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Applying Grey E-S-QUAL Model to Evaluate the Gaps between Expectation and Perception of the Customer Based on E-services Quality: A Case Study of an Iranian Online Retailer

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Abstract- *This study aims to apply Grey system based on modified E-S-Qual model to analyze e-service quality. Questionnaires on the basis of E-S-Qual model, which consisted in 7 dimensions, were distributed among customers of 5040.ir, an online retailer in Iran. 251 questionnaires were obtained from the customer's website. After applying the method and calculating the scores in each dimension, the gap between expectations and perceptions was calculated. The results show that, among 7 dimensions, there are 4 positive and 3 negative gaps. Accordingly, with the aid of the Importance-Performance Matrix, the results are further analyzed. At the end of this study, some suggestions are made for improving quality of the e-services based on results analysis.*

Keywords: *E-service quality, E-S-QUAL model, Grey numbers, Iran*

I. INTRODUCTION

Nowadays, online shopping or e-retailing has been easier, cheaper, and more accessible to manage with the internet. Such interactive online shopping is rapidly increasing as a preferred way of shopping for customers all over the world (Zhang, Huang, He, & Wang, 2015). On the other hand, the internet considerably lowers entrance barriers and reduces switching costs, paves the way for many new entrants, enhances market reach, decreases transaction costs, and intensifies intra-industry competition (Chang, Lee, & Lai, 2012).

Accordingly, most companies are establishing websites, which are regarded as a new channel to conduct business transactions, and customers can make purchases through the companies' websites (Li & Suomi , 2009). Therefore, customers are increasingly turning to the internet, that is, they are increasingly using the internet to obtain information, peruse commercial as well as non-commercial websites, and search for and purchase products (Buhalis, 1988). Thus, the internet has become a platform for customer service.

The quality of online services is a key issue to maintain customer satisfaction (Sharma & Malviya, 2014). The results of previous research show that the quality of services can be generally measured by determining the discrepancy between what the customer wants (customer expectations) and how the customer receives and experiences the services (customer perceptions) (Pakdil & Harwood, 2005). There are a range of studies on the dimensions, measures, and attributes of e-service quality; for instance, Parasuraman, Zeithaml, & Berry (1988) proposed the SERVQUAL instrument, a 22-item scale that measured service quality along five dimensions. Their research became a good source for measuring service by other researchers, e.g., Li et al. (2015); Udo, Bagchi, & Kirs (2011); Nowacki (2005); Urdang & Howey (2001); Kang & Bradley (2002); Ibarra, Casas, & Partida (2014); and Purcăreaa, Gheorghea, & Petrescu (2013). With the advent of e-services, Parasuraman, Zeithaml & Malhotra (2005) changed the predecessor model to make it adequate to the electronic platform. They organized a multiple-item scale (E-S-QUAL) for measuring the service quality delivered by websites.

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However, the SERVQUAL instrument of Parasuraman et al.
(1988), a 22-item scale that measures service quality along five dimensions, forms the
Keystone for all other works

Most of the previous studies on assessing the gaps between expectations and perceptions of customers focused on SERVQUAL or E-S-QUAL method. However, the aim of the present research is to analyze the gaps between expectation of customers and their perception using modified E-S-Qual model based on Grey system. The Grey system theory is used for unascertained problems with poor information. We can make precise description and effective monitoring by developing and extracting valuable information from the "partially known information" for uncertain systems through the Grey system theory (Cui Jun-fu, 2011). It is worth mentioning that, in the real world, we face a lot of situations, and must deal with problems, with vague and imprecise information that usually involve uncertainty in their definition frameworks (Chuanmin, Xiaofei , Yuan, Yosa, & Ye, 2014). Due to this characteristic of Grey system, the E-S-Qual model has been modified based on Grey numbers, so that the opinions of customers towards the e-service quality are gathered in the form of Grey numbers.

The paper is organized into 5 sections. The context of research is described in Section I. Section II explains the background and literature review. Section III shows research methodology. In Section IV, the results of the study are described. Finally, Section V consists in the attained conclusions.

II. LITERATURE REVIEW

A summary of previous research is presented in this section. The research is categorized in two subsections: E-service quality and Grey system.

A. E-Service quality

The concept and importance of service quality appeared in the early 1980s, when practitioners realized that product quality could not gain competitive advantage alone (Kandulapati & Bellamkonda, 2014). Service quality is a marketing concept required for customer satisfaction and customer loyalty; moreover, it involves customer perceptions and customer expectations (Abedin, 2015). There is vast literature on determining the concept of service quality. Initially, Parasuraman, Zeithaml, & Berry (1985) developed a new model to measure a company's service quality. This model was useful to evaluate the gaps between customers' expectation and their perception towards service quality in 10 dimensions. Three years later, in 1988, they modified the model by reducing the dimensions into 5 cases. These dimensions were defined as follows (Parasuraman, Valarie, & Berry, 1988):

- *Reliability*: The ability to perform the promised service dependably and accurately.
- *Assurance*: The knowledge and courtesy of employees and their ability to convey trust and confidence.
- *Tangibles*: Physical facilities, equipment, and appearance of the personnel.
- *Empathy*: The provision of individualized attention to customers.
- *Responsiveness*: The willingness to help customers and to provide prompt service.

Since its rise in the beginning of the 21st century, e-service has been used increasingly. A variety of definitions for e-service quality have been presented by many researchers. Some scholars have defined it as the electronic provision of services to customers (Saanen, Sol, & Verbraeck, 1999). Some others define it as provision of service over electronic networks (Rust & Kannan, 2002). As mentioned before, the most important difference between traditional service and e-service in a library is that the e-users have to participate in the service processes more actively (Einasto, 2014).

