Promotes an atmosphere of trust and cooperation
Reduces creativity and innovation spirit	Promotes creativity and innovation spirit
Focuses only on problems	Establishes cause-effect relations to identify the roots of the problem
Discrete periodic assessments	Continuous assessments

2.3 *Balanced scorecard (BSC)*

As one of the most known models incorporated into performance appraisal systems is “balanced scorecard (BSC)”. It was first introduced by Kaplan and Norton in 1992 since when it has undergone a set of improvements and developments. This model suggests that the performance of any organization should be appraised by a set of balanced indexes, so as top managers can be provide with a general view of four important organizational aspects. These aspects will make it possible to address the following fundamental questions:

1. How are shareholders seen? (financial aspect)
2. Within which contexts should we operate well? (internal business aspect)
3. How shareholders see us? (customer aspect)
4. How can we continue to improve and create value? (training and innovation aspect)

Kaplan and Norton believe that, once informed about these four aspects, one can overcome the problem of information accumulation via limiting the incorporated indexes. Furthermore, the managers will be forced to focus only on limited number of essential and critical indexes. In addition, the use of multiple different performance aspects, prevents partial improvements (Kaplan and Norton, 1992).



Figure 2: Balanced scorecard (Kaplan and Norton, 1992).

2.4 Electronic banking services quality models

Aiming at identification of factors affecting the customers attitude towards using online banking services, Pikkarainen *et al.* (2004) undertook a research entitled as “Consumer acceptance of online banking: an extension of the technology acceptance model”. Accordingly, they reviewed the literature followed by a set of interviews with bank managers in Finland to identify several factors. The obtained results demonstrated that the perceived usefulness of online banking services by the customers and the information provided on online banking services contribute into the customers’ tendency towards using such services. Furthermore, individual revenue levels was considered to be the demographic variable affecting the customers’ tendency towards using online banking services. According to the statistical analyses, the perceived ease of using online banking services, the security level of the provided services, and the pleasure of using online banking services, have no significant contributions into customers’ tendency towards using such services (Rasouli and Manian, 2012).

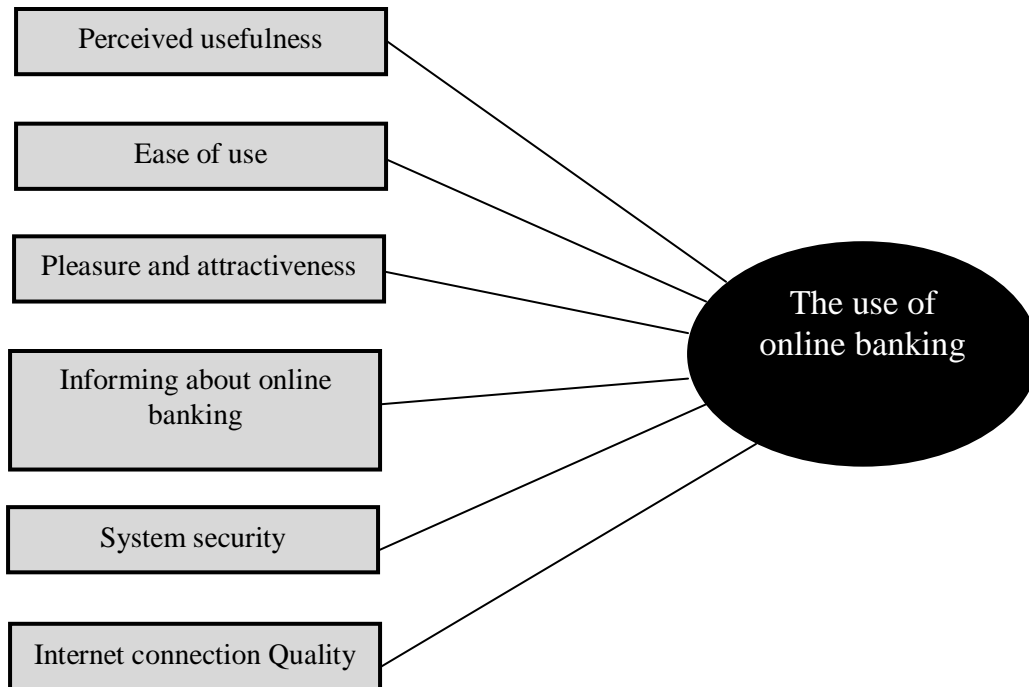


Figure 3: Pikkarainen’s conceptual model.

In their research entitled as “Proposal of a conceptual model to express key factors affecting the quality of systems providing online banking services”, Divandari *et al.* investigated the factors affecting the customers’ insight into online banking. Based on the findings and results of this research, some recommendations are presented on how to design online banking service provision systems, so as to consider the customers’ needs in the course of designing such systems to provide a sort of competitive advantage for the banks providing online services.

