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Full Length Research Paper

An integrated method of quality function deployment, Kano's model and hierarchical decision making for improving e-service of brokerage in Iran

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To achieve customer satisfaction effectively, service providing firms should not only know exactly what customers want but also need to know how much effort is needed to invest on every single attribute that customer expects the service to benefit from. Hence, this research tries to identify customers' required services and determine their priorities to be considered when planning for internet based services. To do so, after customers' needs are gathered through individual interviews with 20 customers, 10 needs are selected to be inserted into the planning matrix of house of quality based on their frequencies and are then prioritized using AHP technique. When the planning matrix is finished, each of the needs is classified using Kano's questionnaire, and the final importance of each need is modified and calculated on the basis of the results of the questionnaires. At last, the results help to determine the final priority for each of the customer's needs.

Key words: Kano's model, quality function deployment, hierarchical decision making, stock exchange brokerage.

INTRODUCTION

Stock exchange is undergoing some rapid and thorough changes everywhere in the world. Since almost 20 years ago, all of the stock exchanges have been moving from crowded transaction halls with sale mechanism towards electronic order-based methods. By stock exchanges' efforts to maintain and increase the revenues of traditional and modern activities, the value chains have been reorganized and at the meantime, a new structure is being formed for the world's financial markets. The structure would have important results and consequences for financial markets and their beneficiaries. However, the brokerage companies considered to be a major part of the stock exchange in Iran also need to exert their attempts to achieve competitive advantages out of the new opportunities set forward by these changes.

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Today, a growing customer segment is formed, who have technological intelligence and prefer the ease of use of technology-based service distribution systems, which is through internet, to the services offered by the employees of the brokerage offices (Karjaluoto et al., 2003). Many firms throughout the world choose to offer electronic services as a means of extending their market, improving the service quality to customers, cutting expenses, and boosting productivity. Findings indicate that the American businesses dedicate almost 50% of their investment to information technology and application of new technologies to offer their services to customers (Hong et al., 2003).

However, Iran is not an exception, and the gradual extension of internet access and people of different social classes owning personal computers have made some potential needs to appear, that is, to receive financial services through the internet. Overlooking this market segment would prepare the ground to competitor companies to offer modern electronic services and

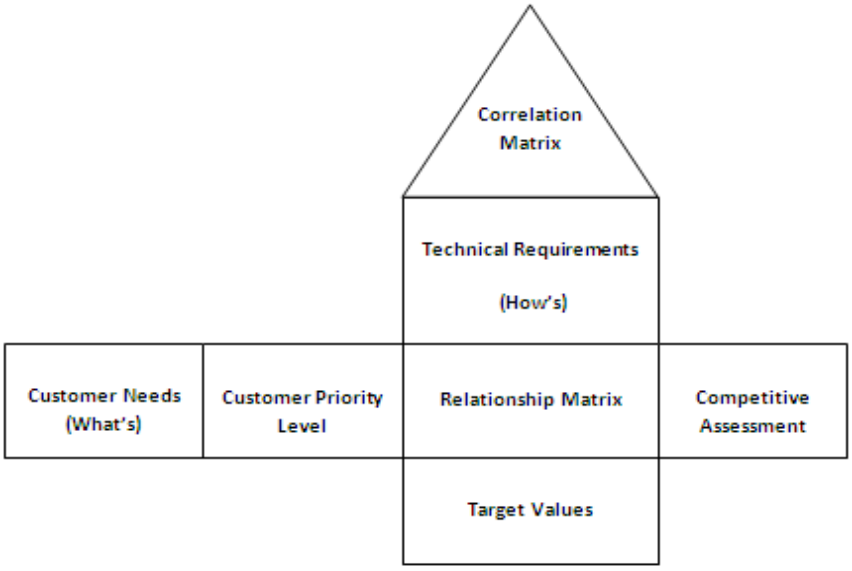

Figure 1. The components of house of quality.

absorb a big potential market share. It should be noticed that customer perceptions about the ease of use of internet services and the usefulness of these services have a positive relation with customer's intention to make use of these services (Azizi and Javidani, 2010). Thus, brokerage companies primarily need to identify their customers' needs accurately, and based on that, plan to offer the best services. Only by doing so can companies ensure that customers are satisfied with the offered services.

