Electronic Services (IT) in the Banking and Financial Institutions

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Abstract. This research investigates the methods for improving the quality of IT services (electronic services) in the Melli Banks branches in Mashhad province, where QFD and ANP models were operated. To this concern, three-dimensional, usability, service interaction and information quality to improve IT service quality were examined. The results of the analysis of the opinion of Melli Bank Customers indicate that three dimensions considered in this study to improve the quality of IT services are effective. The results suggest that there are differences between the effects of these three dimensions and two dimensions of information quality and usability are more important than the service interactions. Then, the strategies to improve IT services and the weights of fuzzy ANP technique, were evaluated based on the house technical quality is identified. Based on the results of the evaluation of recovery strategies, practical suggestions were offered.

Keywords: Analytic Network Process, Quality Function Deployment, Quality, Service, Information Technology and Electronic Service.

1. Introduction and Problem Statement

In order to evaluate the performance and quality of electronic services, traditional indicators for assess financial performance did not fit. Because IT services have the direct and indirect impact on the financial

indicators of an organization such as income and assets, and so on. Investigation on Quality of electronic services has unspecified and complex structure that is difficult to control and evaluate it. Most of the researches done in the field of electronic service quality have used SERVQUAL model. In this research, in order to survey about the Bank's quality of electronic services, for the first time, the E-Servqual model is used. In this research the 3D model of that model will be used and the basic assumptions of the study are as follows:

The use of electronic services on IT service quality has a significant impact on Melli bank.

The quality of information on the website of the Melli bank has a significant impact on the quality of Melli bank's IT services.

The interacting of Web services of Melli bank has a significant impact on improvement of IT service quality there.

In this research, in order to find the solutions for improvement the quality of IT services at Melli bank branches in Mashhad province, combination of the two methods QFD and ANP are investigated. In this paper, for the first time in addition to prioritizing of the influenced factors on quality of electronic services (IT) in the banking and financial institutions with network analysis implementation, also with determination of the dimensions weight and used them as an input to the spread of operation quality model, an appropriate solutions to address the problem of organization will be provided.

2. Method

Since this research in an actual, real and live (dynamic) organization has been conducted and the results can be used to implement practically so is an applied research. Regarding the research aims which is identify the factors affecting the quality of IT services at Melli bank branches in Mashhad province and also offering solutions and ways to enhance the quality of IT services in the community, the following steps were taken for the study. Identify the factors affecting the quality of IT services.- Extract the primary index from the recorded research is extracted. Collecting the research data. At this stage of the investigation, according to the indicators, research questionnaire prepare and among the

population (all client of all branches of the Melli bank of Mashhad province who used at least one of the bank's electronic services during tow month of the study period) will be distributed. Data analysis: the process of this study is shown in the figure (1).
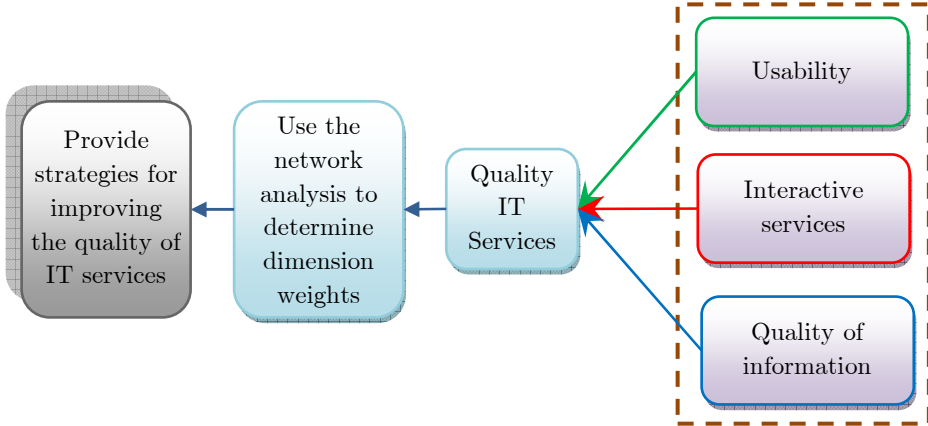