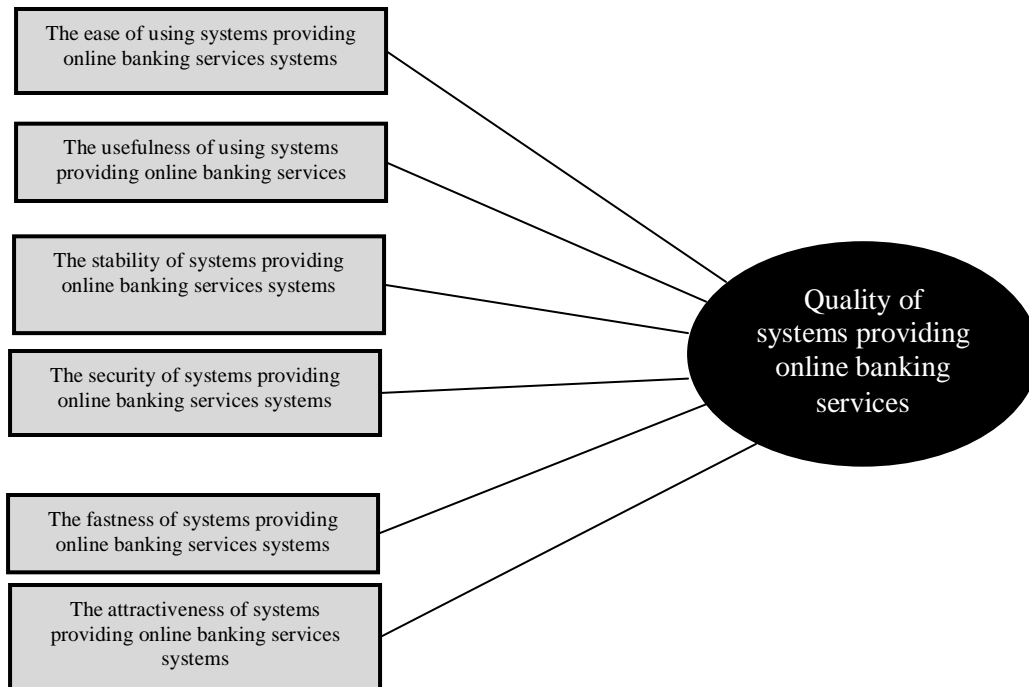


Figure 4: Divandari's conceptual model.

In 2003, aiming at investigating the perceptions by online purchasers, Shwu-Ing Wu conducted a research entitled as “The relationship between consumer characteristics and attitude toward online shopping” where he traced an initial focal group of customers including 10 potential consumers to collect information on their needs and attitude towards online shopping (Wu, 2003).

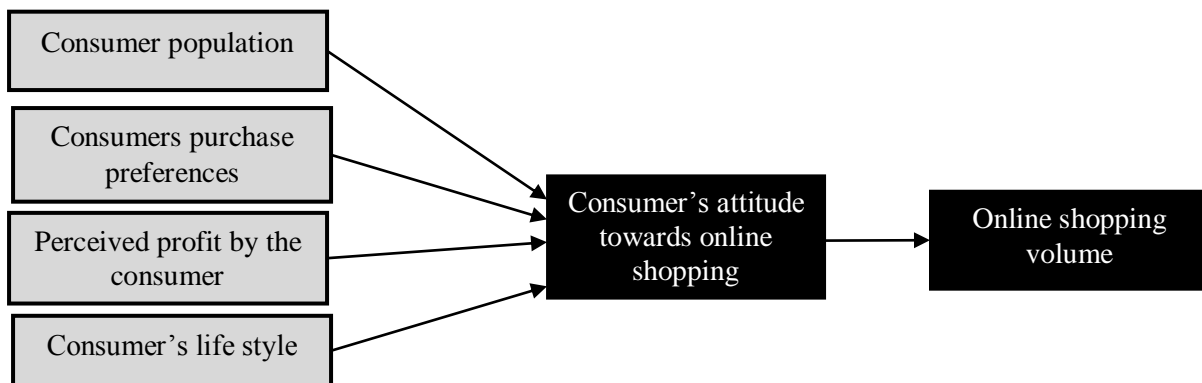


Figure 5: Shwu-Ing Wu's conceptual model.

In 2003, based on previous researches on the adoption of modern services and technologies by the consumers, Chung –Hoon Park and Young – Gul Kim looked for the key effective factors on the purchasing behavior of the consumer within online shopping environment. In this research along with other researches by the same authors, two factors were recognized as being effective

on the shopping behavior of the customers: providing high quality information about the delivered services, and the security of systems providing services (Chung and Young,2003).