Quality function deployment (QFD)

Quality function deployment is an advanced technique in total quality management which focuses on customers' needs. Andronikidis et al. (2009) discussed the integration of quantitative techniques with QFD, and promoted successful application of QFD in finical service organizations.

By focusing on customer's needs and transmitting these needs into all the stages of product or service development, the technique aims at providing customers with more added values. There are apparently different attitudes towards QFD but they all share the same mission for it and that is the realization and translation of customer's quality associated needs into the organization's technical language (Ruyter, 1997).

Structured multiple matrix-driven process is the most common attitude and method used in QFD since it is relatively easy to use and is well-abridged, compared to the other counterparts. The matrixes are given thus:

i. Product planning: translates customer's requirements into engineering or design requirements.

ii. Part planning: translates engineering or design requirements into product or part characteristics.

iii. Process planning: translates product or part characteristics into manufacturing operations.

iv. Production planning: translates manufacturing operations into specific operations and controls.

Based on this model, the output of each of the matrixes is the input to the next matrix. So, through this procedure, quality moves from the planning stage of a product or service to the production and assembly stage systematically (Shillito, 1994). Thus, the matrix of house of quality, functions as an engine which leads the whole process, and besides offering some invaluable information about the product, if appropriately and accurately prepared, can function as the finishing point for many real projects based on the variety and range of the concept extracted by it (Figure 1).

LITERATURE REVIEW

Some of the empirical researches closely associated with planning and improving internet related service quality are reviewed here. Lio and Arnett (2000) asked web masters about the critical success factors of a web site. They found the web masters believed that quality of information and services, use of a system (including ease of use and preservation of personal data), quality of system planning (including process running time and trade off between security and ease of use regarding the method of payment) play an important role for a web site to succeed.

Yoo and Donthu (2001) developed the WebQual scale to assess the quality of a web site. In this scale, the four dimensions of ease of use, beauty of design (the site's

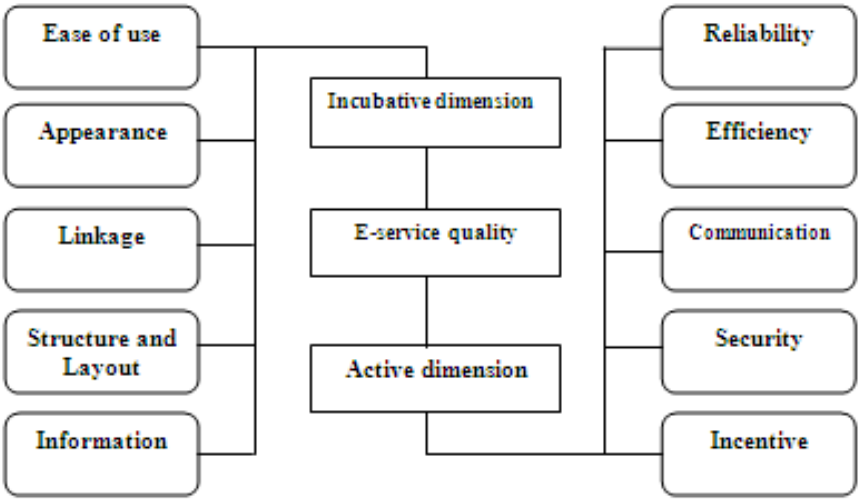

Figure 2. The conceptual model to assess the quality of electronic services.

being innovative using colorful graphics and multimedia), process running time (running online processes without delay and offering interactive responses to customers' requests), and security of personal and financial data are assessed.

Wolfinbarger and Gilly (2002) identified four dimensions for web site quality assessment through a field study exerting a focus group method; the design of website, reliability, preservation of personal data/security, and provided service. They remarked in their research that the main basis of online service quality was the capabilities and design of a web site which consisted of time saving, easy transaction, accurate information, complete information and an appropriate level of personalization.