It is also notable that the offline service quality is traditionally measured by comparing customers' expectations with actual service performance; however, items for evaluating electronic service quality have been changed and adapted for the electronic context (Sasser, Olsen, & Wyckoff., 1978). Therefore, over the past two decades, most of the researchers have focused on uncovering the dimensions of e-service quality. In this regard, Yoo and Donthu (2001) examined online retailers' services and developed a psychometrically rigorous instrument to measure the perceived quality of an internet shopping site (i.e., SITEQUAL) using the dimensions of ease of use, aesthetic design, processing speed, and security. Zeithaml (2002) studied service quality trough electronic channels and defined some indices to measure e-service quality. Wolfinbarger and Gilly (2003) suggested some other factors such as website design, reliability, and security in order to predict service quality of a websites. The dimensions like website design, reliability, responsiveness, trust, and

personalization were defined by Lee and Lin (2005) in order to examine the relationship among e-service quality dimensions and overall service quality, customer satisfaction, and purchase intentions. Parasuraman, Zeithaml, & Malhotra (2005), who developed ServQual model in a traditional context, proposed a model based on efficiency, availability of system, fulfillment, privacy, responsibility, and ease of making contact. A new WebQual model was later introduced by Loiacono, Watson, & Goodhue (2007) for consumer evaluation of websites. Their model included 12 dimensions that were: informational fit-to-task, trust, tailored information, response time, intuitive operations, visual appeal, innovativeness, emotional appeal, consistent image, on-line completeness, relative advantage, and understanding. Su et al. (2008) proposed a conceptual construct consisting of 6 dimensions: outcome quality, consumer service, process controllability, ease of use, information quality, and website design.

For this study, the E-S-Qual model of Parasuraman, Zeithaml, & Malhotra (2005) is considered to measure e-service quality dimensions. Based on this model, customer expectations can be influenced by personal needs, word of mouth, past experiences, and external communications (Parasuraman, Berry, & Zeithaml, 1991). Customer expectations are primarily based on customer needs (Tsai , Hsu, & Lin, 2011). Indeed, the main goal of services is to meet customers' needs and customers hold different types of expectations from the service. Moreover, as Shi et al. (2016) mentioned, Word of Mouth (WOM) affects consumers' expectations and perceived quality, which are two important antecedent factors of customer satisfaction. Furthermore, past experience or the customer's previous exposure to service is another force in shaping customers' expectation. In general, according to e-service quality factors, the gaps between customers' expectation and their perception (i.e., gap=P-E) determine the satisfaction of customers with e-service quality.

As Fig (1) shows, the dimensions are derived from E-S-Qual model, which is a widespread and good measure of e-service quality. The model consists of two main sections. The first section includes the following main dimensions:

- Efficiency: Ease and speed of accessing and using the site.
- Fulfillment: The extent to which the site's promises about order delivery and item availability are fulfilled.
- System availability: Correct technical functioning of the site.
- Privacy: Degree of safety and protection of customer information.

The second section includes dimensions of the e-recovery service quality as follows:

- Responsiveness: Ability of handling problems and returns through the site.
- Compensation: The degree to which the site compensates customers for problems.
- Contact: Access rate to assistance.

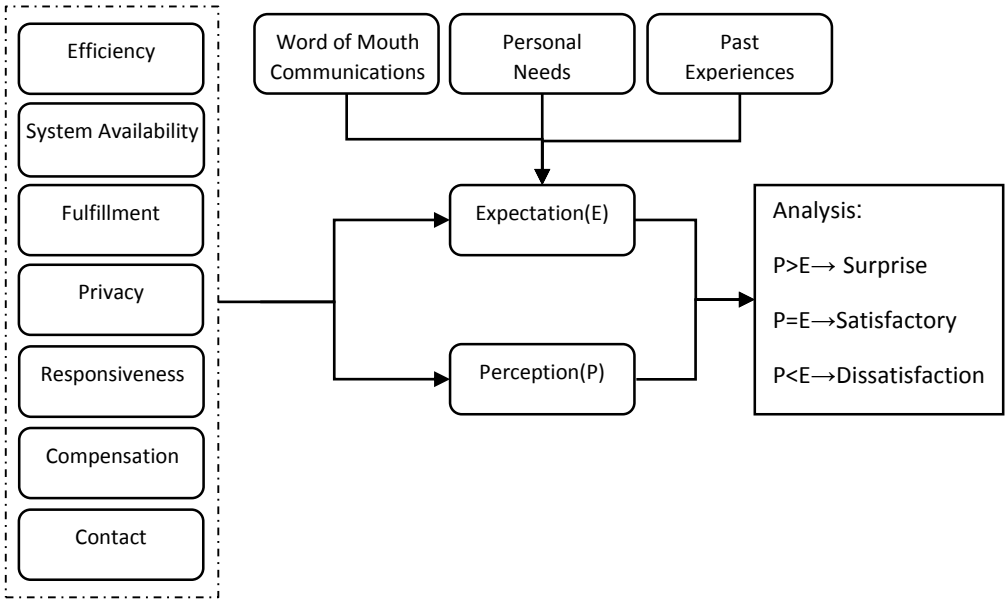

Fig 1. A contextual model according to Parasuraman, Zeithaml, & Malhotra (2005) for understanding e-service quality

B. Grey system

The Grey system theory is a new mathematical solution approach for problems with poor, incomplete, or uncertain

information. This method was first proposed by Deng (1982), (Mao, Gao, Xiao, & Zhu, 2015). There are no special requirements and limitations of the experimental data in the Grey system model. As poor information systems are common, it is reasonable to foresee the broad application of Grey system theory in the future. (Wei & Jun-fu, 2011). The Grey system theory is identified by colors. Accordingly, the systems can be divided into three types: black systems, white systems, and Grey systems. The black system is not perceived; the white system is the thoroughly perceived one; and the Grey system is partly perceived and unascertained between black and white systems (Xia, 2012). Grey number is a real number and the basic element of Grey system. In fact, the precise value could not be determined, but the potential range of values can be defined (Naiming & Jianghui, 2014). In the real world, the customers' opinion is expressed in a range of values; therefore, using Grey system can be useful.