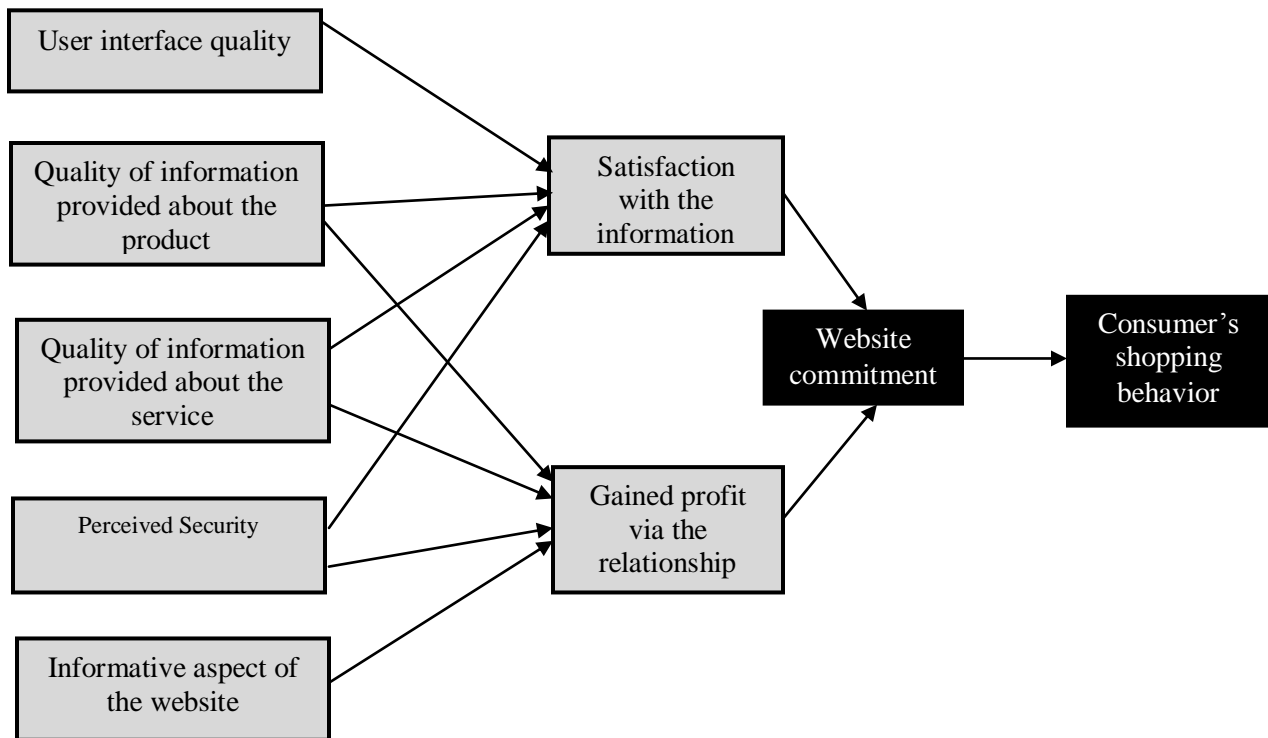


Figure 6: Chung and Young's conceptual model.

In her research entitled as “Presenting a quality model in electronic banking systems according to ISO/IEC 9126”, Leila Farajpour seeks for a methodology to define the quality parameter and have it quantified. Once finished with undertaking numerous investigations, she identified six principal factors affecting external and internal qualities; these were efficiency, usability, functionality, portability, maintainability, and reliability (see Figure 7) (Farajpour, 2008).

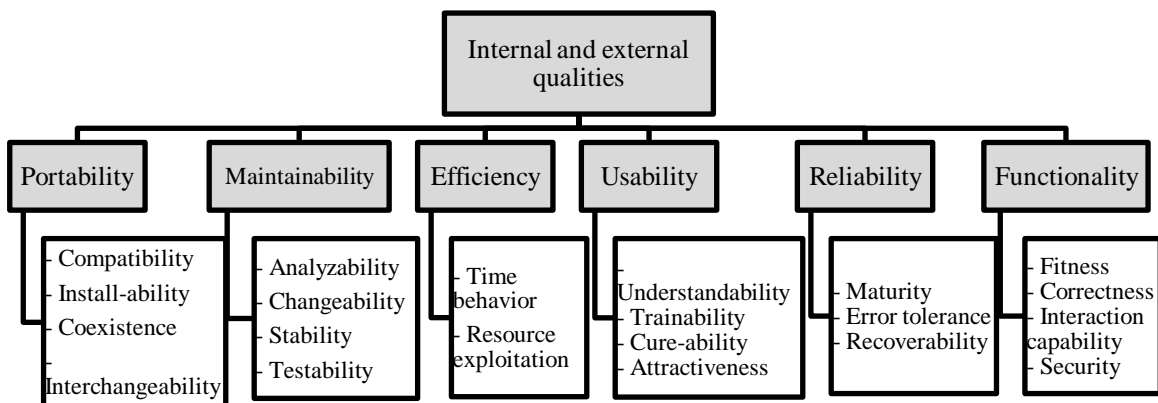


Figure 7: Leila Farajpour's conceptual model.

Mahdi Naddaf and co-workers undertook a research entitled as “investigation of customer satisfaction with electronic banking services using EUSC model” where they considered the contributions from contents of electronic banking services, correctness and accuracy of the provided services within the field of electronic banking, service form and format, ease of using the services and, finally, time saving when using such services, into the customer satisfaction with the electronic banking services. They found that these factors have positive direct contributions into the customer satisfaction (Mahdi Naddaf et al., 2012).

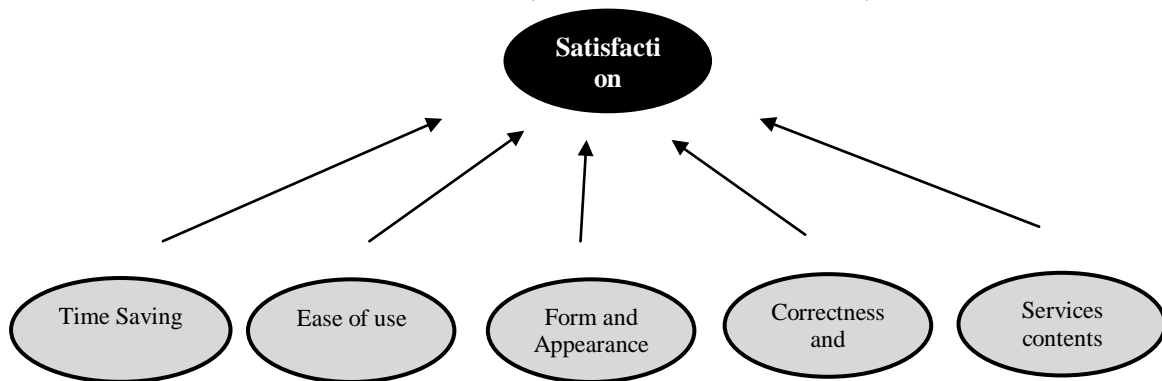


Figure 8: Mahdi Naddaf and co-workers’ conceptual model.