Zeithaml et al. (2002) uncovered 11 dimensions of e-service quality which were similar to those found in their previous research on service quality in the pre-internet age, which includes reliability, responsiveness, access, assurance/trust, security/privacy, and customization/ personalization. However, some new dimensions related specifically to technology were revealed and they are ease of navigation, flexibility, efficiency, site aesthetics and price knowledge (Long and Mcmellon, 2004).

Santos (2003) developed a conceptual model on quality of electronic services based on previous studies and the interviews employed a focus group method. In the model, he suggests that the quality of electronic services consists of incubative and active dimensions and each dimension consists of 5 factors as shown in Figure 2.

Jean-Michel (2003) notes that customer is most important in designing, providing, and evaluating the level of service quality. Fassnacht and Ko¨se (2007) found that high electronic service quality in web-based services had an important role in building overall customer trust for the service provider (Ahasanul, 2009).

Yen and Lu (2008) studied the effect of the quality of internet services (the quality of a website) on customers' satisfaction considering an intermediary factor (disconfirmation). Their proposed model was based on Oliver's (1985) expectation-disconfirmation model (Figure 3). They tested this model on Yahoo! Kimo (tw.yahoo.com) web site which was an online sale. In this study, all of the hypotheses except the second one which is the effect of system accessibility on disconfirmation were approved.

RESEARCH METHODOLOGY

In the current research, quality function deployment (QFD) is used to plan and improve the quality of e-services. QFD is a powerful tool to reflect customer's needs in designing and redesigning process of products and services so that it is often considered as a starting activity and the main success part in total quality management in organizations.

Quality function deployment begins with the quality planning table of house of quality in which, first, customers' needs are drawn out using individual interviews and then the primary priority for each need is determined. In the next stage, the improvement ratio for each need is calculated and when multiplied by the primary priority for each of the needs, the final importance for each of the needs is produced.

Integrating Kano's model in quality function deployment

Obviously, customers' needs and requests do not have a linear relation with their satisfaction. So, the importance of each of the requests and needs can be reviewed with the help of Kano's model. Based on this model, customers 'needs are classified into three classes of; must be quality requirement, one-dimensional quality requirement, and attractive quality requirement. Since the planning matrix of house of quality is a prerequisite to prioritize the needs and determine their degree of importance, by using the integrated Kano's model and the quality planning table, the outcome would be the prioritization of needs regarding their classification in Kano's model and this would let us reflect the nonlinear effect of some of the needs during their final prioritization. Figure 4 depicts the methodology of the integrated model of Kano and QFD.