The Grey number was first introduced by the symbol ⊗, which is usually a number with lower and upper limits $\underline{a}$ and $\overline{a}$, respectively. A new notation of three-parameter interval Grey number was introduced by Luo (2009), in which the highest possibility points were known. Then, the number ⊗ was defined as (1):

$$\otimes \in [\underline{a}, \tilde{a}, \overline{a}]. \quad (1)$$

In definition (1), $\tilde{a}$, which is called the center of gravity, is the largest number of possible values of ⊗ (Luo, 2009). Generally, if $\otimes_1 \in [\underline{a}, \tilde{a}, \overline{a}], \underline{a} < \tilde{a} < \overline{a}$ and $\otimes_2 \in [\underline{b}, \tilde{b}, \overline{b}], \underline{b} < \tilde{b} < \overline{b}$, the operations are as expressions (2)-(7).

$$\otimes_1 + \otimes_2 \in [\underline{a} + \underline{b}, \tilde{a} + \tilde{b}, \overline{a} + \overline{b}]. \quad (2)$$

$$\otimes_1 - \otimes_2 \in [\underline{a} - \overline{b}, \tilde{a} - \tilde{b}, \overline{a} - \underline{b}]. \quad (3)$$

$$\otimes_1 \cdot \otimes_2 \in [min\{\underline{ab}, \underline{a}\overline{b}, \overline{a}\underline{b}, \overline{ab}\}, \tilde{a}\tilde{b}, max\{\underline{ab}, \underline{a}\overline{b}, \overline{a}\underline{b}, \overline{ab}\}]. \quad (4)$$

$$\otimes_1 / \otimes_2 \in [min\{\underline{a}/\underline{b}, \underline{a}/\overline{b}, \overline{a}/\underline{b}, \overline{a}/\overline{b}\}, \tilde{a}/\tilde{b}, max\{\underline{a}/\underline{b}, \underline{a}/\overline{b}, \overline{a}/\underline{b}, \overline{a}/\overline{b}\}]. \quad (5)$$

When k is a positive real number, we have:

$$K. \otimes_1 \in [k\underline{a}, k\tilde{a}, k\overline{a}]. \quad (6)$$

$$\frac{\otimes_1}{k} \in [\underline{a}/k, \tilde{a}/k, \overline{a}/k]. \quad (7)$$

As mentioned before, a Grey number is a median number that changes around a central value. Thus, we can turn it into a crisp number. The act of turning a Grey number into a crisp number is called "Whitenization of Grey Number". For three-parameter interval Grey number $\otimes \in [\underline{a}, \tilde{a}, \overline{a}]$, the whitenization value looks as expression (8) (Li , Zhu, & Guo, 2016).

$$\widetilde{\otimes} = \frac{1}{2}\left(\tilde{a} + \frac{\underline{a}+\overline{a}}{2}\right). \quad (8)$$

Equation (8) is known as the kernel of three-parameter interval Grey number.

According to the issues mentioned above, this study applies Grey system theory based on modified E-S-QUAL model to analyze e-service quality in Iran. There is vast literature on E-S-Qual in various fields, such as banking, insurance, etc.; however, this model has not been applied to Iranian online retailers so far.

In addition to solving the poor and incomplete data obtained from the customers, using Grey numbers can help to more precisely consider the uncertainty existing in customer's response. Customer's response is received in the form of linguistic variables such as "Agree," "Strongly Agree," etc. The Grey system transforms the customer's view into mathematical quantities by assigning numerical ranges to it. Furthermore, this system helps to consider the uncertainty of customers in responding the questions.

III. RESEARCH METHOD

The method of this research is descriptive in terms of strategy and survey in terms of execution path, conducted as a field study. The study does not have any hypotheses. On the other hand, it looks for the answers to the questions of "In which dimension does e-service quality need to improve in order to satisfy customers?" and "how to do this?"

A. Research instrument

The survey questionnaire consisted of three parts. The first part included socio-demographic information such as gender, age, occupation, and educational level of respondents; the customer's expectations and perceptions were measured in the second part. This part included 33 questions related to the quality of e-services derived from the study of Parasuraman, Zeithaml, & Malhotra (2005), which needed to be answered separately according to expectations and perceptions of individuals. A five-point Likert scale format (ranging from 'strongly disagree' to 'strongly agree') was

adopted in this study.

The instrument had been used before; however, because of the change in population, validity and reliability were assessed. Cronbach's alpha coefficient was used to test the internal reliability of the component variables of all dimensions for measuring appearance, price, durability and strength, easy use, fulfilling of needs, and satisfaction feeling. Hair et al. (2006) proposed value of 0.7 or more to be acceptable for this index. The Cronbach's alpha coefficient was 0.96 for overall service quality expectations and 0.97 for overall service quality perceptions. The results showed that the instrument was sufficiently reliable. Besides, validity of the instrument was totally accepted by the experts.