3. Methodology

In terms of its objectives, this is an applied research; it follows a descriptive – survey based approach with its statistical population encompassing all branches of Bank Parsian located within Tehran along with administrative offices and staff departments including financial, credit, IT, support, and legal departments. Within the mentioned branches and departments, all experts of informatics unit along with the customers and employees who were familiar with e-banking issues were considered as the statistical population; however, as the quantification task was conducted via MADM where ideal solution is approached based on similarities, we chosen 15 experts to be surveyed, so as to not only prevent inconsistency level from being heightened, but also facilitate matrix-wise comparisons. Furthermore, the analyses were undertaken via fuzzy TOPSIS which is among the newest quantification methods via MADM. It was first used by Chen (2000) and reported in a paper entitled as “extensions of the TOPSIS for group decision-making under fuzzy environment”. In order to perform fuzzy TOPSIS calculations, first, one need to use a suitable lingual range to collect required data. Chen (2000) proposes a 7-level lingual scale to assign a score to each alternative based on each criteria. In addition, decision matrix can be used to rank the significance of different criteria via such techniques as entropy. Therefore, Chen has proposed similar range to rank the criteria. Briefly speaking, TOPSIS methodology goes through the following five steps:

1. Forming the decision matrix: in TOPSIS technique, n criteria are used to assess m alternatives. To do so, based on each criterion, a score is assigned to each alternative. These scores can be based on either actual quantities or theoretical quality values. Anyway, $am \times n$ decision matrix should be formed.

2. Normalizing the decision matrix: Similar to other multiple-attribute decision-making approaches, the decision matrix should be normalized (why?). In order to normalize the values, vector normalizing method was used. In contrary to simple linear normalizing method, vector normalizing method is undertaken as follows:

$$r_{ij} = \frac{x_{ij}}{\sqrt{\sum_{i=1}^m x_{ij}^2}}$$

3. Forming weighted normalized decision matrix: the next step is to form the weighted normalized decision matrix based on corresponding weights to different criteria. As such, corresponding weights to different criteria should be previously determined using such techniques as AHP or Shannon's entropy method. The weighting task itself is very simple: corresponding weight to each criterion is multiplied by the corresponding matrix elements to that criterion.
4. Calculating positive and negative ideal solutions: the next step is to calculate positive ideal solution (PIS) and negative ideal solution (NIS) where for each criterion, a positive ideal solution (A+) and a negative ideal solution are determined.
5. Distance form positive and negative ideal solutions and determination of ideal solution: calculated in this step are the relative distances from each solution to the ideal solution. The Euclidean distance from each alternative to PIS and NIS can be calculated via the following equation.

The final step leads to the ideal solution. In this step, the following equation is used to determine relative closeness of each alternative to the ideal solution:

$$d_i^+ = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^+)^2}$$

$$d_i^- = \sqrt{\sum_{j=1}^n (V_{ij} - V_j^-)^2}$$

$$CL_i^* = \frac{d_i^-}{d_i^- + d_i^+}$$

The value of CL changes within $[0, 1]$. The closer this value be to 1, the closer would be the corresponding solution to the ideal solution, i.e. the alternative represents a better solution. One of the reasons to choose fuzzy TOPSIS in this research was the popularity of this method in the

previous researches undertaken on different decision-making methods and multiple-criteria techniques. Furthermore, considering the necessity of quality-oriented insight into most of the criteria investigated in this research, fuzzy TOPSIS was seen as the needed method to deal with the subject of this research. In addition, with fuzzy TOPSIS method, one can extract final results from a single matrix, while with other fuzzy methods, a separate matrix should be established for each criterion.

To sum up, the main reasons to use fuzzy TOPSIS in this research included its wide application, high number and hierarchical structure of criteria and sub-criteria under study, and also to cope with uncertainties and ambiguities.

Chung's fuzzy AHP

It is worth mentioning that traditional AHP may not completely reflect human thinking style. In other words, fuzzy sets represent higher consistency with human lingual descriptions which are sometimes ambiguous; therefore, fuzzy sets (fuzzy numbers) are known as better instruments to perform long-term predictions and take decision in real world cases. In 1983, two Dutch researchers, namely Larhorn and Pedrick proposed a method for fuzzy AHP based on logarithmic least squares method. The complexity of different steps of this method has prevented it from being widely used. In 1996, Chung proposed another method called developing analysis. The numbers used in this method were triangular fuzzy numbers. Fuzzy scales used in fuzzy AHP are demonstrated in Diagram 1.

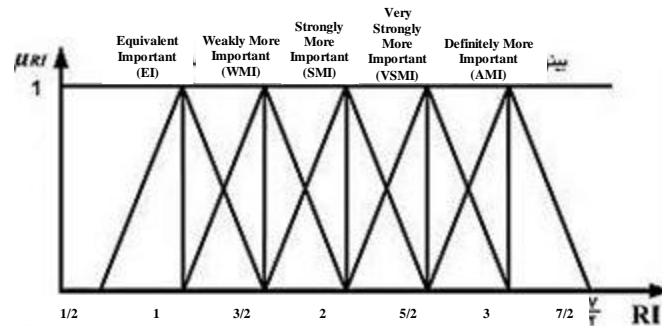


Diagram 1: Linguistic scales used to express the degree of significance.

The concepts and definitions of fuzzy AHP, when approached via developing analysis, are as follows:

Two triangular fuzzy numbers, namely M_1 and M_2 , are considered as is shown in Diagram 2.

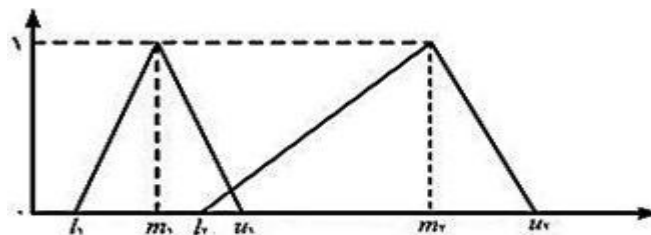


Diagram 2: Triangular numbers m_1 and m_2 .