As the figure shows, the integration of Kano's model and QFD is

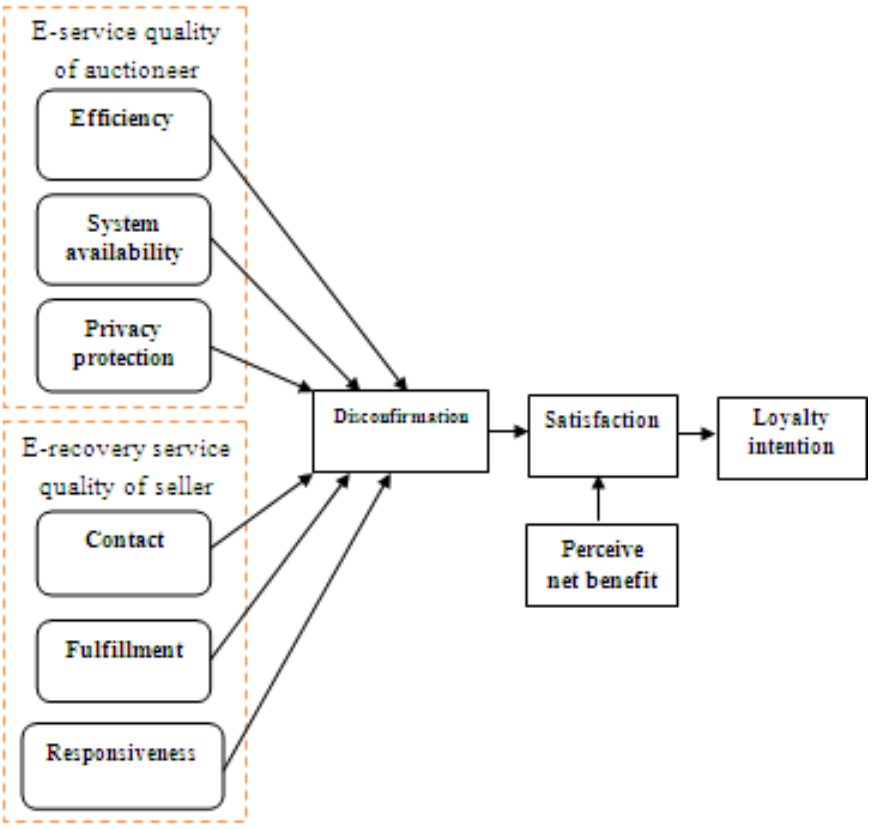

Figure 3. Yen and Lu's research model.

accomplished through two processes. Firstly, the needs are classified using Kano's questionnaires. The questionnaires are filled out on the basis of customers' opinions when a choice is available or when there is no choice that the first question is called functional and other one is dysfunctional. Secondly, the Kano's different classes are specified by combining the two responses, both functional and dysfunctional and for every service quality attribute, the service attribute were classified into six categories as Kano (1984) stated: must be, one-dimensional, attractive, indifferent, questionable or reversal.

In the next stage, the improvement ratio becomes modified by applying the transformation function for improvement ratios and the comparative parameters (Tan and Shen, 2000). The approximate transformation function of improvement ratio is as presented thus:

$IR_{adg} = (IR_0)^{1/k}$

Where: IR_{adg}: adjusted improvement ratio; IR_0: primary improvement ratio; K: *k* values (transformation function) which for the must be requirements.

One-dimensional requirements and attractive requirements are approximately considered as:

Attractive requirements: K = 2
One-dimensional requirements: K = 1
Must be requirements: K = 1.2

Since the primary importance and the adjusted improvement ratio form the final importance, the final importance of the needs are also modified and compared.

CASE STUDY

This research studies internet services of "Melli Iran Brokerage Company"- a company that provides financial services associated with the stock exchange.

First phase; realization and receiving the voice of customer

The first stage in QFD is to realize and receive the voice of customer. Therefore, 15 customers from the central office of Melli Iran brokerage company in Tehran are selected and individually interviewed. The results of these interviews are used to complete the planning matrix of house of quality in the needs selection stage. Totally, 20 quality associated needs and requisites are gathered out of the interviews with the customers.

Second phase; forming the quality planning table

As Figure 4 shows, house of quality consists of several interdependent matrixes, all of which contain some inter-related information. One of these matrixes is the planning table which establishes the basis to the integrated Kano's model and QFD. The different stages to form this matrix are explained further.