B. Sampling and data collection

The sample target of the survey consisted in the customers of '5040.ir,' a popular online retailer website in Iran. To calculate the sample size, Cochran formula is used as follows:

$$n = \frac{\frac{z_{\frac{\alpha}{2}}^2 pq}{d^2}}{1+\frac{1}{N}\left(\frac{z_{\frac{\alpha}{2}}^2 pq}{d^2}-1\right)} = 224.$$

The sample size is obtained to be 224. The link of the web-based questionnaire was distributed as a comment on different pages. Finally, 462 questionnaires were filled in by respondents. Among the responded questionnaires, only 251 cases were considered to contain valid information; the other questionnaires, because of being incomplete, were considered as invalid. It should be noted that the questionnaires were distributed during June 2016 to July 2016, exhibiting 54% valid response.

C. Methodology

First, the answers of respondents were collected. As mentioned before, the customers' answers to each question were in the form of linguistic variables. They should be converted into three-parameter interval Grey numbers, as in Table I.

Then, the respondents' answers should be averaged in the form of a median Grey number for each case and, later, each dimension. For this purpose, expressions (2) and (7) were used. In order to clarify the procedure, let us assume that to a question, the answers are as follows:

A: the number of people choosing 'strongly disagree;'
B: the number of people choosing 'disagree;'
C: the number of people choosing 'undecided;'
D: the number of people choosing 'agree;' and
E: the number of people choosing 'strongly agree.'
N: the total number of respondents

The mean grey value of the question= $\frac{A\times[0,1,2]+[2,3,4]+C[4,5,6]+[6,7,8]+E[8,9,10]}{N}$

For example, if for a question, A=22, B=94, C=70, D=50, and E=15, then:

TABLE I. Linguistic variables and their equivalents based on Kamfiroozi, Aliahmadi, & Jafari Eskandari (2012)

Linguistic variables	Converted to Grey number
Strongly disagree	[0,1,2]
Disagree	[2,3,4]
Undecided	[4,5,6]
Agree	[6,7,8]
Strongly agree	[8,9,10]

The mean Grey value of the question= $\frac{22\times[0,1,2]+94\times[2,3,4]+70\times[4,5,6]+50\times[6,7,8]+15\times[8,9,10]}{22+94+70+50+15}$

$$= \frac{[0,22,44]+[188,282,376]+[300,350,400]+[120,135,150]}{15+50+70+94+22}$$

$$= \frac{[888, 1039, 1390]}{251} = [3.5378, 5.5378]$$

The results are calculated for each question in this way. Afterwards, the average of the Grey score for each question shapes the Grey score of the respective dimensions. It is worth mentioning that the Grey gap in each question or dimension can be calculated using expression (3), i.e., 'Grey Gap=Grey perception score – Grey expectation score'. Finally, in order to discuss and rank the gaps, Grey gap is converted into a crisp number by whitening based on expression (8). The chart shown in Fig (2) briefly explains the process of the research step by step. It is worth mentioning that Microsoft Excel 2016 and SPSS 21 were used to calculate the data.

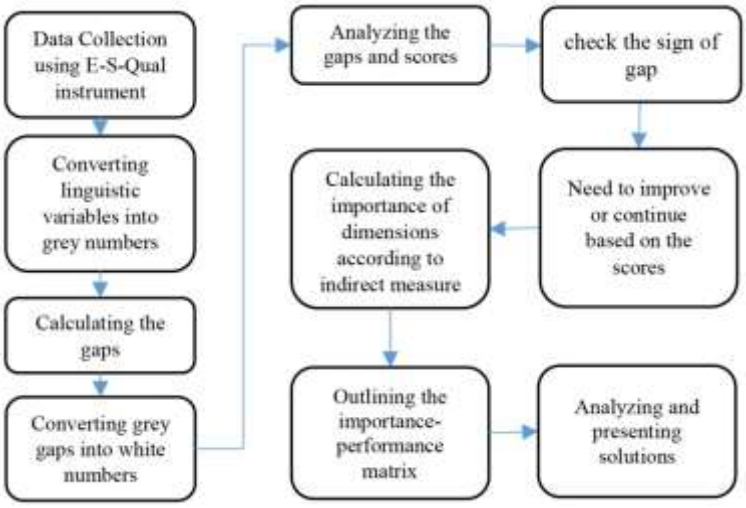

Fig 2. Step by step research methodology

TABLE II. Demographic information of the sample

Variables		N	%
Gender	Male	137	54.60
	Female	114	45.40
Age	0-20	46	18.30
	21-30	113	45.00
	31-40	53	21.10
	41-50	31	12.40
	51-60	8	3.19
Married status	Single	148	59.00
	Married	103	41.00
Occupation	Students	88	35.10
	Self-employed	76	30.30
	Government employee	55	21.90
	Workless	17	6.77
	Other jobs	15	5.98
Level of education	High school and less	41	16.33
	Bachelor	156	62.15
	Master	48	19.12
	Ph.D. and more	6	2.39

IV. RESULTS AND DISCUSSION

A. Profile of respondents

As Table II shows, a total of 251 respondents completely answered the questions. 54.60% of them were male and 45.40% female; 59.00% were single and 41.00% married; 18.30% were aged between 0-20, 45.00% between 21-30, and 21.00%, 12.40%, and 3.19% in the ranges of 31-40, 41-50, and 51-60, respectively.

In addition, 35.10% of the respondents were student, 30.30% self-employed, 21.90% government employee, 6.77% unemployed, and 5.89% in other employments; 16.33% of the respondents attended high school or less, a large number of them (62.16%) were bachelors, and 19.12% and 2.39% were master's educated and PhD, respectively.