Figure 1: Research Process

The statistic population of this research is all clients of the branches of Melli bank of Mashhad province in the interval of two months, which during study period use at least one form of electronic services of this bank. According to this study, the population size is not known in detail, the formula for determining the sample size should be used in an infinite population, which is based on the following formula:

$$\mathbf{n} = \frac{\mathbf{Z}^{2}_{\alpha/2} \, \delta^{2}_{\mathbf{x}}}{\varepsilon^{2}}$$

In the formula for determining the standard deviation of a society, a preliminary sampling will be implemented. For this purpose, a questionnaire survey randomly is distributed among at least 50 clients who used the bank's electronic services, so that with standard deviation estimation, sample size will be determined. It should be noted that the questionnaire would be distributed among the clients of the bank's, which stated that use at least one of the electronic services of the mentioned bank. In this research the majority of information is obtained through questionnaire, which is the principle of this survey, and also the

questionnaire is in the standard form.QFD technique in all design processes and process development. In this research this method is used in order to transfer indicators of the qualification of electronic services into Improvement guidelines, which is itself is an innovation in the financial and banking fields investigations.

3. Findings

In this research according to collected points in order to give priorities to important factors which affecting the quality of IT services, the hypothesis of this research is answered. In the following the results of the research hypotheses is presented.

- Hypothesis 1: The usability dimension has an effect in the enhancement of IT service quality at Melli bank branches in Mashhad province.

In order to investigate this hypothesis, the statistical hypothesis was designed as follows:

o The usability of quality services has positive effect in enhancement of Melli bank of Mashhad. $H_{\circ} : \mu \leq 4$
o The usability of quality services has not positive effect in enhancement of Melli Bank of Mashhad. $H_{1} : \mu > 4$

To test this hypothesis, one-sided T-Student test is used; the result is shown in table (1).

Table 1: Result Extract from the Usability Dimension Investigation

	Test Value = 4					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Usability dimention	11.616	194	.000	.73846	.6131	.8638

The estimated sig is represented that the null hypothesis is rejected at the 95% significance level. Positive values of upper limit and lower limit

indicate the confirmation of the effectiveness of usability in enhancement of quality services at Melli bank branches in Mashhad.

- Hypothesis 2: The service interaction dimension has an effect in the enhancement of IT service quality at Melli Bank branches in Mashhad province.

In order to investigate this hypothesis, the statistical hypothesis was designed as follows:

o   The service interaction of quality services has positive effect in enhancement of Melli Bank of Mashhad. **H**$_\circ : \mu \leq 4$

o   The service interaction of quality services has not positive effect in enhancement of Melli Bank of Mashhad. **H**$_1 : \mu > 4$

To test this hypothesis, one-sided T-Student test is used; the result is shown in table (2).

Table 2: Result Extract from the Service Interaction Dimension Investigation

	Test Value = 4					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Service Interaction	10.651	194	0.000	0.81731	0.6660	0.9687

The result showed in the table is represented that the null hypothesis is rejected at the 95% significance level. In other words, the service interaction in enhancement of quality services at Melli Bank branches in Mashhad is effective.

- Hypothesis 3: The quality of information dimension has an effect in the enhancement of IT service quality at Melli Bank branches in Mashhad province.

In order to investigate this hypothesis, the statistical hypothesis was designed as follows:

o The quality of information of quality services has positive effect in enhancement of Melli Bank of Mashhad. $H_{\circ} : \mu \leq 4$

o The quality of information of quality services has not positive effect in enhancement of Melli Bank of Mashhad. $\mathbf{H}_1 : \mu > 4$

To test this hypothesis, one-sided T-Student test is used; the result is shown in table (3).

Table 3: Result Extract from the Quality of Information Dimension Investigation

	Test Value = 4					
	T	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
Quality of Information	11.466	194	0.000	0.59560	0.4932	0.6981

The result showed the sig is estimated to zero. So the null hypothesis is rejected at the 95% significance level. In other words, the quality of information in enhancement of quality services at Melli Bank branches in Mashhad is effective.

The results of the study indicate the importance of these three dimensions is really important in order to improve the quality of IT services at Melli bank branches are in Mashhad province. The question now is whether or not these three dimensions have the same importance rate? To answer this question, four hypotheses were tested.