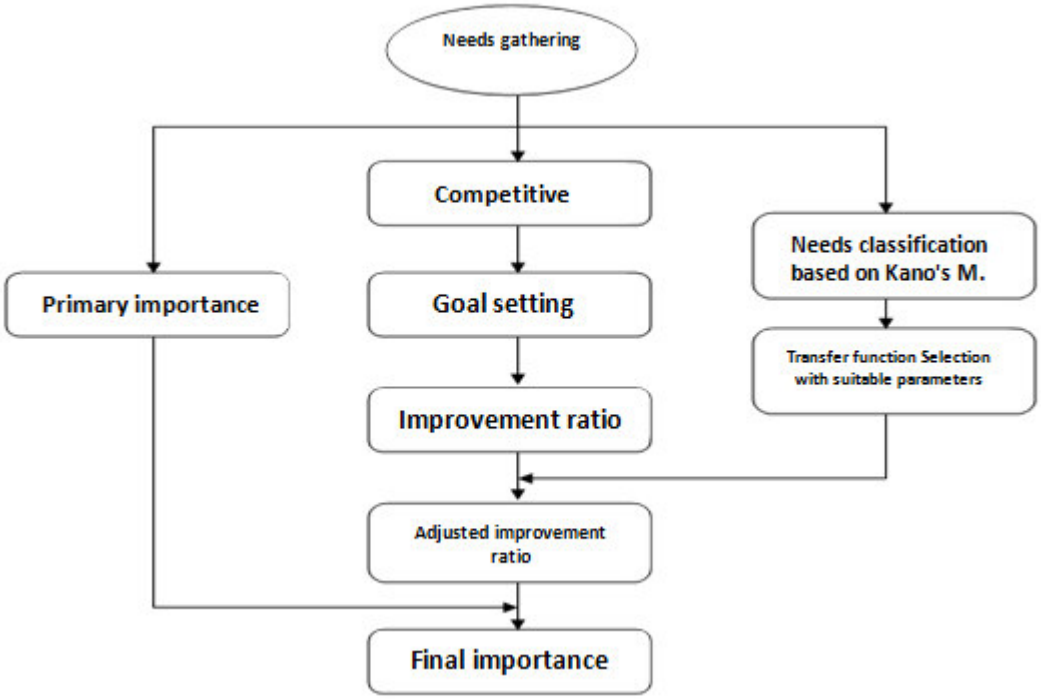

Figure 4. Calculating the final importance of needs based on the integrated Kano's model and QFD.

Table 1. Kano evaluation table.

		Response to dysfunctional question				
		Like	Must be	Neutral	Live with	Dislike
Response to functional question	Like	Q	A	A	A	O
	Must be	R	I	I	I	M
	Neutral	R	I	I	I	M
	Live with	R	I	I	I	M
	Dislike	R	R	R	R	Q

M = must be; O = one-dimensional; A = attractive; I = indifferent; Q = questionable; R = reversal.

Identification of customers' quality associated needs and requisites: The first stage in completing the planning matrix of house of quality deals with the identification of customers' needs and requisites. For this study, 10 needs that had the highest frequencies are selected through interviews to be inserted into the planning table of house of quality (Table 2).

Primary prioritization of customers' needs: The second stage in forming the planning matrix of house of quality is to determine the degree of importance of customer's needs, that is to say, the primary prioritization of needs. For the current study, Analytical Hierarchy Process (AHP) is used to prioritize the needs. Figure 5 introduces Decision hierarchy in a schematic model.

In this stage, a group consisting of experts (three from the company; the chief manager, the executive manager, and a specialist from R&D department) and three of the customers is formed to help. Firstly, the two criteria of "organization's opinion" and "customer's opinion" are compared and secondly, the needs are compared in pairs based on the two criteria by this group (Figure 3).

In Table 3, the 3rd and 4th columns show the weight for each of the needs based on the customers' opinions and the organization's. The 5th column shows the final weights which are calculated by the sum of each need's weight multiplied by its associated criterion. As the table shows, the highest priority is 0.22 which belongs to "There should be no delay and interruption while using the website" and the lowest priority is 0.03 which belongs to "Customers should have the possibility to customize the website". The final priorities produced in this table are used as the primary degree of importance for each of the needs in the planning table of house of quality.

Table 2. The customers' needs to be inserted into the matrix of house of quality.

S/No.	Customer's needs	
1	Customers should be notified when their e-request undergoes any process.	CN1
2	Customers should have the possibility to customise the web site.	CN2
3	A know-how guide to use the services offered should be available on the web site.	CN3
4	The site should be visually attractive.	CN4
5	There should be links for the customers to send their opinions and suggestions.	CN5
6	The orders should be processed on time.	CN6
7	Using services through internet should not expose customers to risk.	CN7
8	Customers should be able to easily send their buy and sell requests through the web site.	CN8
9	The website should provide educational and training services to the shareholders.	CN9
10	There should be no delay and interruption while using the web site.	CN10

CN = Customer's needs.