Corresponding mathematical operators to M_1 and M_2 are as Equations (1), (2), and (3).

$$M_1 + M_2 = (l_1 + l_2, m_1 + m_2, u_1 + u_3) \quad (1)$$

$$M_1 * M_2 = (l_1 * l_2, m_1 * m_2, u_1 * u_3) \quad (2)$$

$$M_1^{-1} = \left(\frac{1}{u_1}, \frac{1}{m_1}, \frac{1}{l_1}\right) \quad M_2^{-1} = \left(\frac{1}{u_2}, \frac{1}{m_2}, \frac{1}{l_2}\right) \quad (3)$$

It should be noted that when two triangular fuzzy numbers are multiplied or a triangular fuzzy number is inverted, the results is not a triangular fuzzy number anymore. These equations are solely to provide approximations of actual results of multiplication of two triangular fuzzy numbers or inverting a triangular fuzzy number. In the developing analysis method, for each row in pairwise comparison matrixes, S_k , which itself is a triangular fuzzy number, is calculated as follows:

$$S_k = \sum_{j=1}^n M_{ij} * \left[\sum_{i=1}^m \sum_{j=1}^n M_{ij} \right]^{-1} \quad (4)$$

where k denotes the row number and m and n are the number of alternatives and criteria, respectively. In developing analysis method, once finished with calculating S_k values, one should determine their relative degrees of magnitude with respect to each other. Generally speaking, taking M_1 and M_2 as two triangular fuzzy numbers, their relative degrees of magnitude are defined by Equation (5).

$$V(M_1 \geq M_2) = 1, \quad \text{if } m_1 \geq m_2$$

$$V(M_1 \geq M_2) = \frac{u_2 - l_2}{(u_2 - l_2) + (m_2 - m_1)}, \quad \text{Otherwise} \quad (5)$$

The value by which a triangular fuzzy number is greater than another triangular fuzzy number can be obtained via Equation (6):

$$V(M_1 \geq M_2, \dots, M_k) = V(M_1 \geq M_2), \dots, V(M_1 \geq M_k) \quad (6)$$

Therefore, the weight vector for different criteria will be of the form expressed by Equation (7):

$$W'(x_i) = \text{Min}\{V(S_i \geq S_k)\}, \quad i = 1, 2, \dots, n \quad k \neq i \quad (7)$$

4. Finding

4.1 Results of solving hierarchical model using Chung's method for the "financial" aspect

Step 1: Corresponding hierarchical decision tree to the present project is as follows:

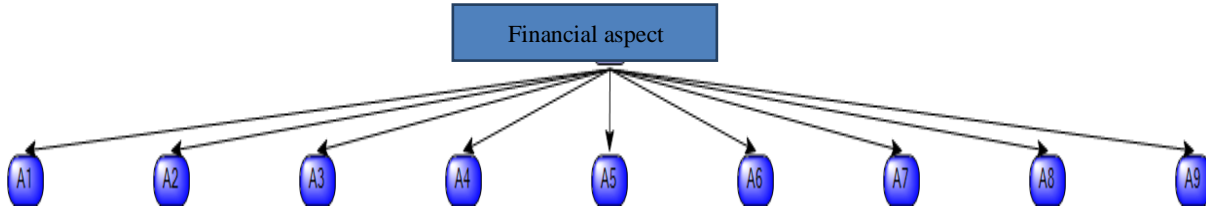


Figure 9: hierarchical decision tree.

Steps 2, 3, and 4: The following lingual terms were used to perform pairwise comparisons:

Table 3: Fuzzy range and corresponding lingual terms.

Code	Lingual term	Fuzzy number
1	Very high	(7, 9, 11)
2	High	(5, 7, 9)
3	Medium	(3, 5, 7)
4	Low	(1, 3, 5)
5	Very low	(1, 1, 3)

Reported in Table 4 are the names and designation codes of different alternatives.

Table 4: Names and abbreviations of different alternatives.

Alternative's name	Designation code
Fastness	A1
Ease	A2
Usefulness	A3
Stability	A4
Security	A5
Attractiveness	A6
Advertisement	A7
Variety of provided services	A8
Reliability	A9

In Appendix, arithmetic average of experts' opinions is shown. The last row of this table denotes the sum of elements in each row.

The following order of significance was obtained for alternatives with respect to financial aspect:

Table 5: Order of significance of alternatives with respect to financial aspect.

Alternative's name	Designation code	Significance rank
Fastness	A1	Rank 1
Ease	A2	Rank 2
Usefulness	A3	Rank 3
Security	A5	Rank 4
Stability	A4	Rank 5
Attractiveness	A6	Rank 6
Advertisement	A7	Rank 7
Variety of provided services	A8	Rank 8
Reliability	A9	Rank 9

As reported in Table 5, where calculated order of significance of alternatives with respect to financial aspect was indicated, one may see that security possesses higher significance than that of stability, i.e., when financial aspect is concerned, one may consider security criterion as more significant than stability criterion. Therefore, the following order of significance was obtained for the analyzed criteria of online banking services in the financial aspect: fastness, ease, usefulness, security, stability attractiveness, advertisement, variety of provided services, and reliability.

The following order of significance was obtained for alternatives with respect to customer:

Table 6: Order of significance of alternatives with respect to customer.