B. Calculations and analysis

In the questionnaires, there were 30 items. For each one, the mean value of answers was calculated in a Grey Number, separately; the results are shown in Table III. The first column shows the e-service quality dimensions; the second and third columns represent the expectations and perceptions of customers, respectively. Finally, the fourth column illustrates the difference between expectations and perceptions.

TABLE III. Grey values of dimensions and sub-dimensions according to the filleting questionnaires

Attributes	Grey expectation	Grey perception	Grey gap
Efficiency	**[4.4960,5.4960,6.4960]**	**[3.9522,4.9522,5.9522]**	**[-2.5438,-0.5438,+1.4562]**
Q1	[3.5378,4.5378,5.5378]	[3.1474,4.1474,5.1474]	[-2.3904,-0.3904,+1.6096]
Q2	[4.0558,5.0558,5.0558]	[3.1633,4.1633,5.1633]	[-2.8924,+0.8924,+1.1076]
Q3	[4.8845,5.8845,6.8845]	[3.7530,4.7530,5.7530]	[-3.1315,-1.1315,+0.8685]
Q4	[4.5896,5.5896,6.5896]	[3.7131,4.7131,5.7131]	[-2.8765,-0.8765,+1.1235]
Q5	[5.0438,6.0438,7.0438]	[4.3665,5.3665,6.3665]	[-2.6773,-0.6773,+1.3227]
Q6	[5.0438,6.0438,7.0438]	[4.9562,5.9562,6.9562]	[-2.0876,-0.0876,+1.9123]
Q7	[5.1793,6.1793,7.1793]	[5.1076,6.1076,7.1076]	[-2.0717,-0.0717,+1.9283]
Q8	[3.6334,4.6334,5.6334]	[3.4104,4.4104,5.4104]	[-2.2231,-0.2231,+1.7769]
System Availability	**[4.1394,5.1394,6.1394]**	**[4.7629,5.7629,6.7629]**	**[-1.3765,+0.6235,+2.6235]**
Q9	[4.0876,5.0876,6.0876]	[4.9402,5.9402,6.9402]	[-1.1474,+0.8526,+2.8526]
Q10	[4.2151,5.2151,6.2151]	[5.2749,6.2749,7.2749]	[-0.9402,+1.0598,+3.0598]
Q11	[4.3427,5.3427,6.3427]	[4.8526,5.8526,6.8526]	[-1.4900,+0.5060,+2.5100]
Q12	[3.9124,4.9124,5.9124]	[3.9841,4.9841,5.9841]	[-1.9283,+0.0717,+2.0717]
Fulfillment	**[4.4988,5.4988,6.4988]**	**[4.7809,5.7809,6.7809]**	**[-1.7179,+0.2821,+2.2821]**
Q13	[4.7117,5.7117,6.7117]	[5.0199,6.0199,7.0199]	[-1.6972,+0.3028,+2.3028]
Q14	[4.6539,5.6539,6.6539]	[4.6135,5.6135,6.6135]	[-2.0398,-0.3984,+1.9602]
Q15	[4.3665,5.3665,6.3665]	[4.8446,5.8446,6.8446]	[-1.5219,+0.4781,+2.4781]
Q15	[4.1116,5.1116,6.1116]	[4.6375,5.6375,6.6375]	[-1.4741,+0.5259,+2.5259]
Q16	[4.6454,5.6454,6.6454]	[4.7889,5.7889,6.7889]	[-1.8566,+0.1434,+2.1434]
Privacy	**[4.0903,5.0903,6.0903]**	**[4.0212,5.0212,6.0212]**	**[-2.0691,-5.0691,+1.9309]**
Q17	[4.2709,5.2709,6.2709]	[4.0956,5.0956,6.0956]	[-2.1753,-0.1730,+1.8247]
Q18	[4.1912,5.1912,6.1912]	[4.0398,5.0398,6.0398]	[-2.1514,-0.1514,+1.8486]
Q19	[3.8088,4.8088,6.8088]	[3.9283,4.9283,5.9283]	[-1.8805,+0.1195,+2.1195]
Responsiveness	**[4.2342,5.2342,6.2342]**	**[4.3936,5.3936,6.3936]**	**[-1.8406,+0.1594,+2.1594]**
Q20	[4.6454,5.6454,6.6454]	[4.9243,5.9243,6.9243]	[-1.7211,+0.2789,+2.2789]
Q21	[4.6534,5.6534,6.6534]	[4.9880,5.9880,6.9880]	[-1.6653,+0.0558,+2.0558]
Q22	[4.7888,5.7888,6.7888]	[5.1076,6.1076,7.1076]	[-1.6812,+0.3187,+2.3187]
Q23	[3.7448,4.7448,5.7448]	[3.3865,4.3865,5.3865]	[-2.3584,-0.3584,+1.6416]
Q24	[3.3386,4.3386,5.3386]	[3.5618,4.5618,5.5618]	[-1.7769,+0.2231,+2.2231]
Compensation	**[3.9097,4.9097,5.9097]**	**[3.9177,4.9177,5.9177]**	**[-1.9920,+0.0080,+2.0080]**
Q25	[3.8884,4.8884,5.8884]	[4.0000,5.0000,6.0000]	[-1.8884,+0.1115,+2.1115]
Q26	[3.9841,4.9841,5.9841]	[4.0400,5.0400,6.0400]	[-1.9442,+0.0558,+2.0558]
Q27	[3.8565,4.8565,5.8565]	[3.7113,4.7113,5.7131]	[-2.1434,-0.1434,+1.8565]
Contact	**[5.3360,6.3360,7.3360]**	**[4.7490,5.7490,6.7490]**	**[-2.5870,-0.5870,+1.4130]**
Q28	[5.8964,6.8964,7.8964]	[5.8008,6.8008,7.8008]	[-2.0956,-0.0956,+1.9043]
Q29	[5.2271,6.2271,7.2271]	[5.1474,6.1474,7.1474]	[-2.0797,-0.0797,+1.9203]
Q30	[4.8845,5.8845,6.8847]	[3.2988,4.2988,5.2988]	[-3.5857,-1.5857,+0.4143]