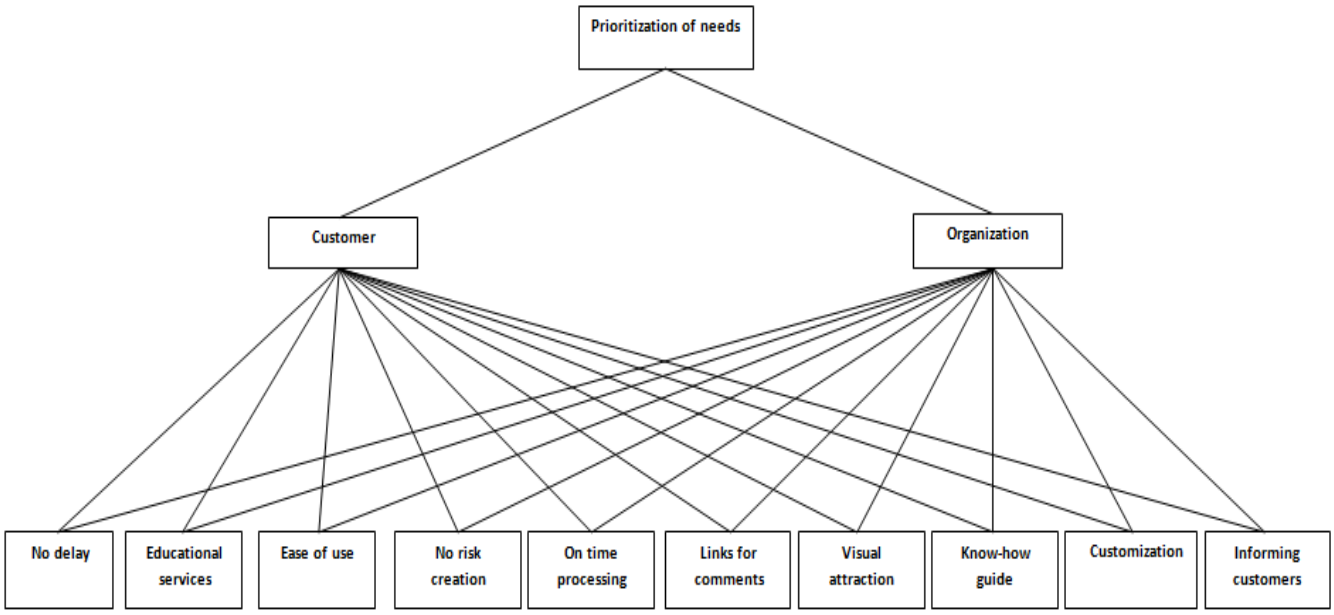

Figure 5. AHP's decision tree.

To assess the reliability of the results, the inconsistency rate is computed for the pair comparisons of decision criteria and also for the needs based on each criterion. The computed inconsistency rate for the decision criteria is zero, for pair comparisons by the customers' opinions and by the organization's opinions are relatively 0.06 and 0.04. Since inconsistency rate below 0.1 denotes reliability of results produced by AHP (Saaty, 1994), this research benefits from a favorable level of reliability.

Competitive analysis: The third stage in forming the planning table of house of quality addresses competitive analysis. Therefore, the company's situation associated with each of the customers' needs is compared to the situation of the same need in the competitors 'companies- the other brokerage companies which offer services through internet- from a customers' perspective.

So, the customers taking part in AHP's group comparisons are asked to compare the company's services to those of the competitors for each of the needs. This comparison is made in a scale of "1 to 7". Number "1" stands for "the least important" and number "7" stands for "the most important". The results of this assessment are shown in the 4th column of Table 4.

Company's target: Company's target to remove impedements and improve needs associated with each product and services are made based on a set of factors. These factors are the criteria which a company can improve its product/service to remove the existing problems.

For this step, the company's targets aiming at each of the needs are set based on experts' opinions. The experts set the priority of the plans in a scale of "1 to 7" in which "1" represents "the least important" and "7" represents "the most important". Table 4 shows the prioritization of the company's target.

Improvement ratio: The improvement ratio for each of

Table 3. The final prioritization of the needs by AHP.