• Hypothesis 4: There is no significant difference between the average ratings of the importance of the dimensions to enhancement of the quality of IT services in the Melli Bank.

To investigate this hypothesis, the statistical hypothesis was designed as follows

o There is no significant difference between the average ratings of the importance of the dimensions to enhancement of the quality of IT services in the Melli bank. $\mathbf{H}_{\circ} : \mu_1 = \mu_2 = \mu_3$

o   There is a significant difference between the average ratings of the importance of the dimensions to enhancement of the quality of IT services in the Melli bank. $\mathbf{H}_1 : \mu_i \neq \mu_j$

To test this hypothesis, Variance analyses (ANOVA) are used; the result is shown in table (4).

Table 4: Result of Variance Analyses

Sig	Statictic of test value	2 Freedom Degree	1 Freedom Degree	Dimentions
0.049	3.031	585	2	Usability
				Interaction Service
				Quality Of Information

The result showed in the table is represented that the null hypothesis is rejected at the 95% significance level. In other word, there is a significant different between average ratings of the importance of the dimensions to enhancement of the quality of IT services in the Melli bank.

In this research, with using the technique of fuzzy ANP, the degree of importance to each of these dimensions in the quality of IT services is determined. Hence in order to pair-comparisons were used by the experts, the second questionnaire is performed. Overall, opinion of 9 experts was collected. Figure (2) represent research network diagram to determine the dimensions indicated.
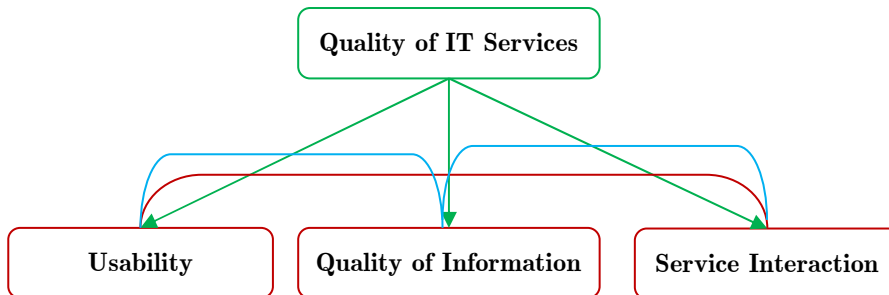

Figure 2: Diagram of Research Network

In this part of research, the weights of each component are calculated.

According to the super matrix, the process of the calculation of the weight of the components is:

First step: in order to aggregate experts' opinion, we calculate the paired comparisons of the mean of the responders.

Second step: calculate the eigenvectors. To compute the eigenvectors of each of the tables of the aggregated paired comparisons, logarithmic least squares method, which is shown below, is used.

$$\mathbf{w_k^s} = \frac{\left(\prod_{j=1}^{n} \mathbf{a_{kj}^s}\right)^{1/n}}{\sum_{i-1}^{n} \left(\prod_{j=1}^{n} \mathbf{a_{kj}^m}\right)^{1/n}}, \quad \mathbf{s} \in \left\{\mathbf{l, m, u}\right\}$$

So:

$$\mathbf{\tilde{w}_k} = (\mathbf{w_k^l}, \mathbf{w_k^m}, \mathbf{w_k^u}) \quad \mathbf{k = 1, 2, 3, ..., n}$$

The following tables show the mean experts opinion. In the last column of the table, eigenvector is shown.

Table 5: Mean of Paired Comparisons to the Target (w21)

Target	Information Quality	Service Interaction	Usability	$\mathbf{w_k^3} = \dfrac{\left(\prod_{j=1}^{3} \mathbf{a_{kj}^s}\right)^{1/3}}{\sum \left(\prod_{j=1}^{3} \mathbf{a_{kj}^m}\right)^{1/3}}$
Information Quality	(1,1,1)	(0.392,0.485,0.63)	(0.472,0.858,0.735)	(0.182,0.21,0.248)
Usability	(2.553,2.062, 1.587)	(1,1,1)	(0.68,0.885,1.167)	(0.328,0.391,0.46)
Service Interaction	(2.12,1.71,1.361)	(1.47,1.13, 0.857)	(1,1,1)	(0.337,0.399,0.468)
Compatibility				
		RIᵐ = 0.001	RIᵍ = 0.001	