TABLE IV. Whith values of dimentions based on the grey

Attributes	white expectation	white perception	white gap
1-Efficiency	5.4960[3]	4.9522[6]	-0.5438[3]
2-System Availability	5.1394[5]	5.7629[2]	+0.6235[1]
3-Fulfillment	5.4988[2]	5.7809[1]	+0.2821[4]
4-Privacy	5.0904[6]	5.0212[5]	-0.0691[6]
5-Responsiveness	5.2342[4]	5.3926[4]	+0.1594[5]
6-Compensation	4.9097[7]	4.9177[7]	+0.0080[7]
7-Contact	6.3360[1]	5.7490[3]	-0.5870[2]
Overall	5.3864	5.3682	-0.1270

It is necessary to note that the sub-dimensions or questions in each dimension, expressed with the symbol 'Q,' are averaged; then the score of each dimension of e-service quality is determined.

In order to perform further analysis, the Grey numbers should be converted into white numbers. Table IV shows the white values of Grey numbers. This would help to rank the dimensions and understand the gap values.

There are numbers above the scores which determine ranking points; for example, the dimension "Efficiency" is of the third rank regarding the expectation values. It is also of the sixth and third ranks regarding the perception and gap values, respectively.

It is shown in Table IV that in the results of e-service quality gaps between the expectations and perceptions, there are four positive and three negative gaps. Based on the results, we can come to the conclusion that the website needs to improve in some dimensions. By sorting the gap values between customer expectation and customer perception, the weakest and the strongest aspects of the site will be determined.

According to the statistics given in Table IV, we can get the following analysis results:

In terms of e-service quality expectations, the first dimension is "Contact" (6.3360), the second one is "Fulfillment" (5.4988), and the third one is "Efficiency" (5.4960), followed by "Responsiveness" (5.2342), "System Availability" (5.1349), "Privacy" (5.0904), and "Compensation"(4.9097).

Accordingly, nowadays, customers need powerful communication channels to create better contact, which leads to higher expectations for it. The existence of a contact channel creates trust and engagement with customers, because they will be ensured that if a problem occurs, they can easily take advantage of after-sales service. Certainly, one of the ways to create a great communication between customers and online service is establishing a center to answer customers 24 hours a day. These centers are commonly called the "Contact Center" and make contact with some customers through, e.g., phone calls, e-mail, postal mail, online answering, and website chats and collect the information of customers during purchasing. It can be said that a contact center is generally part of an enterprise's overall management of the relationship with customers.

Another important dimension of expectations is Fulfillment. It mostly focuses on delivery of orders and its quality. From the perspective of the customer, the time exceeding the promised time is considered to be delay. A customer who is annoyed by a long wait would probably be an unsatisfied customer.

The third dimension is Efficiency. It mostly focuses on accessing and using the website in which customers can complete the tasks for which they use the service. It emphasizes that the website should not be confusing or vague. Customers are often looking for simple cases, that is, they could find what they want easily, the necessary information would be readily available, etc. Such factors should be simple, fluent, and understandable to the customers. Design factors such as shortcuts, menus, links, and other buttons have an impact on efficiency. If they work properly, with clearly expressed actions, less time and effort are needed for the user to make an order and receive their services.

In the terms of e-service quality perception, the first dimension is "Fulfillment" (5.7809), the second one is "System Availability" (5.7629), and the third one is "Contact" (5.7490), followed by "Responsiveness" (5.3926), "Privacy" (5.0212), "Efficiency"(5.9522), and "Compensation"(4.9177).

In the terms of e-service quality gap, the first dimension is"System Availability" (+0.6235), the second one is

"Contact" (-0.5870), and the third one is "Efficiency"(-0.5438), followed by "Fulfillment" (+0.2821), "Responsiveness" (+0.1594), "Privacy" (-0.0691), and "Compensation"(+0.0080).

Importance-Performance Analysis (IPA) was first proposed by Martilla & James (1977); it measures the importance and performance of services or products in terms of some selected attributes. The method can be used to evaluate gap scores of E-S-Qual model. IPA is an effective tool for evaluating competitive position, identifying opportunities for improvement, and designing targeted marketing strategies and proper service quality. Furthermore, the data collected via questionnaires can be plotted in four quadrants, in which the vertical axis reflects the importance and the horizontal axis reflects the performance (Wu, 2013).

After data collection, expectation and perception can be plotted in four areas as follows:

A) Possible overkill

Importance perceived by the customer is low, but performance of the organization's product or service quality characteristic is high.

B) Keep-up with the good work

Performance of the organization is high; also, customers feel that the service or quality characteristic of the product is good.

C) Low priority

The performance of the organization's product or service quality characteristic is low, and the importance perceived by the customer is also low.

D) Concentrate here

Customers feel that the service or quality characteristic of the product is high, but the performance of the organization is low (Gonçalves, Pinto , Batista, Pereira, & Bovi Ambrosano, 2014). Thus, the organizations' strategy should seek to shift all dimensions to the quarter A Fig (3).

In this matrix, horizontal axis and vertical axis show customer expectations and customer perceptions, respectively. The averages of customers' expectations and perceptions are specified in the matrix center. The mean values of expectations and perceptions are 5.2864 and 5.3682, respectively. Then, the rest of white scores will be placed in the matrix Fig (4).