Alternative's name	Designation code	Significance rank
Ease	A2	Rank 1
Fastness	A1	Rank 2
Usefulness	A3	Rank 3
Security	A5	Rank 4
Stability	A4	Rank 5
Attractiveness	A6	Rank 6
Advertisement	A7	Rank 7
Variety of provided services	A8	Rank 8
Reliability	A9	Rank 9

As reported in Table 6, where calculated order of significance of alternatives with respect to customer was indicated, one may see that ease criterion possesses higher significance than that of fastness, i.e., when customer is concerned, one may consider ease criterion as more significant than fastness criterion. Therefore, the following order of significance was obtained for the analyzed criteria of online banking services in the customer aspect: ease, fastness, usefulness, security, stability, attractiveness, advertisement, variety of provided services, and reliability. The following order of significance was obtained for alternatives with respect to growth and learning aspect:

Table 7: Order of significance of alternatives with respect to growth and learning aspect.

Alternative's name	Designation code	Significance rank
Fastness	A1	Rank 1
Ease	A2	Rank 2
Usefulness	A3	Rank 3
Security	A5	Rank 4
Reliability	A9	Rank 5
Attractiveness	A6	Rank 6
Advertisement	A7	Rank 7
Stability	A4	Rank 8
Variety of provided services	A8	Rank 9

As reported in Table 7, where calculated order of significance of alternatives with respect to growth and learning aspect was indicated, one may see that security criterion possesses higher significance than that of reliability, i.e., when growth and learning aspect is concerned, one may consider security criterion as more significant than reliability criterion while stability criterion stands ahead of the variety of provided services. Therefore, the following order of significance was obtained for the analyzed criteria of online banking services in the growth and learning aspect: fastness, ease, usefulness, security, reliability, attractiveness, advertisement, stability, and variety of provided services.

The following order of significance was obtained for alternatives with respect to internal process aspect:

Table 8: Order of significance of alternatives with respect to internal process aspect.

Alternative's name	Designation code	Significance rank
Fastness	A1	Rank 1
Ease	A2	Rank 2
Stability	A4	Rank 3
Security	A5	Rank 4
Usefulness	A3	Rank 5
Attractiveness	A6	Rank 6
Advertisement	A7	Rank 7
Variety of provided services	A8	Rank 8
Reliability	A9	Rank 9

As reported in Table 8, where calculated order of significance of alternatives with respect to internal process was indicated, one may see that stability criterion possesses higher significance than that of usefulness, i.e., when internal process aspect is concerned, one may consider stability criterion as more significant than usefulness, as it ranked 3 – 2 ranks higher than usefulness. Therefore, the following order of significance was obtained for the analyzed criteria of online banking services in the internal process aspect: fastness, ease, stability, security, usefulness, attractiveness, variety of provided services, and reliability.

4.2 The proposed model in the present research

Once finished with literature review and research background investigation, a new conceptual model was designed because of the following reasons:

1. The necessity to propose a native model for the banks.
2. Since most of the existing conceptual models are the results of foreign projects, it seems necessary to pay larger deal of attention to Islamic Banking and Usury-Free Banking criteria.
3. The previous models do not account for comprehensive ICT-based attributes such as network and security.
4. Investigating the previous models, there is a need to develop a new model where extreme simplicity is accompanied with high efficiency and minimum error rate.
5. In the modern world of business where advertising serves as one of the most important competitive tools for organizations, developing a model wherein service provision fastness and environment appearance are taken into consideration, will contribute to attract more users.

Among principal factors affecting e-banking services one may refer to the ease of using systems providing banking services, usefulness of systems providing banking services, stability of systems providing banking services, security of systems providing e-banking services, fastness of systems providing e-banking services, and attractiveness of systems providing e-banking services (Divandari et al., 2013).

Furthermore, contributions from e-banking services into the firm's performance are measured by BSC model with the following factors: 1) financial, 2) customer, 3) internal processes, and 4) growth and learning (Kaplan and Norton, 1992).

Considered in the designed model for the present research are the experts' opinions extracted from the interviews undertaken. Once finished with literature review and research background investigation, the proposed conceptual model in this research is as follows:

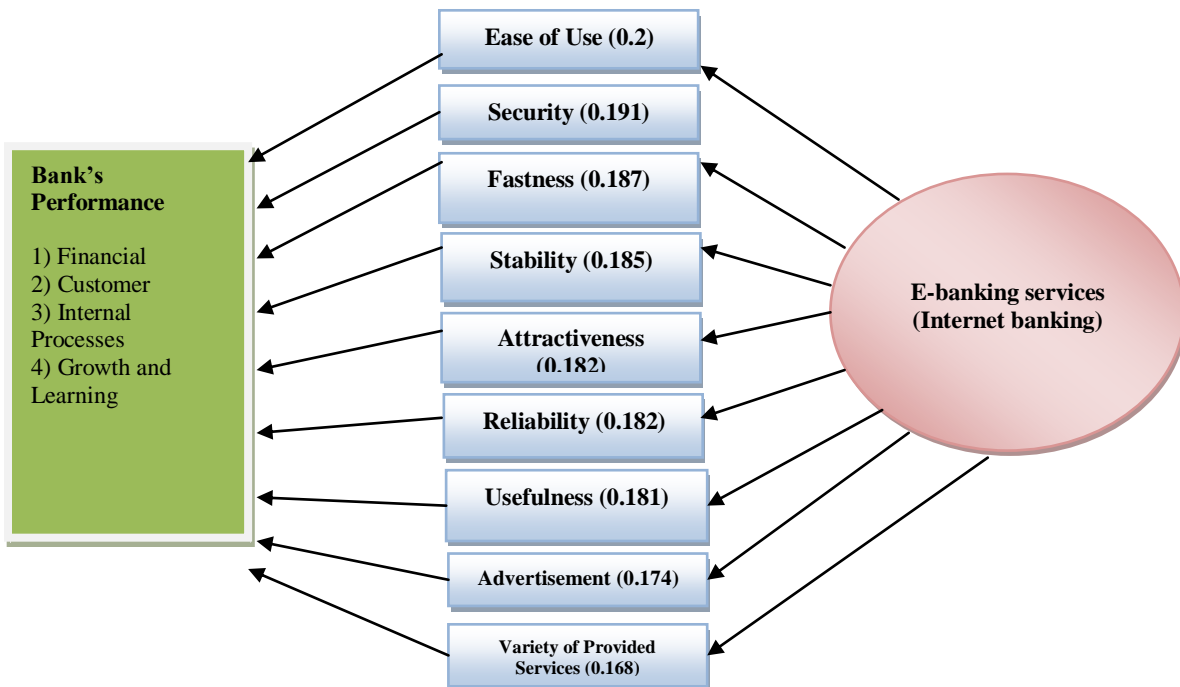


Figure 10: The present research's conceptual model

4.3 Analysis of the findings

Considering the collected data from the questionnaires, Table 3 reports the fuzzy numbers and lingual terms used in the present research.

Table 9: Fuzzy range and corresponding lingual terms.

Code	Lingual term	Fuzzy number
1	Very high	(7, 9, 11)
2	High	(5, 7, 9)
3	Medium	(3, 5, 7)
4	Low	(1, 3, 5)
5	Very low	(1, 1, 3)

Based on the steps described above, the alternatives were evaluated according to different criteria using fuzzy numbers and lingual terms in the table above; the results are reported in Table 9. The numbers reported in this table represent fuzzy averages of experts' opinions. The corresponding weight to each criterion was also obtained based on surveys taken by experts.

Table 10: Corresponding fuzzy scores to evaluated alternatives (decision matrix).

	C1	C2	C3	C4
Criterion	Positive	Positive	Positive	Positive
A1	(5.4, 7.4, 9.4)	(5.933, 7.933, 9.933)	(4.733, 6.733, 8.733)	(5.667, 7.667, 9.667)
A2	(5.8, 7.8, 9.8)	(6.333, 8.333, 10.333)	(5.8, 7.8, 9.8)	(5.8, 7.8, 9.8)
A3	(5.533, 7.533, 9.533)	(5.4, 7.4, 9.4)	(4.6, 6.6, 8.6)	(5.133, 7.133, 9.133)
A4	(5.133, 7.2, 9.133)	(5.533, 7.533, 9.533)	(5.533, 7.533, 9.533)	(5.133, 7.133, 9.133)
A5	(6.467, 8.467, 10.467)	(6.333, 8.333, 10.333)	(4.467, 6.467, 8.467)	(5.133, 7.133, 9.133)
A6	(4.867, 6.867, 8.867)	(6.2, 8.2, 10.2)	(5.4, 7.4, 9.4)	(4.333, 6.333, 8.333)
A7	(4.867, 6.867, 8.867)	(6.333, 8.333, 10.333)	(4.2, 6.067, 8.067)	(4.333, 6.2, 8.2)
A8	(4.333, 6.2, 8.2)	(5.8, 7.8, 9.8)	(4.467, 6.467, 8.467)	(4.067, 6.067, 8.067)
A9	(5.8, 7.8, 9.8)	(5.8, 7.8, 9.8)	(4.333, 6.333, 8.333)	(4.867, 6.867, 8.867)
Criterion's weight	(0.25, 0.25, 0.25)	(0.25, 0.25, 0.25)	(0.25, 0.25, 0.25)	(0.25, 0.25, 0.25)

Continuing with the research, we address findings obtained in different steps undertaken in the course of fuzzy TOPSIS approach to prioritize the studied alternatives.

Table 11: Ranking of different alternatives.

#	Alternatives	Distance to PIS	Distance to NIS	CC	Rank
1	A1	3.268	0.754	0.187	3
2	A2	3.218	0.802	0.2	1
3	A3	3.295	0.728	0.181	7
4	A4	3.277	0.745	0.185	4
5	A5	3.253	0.768	0.191	2
6	A6	3.291	0.731	0.182	5
7	A7	3.323	0.699	0.174	8
8	A8	3.346	0.677	0.168	9
9	A9	3.292	0.73	0.182	6

The results of ranking process via fuzzy TOPSIS reveals that the ease criterion is more significant than and thus preferred over other criteria.

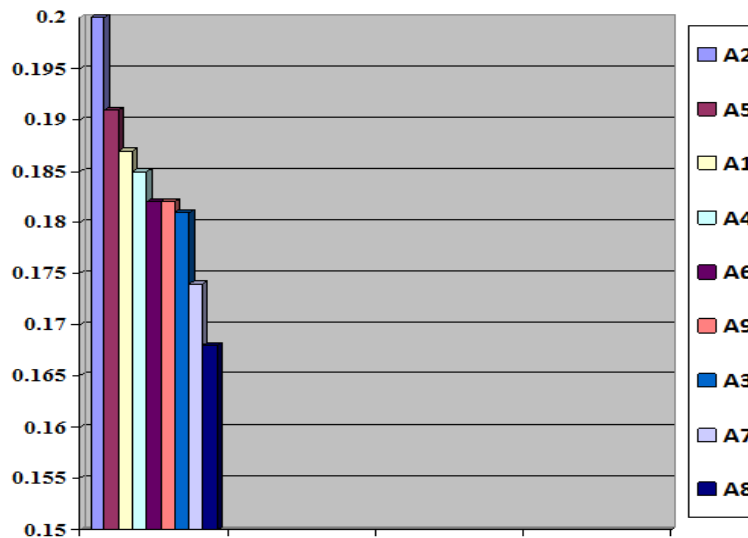


Diagram3: Summary of criteria's ranking.