S/No.	Customer's needs	Customer 0.55	Organization 0.45	Final weight
1	CN1	0.07	0.14	0.10
2	CN2	0.04	0.02	0.03
3	CN3	0.09	0.02	0.06
4	CN4	0.06	0.02	0.04
5	CN5	0.06	0.02	0.04
6	CN6	0.12	0.26	0.19
7	CN7	0.06	0.11	0.09
8	CN8	0.10	0.05	0.08
9	CN9	0.18	0.08	0.14
10	CN10	0.19	0.25	0.22

Table 4. The planning matrix of house of quality.

S/No.	Customer's needs	Primary importance	Competitive analysis		Target	Improvement ratio	Final importance
			company	competitors			
1	CN1	0.10	3	5	7	2.3	0.23
2	CN2	0.03	4	4	6	1.5	0.05
3	CN3	0.06	3	6	5	1.6	0.10
4	CN4	0.04	5	6	5	1	0.04
5	CN5	0.04	4	7	6	1.5	0.06
6	CN6	0.19	4	2	5	1.3	0.24
7	CN7	0.09	4	5	6	1.5	0.14
8	CN8	0.08	5	6	7	1.4	0.11
9	CN9	0.14	2	3	3	1.5	0.21
10	CN10	0.22	4	6	6	1.5	0.33

the needs is determined here. Improvement ratio is calculated by the company's target divided by the current customer satisfaction value of company. This ratio is a measure of the needs' improvement regarding the competitors' strengths, weaknesses and status. Table 4 shows the improvement ratio for each of the needs in the 6^{th} column.

Final prioritization of needs: The final prioritization of the needs is calculated by the multiplication of the degree of importance for each need by its improvement ratio (Table 4).

As is shown in Table 4, the highest priority is 0.33 which belongs to need No. 10, "There should be no delay and interruption while using the web site", and the lowest priority is 0.04 which belongs to need No. 4, "The site should be visually attractive".

Third stage; integration of Kano's model and planning table of house of quality

Classification of needs

The first stage to this integration is classification of needs. Kano's model specifies three requirements; "attractive requirement", "one-dimensional requirement", and "must be requirement". A slight improvement in the attractive needs leads to customers' satisfaction but do not cause dissatisfaction when not fulfilled (Witell and Dominguez, 2005). For the one-dimensional needs, customer satisfaction is a linear function of performance of product/service attribute. High attribute performance lead to high customer satisfaction, But for the must be needs, customer's become dissatisfied when performance of product/service attribute is low. However, customer satisfaction does not rise above neutral even with a high performance of product/service attribute (Tan and Pawitra, 2001). In the current research, Kano's questionnaires are completed by 30 customers of Melli Iran Brokerage Company who were clients of the internet services. Figure 5 demonstrates the collected data out of the Kano's questionnaires and also the Kano's classification of the needs based on their frequencies.

Modification of the needs' improvement ratio

The second stage for integrating Kano's model and house of quality is to modify needs' improvement ratio.

Table 5. The classification of needs based on Kano's.

S/No.	A	O	M	I	Sum	Results
1	8	11	6	5	30	One-dimensional
2	13	6	4	7	30	Attractive
3	4	8	16	2	30	Must be
4	6	14	7	3	30	One-dimensional
5	5	9	12	4	30	Must be
6	15	7	5	3	30	Attractive
7	2	6	19	3	30	Must be
8	12	9	5	4	30	Attractive
9	5	13	6	6	30	One-dimensional
10	4	20	4	2	30	One-dimensional
Sum	3	4	3	-	-	-

Table 6. QFD and Kano's final adjusted importance.