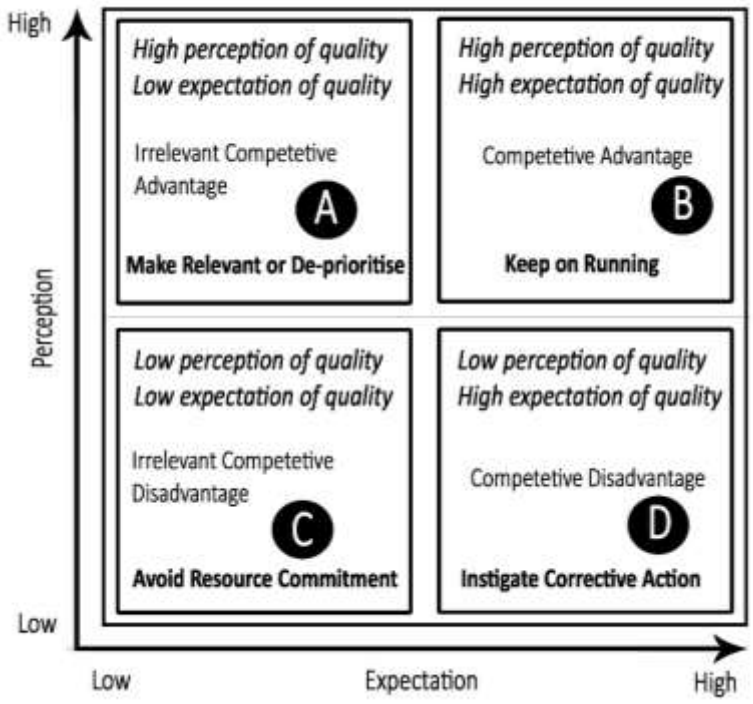

Fig 3. The Importance-Performance Matrix (Martilla & James, 1977)

According to Table IV, dimension ۱# has a relatively high negative gap; Moreover, as shown in Figure 4, it is placed in the quarter D, which shows that the organization must concentrate its power on improving the efficiency of the website. Dimension #2 has the highest gap and is positive; it is in quarter A, meaning that the company's resources are being wasted in this case. Dimension #3 is the fourth gap placed in quarter B, which shows that the website has a good performance based on customers' expectations, so the strategies related to this feature should be continued. In dimension ۴#, despite the negative gap, perceptions and expectations are almost equal and due to being in quarter C, its improvement does not make much satisfaction in customers, which means that the company should continue its strategies about privacy. Dimension #5 also has a good situation in terms of gap and is placed at quarter A, thus the organization has used more power than required for the customers' expectation and it is necessary to change some strategies in this case. In dimension #6, expectations and perceptions are close to each other, and since it is in low-priority quarter, the company has adopted the right strategy. Finally, dimension #7 has a large gap between perception and expectations and because it is in quarter B, it can be concluded that the company's performance has been favorable in comparison with the other dimensions, but due to high customer expectations in this case, the gap is negative. Therefore, given that the customer ultimately determines the quality, it is better for the company to improve its performance and adopt better strategies.

In addition to IPA matrix in terms of expectation and perception, the matrix is plotted based on importance and perception. For this purpose, the importance of dimensions should be determined according to customers' view. Most IPA studies use direct rating method by questionnaires, but in this paper, the importance of e-services attributes has been determined through indirect measures. Thus, dependent variables are measured through the importance scores, with an overall performance, and independent variables are evaluated by the performance scores of single features (Riviezzo, de Nisco, & Napolitano, 2009). Accordingly, Table V shows the required calculation. The mean value of perception scores has been calculated and, then, Pearson correlation between overall expectation (mean value) and each dimension's expectation is prepared; the results are shown in Table V, "Corr. Pearson" column. Afterwards, the calculated numbers are normalized and prepared, represented in the "Normalized Corr. (importance)" column.