Knowing that one of the objectives of today's e-banking services is to electronically simplify the process of banking operations (an objective particularly respected by the banks themselves), the resulting output diagram of fuzzy TOPSIS confirms this concern; i.e., A2 criterion ("ease" criterion) achieved the highest score, 0.2, along with 0.802 and 3.218 distances from NIS and PIS, respectively. Next to the ease criterion, A5 criterion ("security" criterion) was confirmed to be the second significant criterion in the resulting output diagram of fuzzy TOPSIS. This was in agreement with the importance of securing customer's information and establishing e-banking services on the basis of security. The corresponding score to this criterion was 0.191 with 0.768 and 3.253 distances from NIS and PIS, respectively. The third significant criterion is the "fastness" of online banking operations because when a customer choose to undertake his/her banking affairs via online portals, he/she normally expects his/her intended operations to be

succeeded within a very lower period of time compared to that of when he/she refers to the bank in-person. Accordingly, the Diagram 1 confirms that the criterion A1 (“fastness” criterion) has the third highest score, 0.187, along with 0.754 and 3.268 distances from NIS and PIS, respectively. On the other hand, since, for example, as the “variety of provided banking services” is very limited in Iran, the diagram confirms that this criterion (criterion A8) has the lowest score among all investigated criteria. The corresponding score to this criterion was found to be 0.168 with 0.677 and 3.346 distances from NIS and PIS, respectively. Similarly, as “advertisement” technology is undergoing its initial stages within Iran and thus has very small contributions into the e-banking aspects, the diagram confirms that the criterion A7 (“advertisement” criterion) has the second lowest score among the studied criteria in this research. The corresponding score to this criterion was found to be 0.174 with 0.699 and 3.323 distances from NIS and PIS, respectively. Using fuzzy AHP method, we achieved to the following order of significance for e-banking services’ criteria with respect to financial aspect: fastness, ease, usefulness, security, stability, attractiveness, advertisement, variety of provided services, and reliability. However, the following order of significance was obtained for e-banking services’ criteria when customer was concerned: ease, fastness, usefulness, security, stability, attractiveness, advertisement, variety of provided services, and reliability. And the following order of significance for e-banking services’ criteria was obtained in internal process aspect: fastness, ease, stability, security, usefulness, attractiveness, variety of provided services, and reliability. Finally, when growth and learning aspect was concerned, the following order of significance was found for e-banking services’ criteria: fastness, ease, usefulness, security, reliability, attractiveness, advertisement, stability, and variety of provided services.

5. Discussion & Conclusion

As comprehensively discussed throughout this research, the importance and necessity of e-banking services stem from the fact that online banking serves as a facilitator, for both the bank and the customer, by providing customers with such services as online balance monitoring, fund transfer between all accounts in the bank, create account bills, etc. Furthermore, these services allow for blocking of lost or stolen credit cards. Online bank facilities offered by many financial institutions, although have many common features and capabilities, but have some special applications as well. As such, the necessity and importance of e-banking services motivated us to plan the present research. Therefore, the results of this research can be directly used by banks, while other banks and financial and credit institutions may also be served as indirect users of these results. The followings are some of the conclusions drawn from the present research:

1. With this research, we succeeded to investigate accurate e-banking features and the direct and indirect contributions from e-banking services into overall and partial performance of different parts of the bank.
2. With this research we succeeded to both directly and indirectly address upcoming challenges in e-banking services and present some general solutions.
3. It is expected that e-banking (online banking) services adoption leads to enhanced financial performance for the corresponding bank or credit institute.

4. E-banking services are expected to facilitate and accelerate financial operations of customers leading to enhanced customer satisfaction with the bank or financial institution.
5. This research is expected to help banks and financial institutions with evaluation and comparison of financial performance, customer performance, and knowledge process performance, so as the corresponding bank or institution can find whether deployment of online banking contributed into enhancements in such components or not.
6. It is expected that, by prioritizing and scoring different criteria of e-banking services, banks can establish proper policies and move along the right route toward e-banking evolutions.
7. It is expected that the developed order of priority leads the bank to attempt to further ease e-banking services, because the “ease” criterion achieved highest score among other criteria investigated in this research.

As shown in the conceptual model proposed in this research (Figure 9), principal factors affecting bank’s performance included the ease of using systems providing banking services, usefulness of systems providing banking services, stability of systems providing banking services, security of systems providing e-banking services, fastness of systems providing e-banking services, attractiveness of systems providing e-banking services advertisements and information provided on services, variety of provided services, and reliability of the systems providing e-banking services. In the following, a brief description is presented for each of these recognized factors determined through an investigation on the literature:

- The ease of using systems: Systems are designed in such a way that simplify the way customers use them (Minijoon, 2001).
- Usefulness of using systems: To design the systems in such a way to allow customers enjoy banking services at high productivity and efficiency levels (Divandari, 2012).
- Stability and error-averse nature of systems: The ability of technical systems utilized in the website to continuously provide customers with services free from errors or discontinuities (Divandari, 2012).
- Systems’ security: The ability of systems utilized for services provision to maintain the security of organization’s information such as information on sale, prices, inventories, etc. (Chen and Chang, 2003).
- Attractiveness of using systems: To design systems in such a way to make it attractive for the customers to use online banking services (Pikkarainen, 2004).
- Advertisement affairs and information provided on services: Providing awareness via training programs or multimedia advertisements to make public audience familiar with how to use electronic services (Minijoon, 2001).
- Quality and variety of provided services: Variety of information provided to customer via e-banking services (Mahdi Naddafet *al.*, 2012).

Reliability: Refers to a system or complex that performs, without any failure, prescribed tasks with predefined constraints in the design stage, in specified operating conditions (Polaoglu and Ekin, 2001).

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