Table 6: Mean of Paired Comparisons to the Quality of Information

Information Quality	Usability	Service Interaction	$w_k^2 = \dfrac{\left(\prod\limits_{j=1}^{2} a_{kj}^s\right)^{1/2}}{\sum\limits_{i-1}^{2}\left(\prod\limits_{j=1}^{2} a_{kj}^m\right)^{1/2}}$
Usability	(1,1,1)	(0.794,0.885,1)	(0.445,0.47,0.499)
Service Interaction	(1.26,1.13,1)	(1,1,1)	(0.499,0.53,0.56)

Table 7: Mean of Paired Comparisons to the Usability

Usability	Information Quality	Service Interaction	$w_k^2 = \dfrac{\left(\prod\limits_{j=1}^{2} a_{kj}^s\right)^{1/2}}{\sum\limits_{i-1}^{2}\left(\prod\limits_{j=1}^{2} a_{kj}^m\right)^{1/2}}$
Information Quality	(1,1,1)	(0.794,1.049,1.442)	(0.449,0.512,0.6)
Service Interaction	(1.26,0.953,0.693)	(1,1,1)	(0.416,0.488,0.561)

Table 8: Mean of Paired Comparisons to the Service Interaction of Services

Service Interaction	Information Quality	Usability	$w_k^2 = \dfrac{\left(\prod\limits_{j=1}^{2} a_{kj}^s\right)^{1/2}}{\sum\limits_{i-1}^{2}\left(\prod\limits_{j=1}^{2} a_{kj}^m\right)^{1/2}}$
Information Quality	(1,1,1)	(0.443,0.58,0.794)	(0.321,0.367,0.429)
Usability	(2.26,1.725,1.26)	(1,1,1)	(0.541,0.633,0.724)

Third step: create the matrixes $\mathbf{W}_{ij}$. These matrixes represent the result from calculation of eigenvectors for paired comparisons matrices. For example, matrix $\mathbf{W}_{22}$ is eigenvectors of the paired inner comparisons in the second level. Required matrixes in order to define component weight for the study are as follows.

Table 9: Eigenvectors Matrix of level 2 to 2 (w22)

	Information Quality	Usability	Service Interaction
Information Quality	(0,0,0)	(0.449,0.512,0.6)	(0.321,0.367,0.429)
Usability	(0.445,0.47,0.499)	(0,0,0)	(0.541,0.633,0.724)
Service Interaction	(0.499,0.53,0.56)	(0.416,0.488,0.561)	(0,0,0)

Table 10: Eigenvectors Matrix of level 2 to 1

	Target
Information Quality	(0.182,0.21,0.248)
Usability	(0.328,0.391,0.46)
Service Interaction	(0.337,0.399,0.468)

Fourth step: Calculation of the weights to compute the final weight of each component ($\mathbf{W}_i^*$) should the eigenvectors matrix of internal relations multiply to the eigenvectors of the same level, again multiply by final weight of upper level.

$$\mathbf{W}_i^* = \mathbf{W}_{ii} \times \mathbf{W}_{i(i-1)} \times \mathbf{W}_{i-1}^*$$

If there is no matrix $\mathbf{W}_{ii}$ for a level, an identity matrix is replaced to it. In other words, the following formula should be used.

$$\mathbf{W}_i^* = \mathbf{I} \times \mathbf{W}_{i(i-1)} \times \mathbf{W}_{i-1}^*$$

Table 11: Final Weights matrix

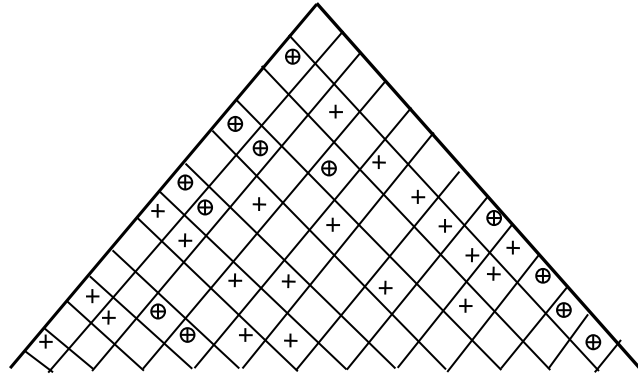| Component	Final fussy weight	Final component weight
Information Quality	(0.256,0.347,0.480)	0.349
Usability	(0.264,0.351,0.463)	0.35
Service Interaction	(0.229,0.302,0.398)	0.301

Above results indicate that in terms of data quality and usability dimensions from experts point of view, are almost the same weight. The importance of the service interaction is below than the other two

dimensions. Weights are determined in this part are an input for QFD method to evaluate strategies for improving the quality of IT services.