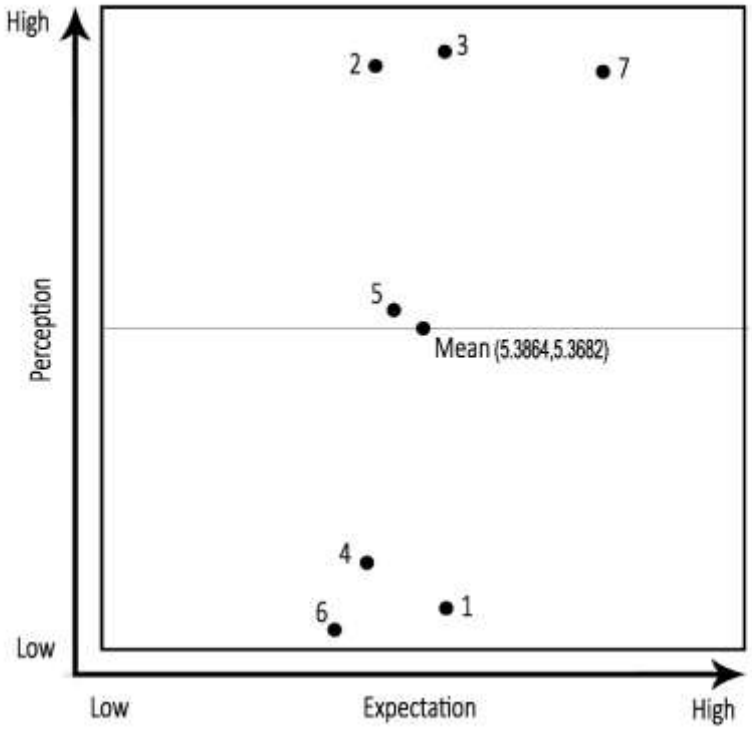

Fig 4. The Expectation-Perception Matrix in the case of 5040.ir

TABLE V. Standard deviation and correlation calculation of dimentions

Attributes	Expectation	Perception	SD Expectation	SD Perception	Corr. Pearson	Normalized Corr. (importance)
1-Efficiency	5.4960	4.9522	1.0656	1.0842	0.3521	0.1574
2-System Availability	5.1394	5.7629	1.0545	1.0642	0.3674	0.1642
3-Fulfillment	5.4988	5.7809	1.0637	0.9016	0.3781	0.1690
4-Privacy	5.0904	5.0212	0.9943	1.2510	0.2865	0.1280
5-Responsiveness	5.2342	5.3926	1.0421	0.9942	0.2987	0.1335
6-Compensation	4.9097	4.9177	0.9678	1.0122	0.2312	0.1033
7-Contact	6.3360	5.7490	1.0854	1.0574	0.3226	0.1442
Mean	5.3864	5.3682	1.0391	1.0649	-	-

According to Table V, the importance-performance results are shown in Fig (5). The results are mainly similar to the expectation-perception matrix shown in Fig. (4). But, dimension #2 has been moved to quarter B; it means that this factor is important according to the importance of other dimensions. Fortunately, the performance of the company is as good as costumers expect. The difference between expectation and importance represents that this factor is an important dimension, but may cause reduction of customers' expectations. For example, the low speed of the internet is one of the factors that reduces the expectations. However, despite the existing problems, our case study has good system availability.

In addition, Fig (5) shows that Fulfillment, Efficiency, System availability, and Contact are the most important dimensions from the viewpoint of customers. As a result, websites should invest totally on these factors. In this case, the efficiency dimension must be in priority of improvement. The other dimensions are less important from the viewpoint of customers. Consequently, they must be considered as the next priorities for investment.

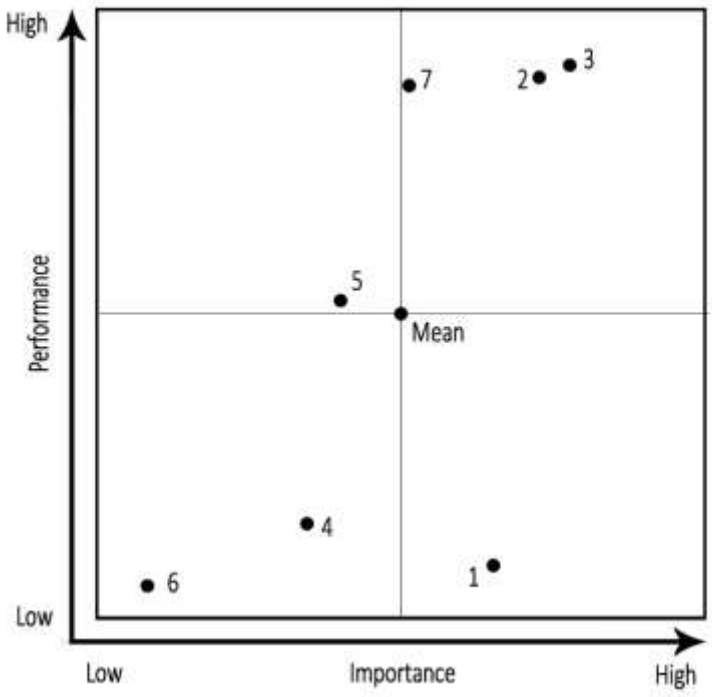

Fig 5. The Importance-Performance Matrix in the case of 5040.ir

Regarding the above findings, the following strategies are suggested:

- **Efficiency**

It is necessary to improve site design based on customer behavior; for example, the organization of the site needs to be more powerful so that the customers can more quickly find their required items. It is better to apply modern product sorting methods based on new products, most viewed, price, etc. Also, in order to help customers choose their favorite products, more colors can be employed in the design of the site. To improve the speed of transactions, using the programming changes is proposed. The search engine of the site could be more powerful to help the users find their items. In addition, the server could use pictures with lower sizes so that the pages would have better performance.

- **Contact**

The website needs a more powerful call center by using more and more phone lines with enough operators in order to answer customers' calls. The company needs to be active in new virtual networks, such as Instagram, Twitter, Facebook, etc. It is necessary to create an application on Android and IOS platforms, in which mobile users could more easily communicate with the site. It is no need to mention that the e-mails and online questions should be answered more quickly.

- **System Availability** and **Responsiveness**

These dimensions exceed customers' expectations and with investments reduction in site programming in the area of system availability, the company can reduce the costs. In addition, it is possible to pay less attention to responsiveness to the extent that it satisfies customers' expectations.

- **Fulfillment, Privacy** and **Compensation**

The current strategies can be continued.

V. CONCLUSIONS

In this study, the Grey E-S-QUAL method was applied to an e-service retailer in Iran. Based on this model, the gaps between the e-service quality expectations and perceptions could measure e-service quality. The dimensions of e-service quality were taken from the study of Parasuraman, Zeithaml, & Malhotra (2005). The results of online distribution of questionnaires showed that there was a negative gap in 3 dimensions and positive gap in the other 4 dimensions. Based on the data analysis and discussion given in the previous section, the main problems were "Efficiency" and "Contact;" thus, some solutions in order to improve the website efficiency and contact were proposed.

The proposed model for e-service quality can be used by managers, service providers, and researchers in order to measure the gaps between customers' expectation and their perception. Moreover, future researchers can use this model on the basis of other dimensions according to their case study. They also can use fuzzy E-S-Qual instead of Grey E-S-Qual.

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