S/No.	Customer's needs	Kano's class	Kano's parameter (K)	Adjusted improvement ratio	Final adjusted importance
1	There should be no delay and interruption while using the website.	One-dimension	1	1.5	0.33
2	Customers should be notified when their e-request undergoes any process.	One-dimension	1	2.3	0.23
3	The orders should be processed on time.	Attractive	2	1.1	0.21
4	The website should provide educational and training services to the shareholders.	One-dimension	1	1.5	0.21
5	Using services through internet should not expose the customers to risk.	Must be	0.5	2.2	0.20
6	The know-how guide to use the services offered should be available on the website.	Must be	0.5	2.5	0.15
7	Customers should be able to easily send their buy and sell requests through the web site.	Attractive	2	1.2	0.1
8	There should be links for the customers to send their opinions and suggestions.	Must be	0.5	2.2	0.09
9	Customers should have the possibility to customise the website.	Attractive	2	1.2	0.04
10	The website should be visually attractive.	One-dimension	1	1	0.04

Therefore, the improvement ratio for each of the needs is modified according to Kano's classification through the transformation functions for improvement ratios. The comparative parameter "k" for the basic, functional and motivating needs is relatively 0.5, 1 and 2 (Tan and Shen, 2000). According to the transformation functions for improvement ratio $RI_{adg} = (RI)^{1/k}$, and the reverse effect of the parameter k as its exponent, the improvement ratio for basic needs rises, for functional needs remains the same, and for the motivating needs declines. Hence, the transformation functions for improvement ratios change, based on their exponent. Figure 6 shows the results for the modified improvement ratios.

Final adjusted importance based on Kano's model

For the integrated model, the improvement ratios are modified according to Kano's model by the classification of the needs and using the transformation function for improvement ratios and its specific comparative parameters. The final adjusted importance is also modified for each of the needs regarding their improvement ratios. Since the changes to the improvement ratios for the must be, one-dimension, and attractive needs are relatively increasing, not changed, and decreasing, the needs' final adjusted importance change according to the modified improvement ratios. So, the final importance for the must be needs increases, for the attractive needs decreases and for the one-dimension needs remains the same (Table 6).

According to Table 6, the highest priority is 0.33 which belongs to need 10, that is , "There should be no delay and interruption while using the website" and the lowest priority is 0.04 which belongs to needs 2 and 4, that is,

"Customers should have the possibility to customize the website" and "The website should be visually attractive".

CONCLUSIONS AND IMPLICATIONS

In this research, customers' needs are identified and reviewed through the integration of Kano's model and QFD. Based on the results, the priorities of the needs are; no delay or interruption in using the website, notification of customers when their requests are being processed, on time order processing, offering educational and training services, causing no risk, the availability of a know-how guide to use the website, the ease of sending orders, the possibility to make suggestions, the possibility to customize the website by customers, and visual attractiveness of the website. According to these results, some suggestions and implications are further made.

i. Regarding the point that the inserted needs to the planning matrix of house of quality are mostly web-based technologies and also since the highest priority in Table 6 belongs to "There should be no delay and interruption while using the website", it is highly suggested to use professional designer and advanced support technologies to provide internet services.
ii. The second determined priority belongs to the notification of customers when their request is undergoing any process. Therefore, after receiving the customers' requests, they can be informed of the status of the share market. When a buy, or sell order is processed, the customer can be kept abreast by an email or a short message to their cell phon.
iii. Considering the fact that the users of internet services are often newcomers to the Tehran stock exchange and also as the third priority identified here belongs to providing the customers with educational and training services, offering educational and training services such as how to work in the stock exchange, how to analyze the different shares' status and also offering articles related to decision making in the stock exchange will lead to more customer's satisfaction. Moreover, it will increase the possibility of absorbing potential customers who want to know more about the stock exchange and choose a brokerage company.
iv. Since service is by nature intangible, service producing companies can achieve customers' satisfaction and loyalty through obtaining their trustfulness. Since time plays a vital role for shareholders working in the stock exchange to buy or sell shares, customers wish their requests to be processed on time and on a time-priority basis. Thus, the customers' request receiving systems should be designed and planned in a way to let the brokers have immediate access to the orders. This is a way to achieve customers' trustfulness.
v. Since meeting the basic and functional needs is very important and not feeding these needs will lead to customers' dissatisfaction, it is suggested the company tries to meet these needs which also have a higher adjusted importance in the short run. These include needs such as "no delay or interruption in using the website" and "offering educational and training services".
vi. Since customers change their interests and expectations as the time goes by, it is suggested to review the identification of their needs on a regular time basis.

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