In this part of research, with method of interviews with experts from the Melli bank branches, strategies to improve the quality of IT service were identified. With the arrival of the data collection mechanisms to the quality house and data collecting using experts opinion, the quality house of enhance strategies based on dimensions of the quality of IT services is shown in Figure (3).

4. Conclusion

Dimensions of e-service have significant impact on enhancement of IT services in the Melli bank.In order to investigation of effect of the service qualification dimensions on improving the quality of IT services in Melli bank branches of Mashhad, for each of the three dimensions of usability, information quality and service interaction, a statistical theory was developed. To evaluate the effectiveness of the three dimensions, the comparison of the mean of a population was used. For this purpose, T-student statistic is used. The results indicate that the point of views of the clients of the Melli bank branches in Mashhad, the service quality dimensions has a significant impact on IT service quality from the Melli bank branches in Mashhad. Therefor firstly three hypotheses were confirmed as mentioned before. The degree of impact of quality service dimensions on improving the quality of IT services has significant differences with each other. The impact of three dimensions on the quality of IT services offer a question that whether or not, these three dimensions have the same effectiveness? ANOVA was used to analyze the hypothesis, which answers the question. These results indicate the effectiveness of these three dimensions in confident level at 95 %. There are significant differences between the degrees of effectiveness on the enhancement of quality of IT services. Therefore with using fuzzy ANP technique the degree of importance of each of the three dimensions was determined. Based on the results of the fuzzy ANP technique, the importance of information quality and usability to improve the quality of IT services are more than service interaction. The weights obtained in this step were used to analyze the house quality.

	Training of employees and managers in the field of ICT compatible with international standards in order to increase their skills in using ICT in banking processes.	Consider the training of ICT as a separate subject in the training programs while working for staff	Increased investment in new hard wares, soft wares, network access	Public sector with private sector participation in projects related to e-learning n order to make it easy for customers and employees of banking services	A robust and comprehensive strategy for implementation and deployment of information technology in the banking sector.	Collaboration with stakeholders, especially with clients in order to ensure the successful implementation of designed strategies.	Update tools and facilities of information technology in bank branches	Development and dissemination of electronic learning content for employees and customers.	Create Website for Melli Bank branches in order to provide information and links to IT services.	Online virtual Learning Center tutorials designed to train employees.	Creation and deployment of IT services, insurance coverage.	Promote the development of e-banking security while benefiting from the knowledge of the IT sector	Degree of importance	Situation Analysis of the Mali Bank of Mashhad	Situation Analysis of the other Bank of Mashhad
Quality of information	9	3	9	3	3	7	9	3	5	3	5	7	0.349	4.3	3.9
Usability	3	5	7	9	7	9	3	3	3	9	9	9	0.35	3.6	4.1
Service interaction	9	7	5	7	9	5	3	5	5	7	9	5	0.301	3.4	3.8
Difficulty reaching the target with existing facilities	2.1	2.2	4.3	3.8	2.7	2.5	3.5	3.3	4.6	2.1	4.3	3.9			
The cost of the acquisition	2.1	2.5	4.5	4.4	2.7	2.3	4.1	2.1	2.3	3.5	4.2	4.3			
The states of Mali Bank in the degree of effort to implement the strategy	1.3	1.4	2.1	2.6	2.3	1.8	2.1	1.4	1.7	2.4	1.2	1.1			
The states of other banks in the degree of effort to implement the strategy	1.7	2.2	2.9	3.2	2.4	2.1	2.5	1.6	2.1	2.1	1.1	1.2			
Absolute weight	7	5	7	6	6	7	5	4	4	6	8	7	81		
Relative weight (percent)	9	6	9	8	8	9	6	4	5	8	9	9	100%		

Figure 3: House of Quality

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