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QUALITY INDICATORS IN THE MOBILE INDUSTRY RANKINGS BASED ON INDICATORS OF CUSTOMER SATISFACTION WITH THE HYBRID APPROACH DEMATEL AND ANP APPROPRIATE STRATEGY BASED ON GRAY SYSTEM

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ABSTRACT

The quality of services as a vital element in the strategic competitiveness and commercial success are various methods have been developed to evaluate it. Prioritizing qualitative indicators based on the quality of mobile phone services enables the company gives top priority due to the higher percentage of satisfied customers provide. This study tries to customer satisfaction according to criteria to prioritize mobile operators pay qualitative characteristics.

A sample consisted of 450 individuals (46% women, 54% men) from IRANCELL operator (Iran) in 2015 which selected randomly. Results shows between four considered strategies maximum priorities belong to S1 which is denote to more services beyond customer expectations.

KEY WORDS: Customer Satisfaction, Mobile Operators, ANP, Dematel, Gray System

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INTRODUCTION

In the information age, it is natural that one of the highest rate of growth in the telecommunications industry, among other industries have. Like any other industry, the telecommunications industry is also gaining a new customer is much more difficult and expensive than retaining existing customers. In addition to cost 5 times as attract new customers, backed retain current customers. Studies have shown a direct correlation between customer satisfaction and quality of service provided there. Therefore, it is natural that mobile operators are always on maintaining and improving the quality, increase customer loyalty and maintain them. Judgment about phone service a mobile operator customers primarily on the properties of different beliefs or expectations along with it, the quality of operator services and experiences based on it. The quality of services as a vital element in the success of business and strategic competition in the mobile phone business is considered and various methods have been developed to evaluate it. Identify and prioritize the needs of mobile operators to provide service features for customer relationship management and maintaining their loyalty to the provider has caused a lot of research done in this area. However, according to internal thought and invisible customers, lack of access and comment on all of them, deficiency of information and uncertainty of how to meet them, methods for measuring the quality of services provided and the shortcomings of a mobile phone. Previous researchers to measure the quality of service of mobile operators have used different models and variables. Some of them models such as Servqual and Srvprf general use, others through add dimensions to these models for mobile services industry, have tried to measure the quality of services in the industry. Some other researchers have used more specific assessment tools for cell phone operators and prove effects of these dimensions on customer behavior and satisfaction (Pezeshki, 2009).

Research carried out in this area, quality of services specific to mobile services industry in customer satisfaction and loyalty play a key role, has identified. Table (1) shows this dimensions:

Table 1: Quality Dimensions

Quality Dimensions	Researchers
Network Quality	(Gunjan M., 2011 .) , (V., 2011) , (Eshghi A., 2008)
Value added services	(Jahanzeb S., 2011) , (Gunjan M., 2011 .)
Bill	(Lim H., 2006) , (Krishnan R., 2008)
Convenience	(Ling C. E., 2008 .) , (Liang D., 2012 .)
Merit employees	(Eshghi A., 2008) , (Krishnan R., 2008)
Pricing plans	(Ling C. E., 2008 .) , (Gunjan M., 2011 .)
customer services	(Pezeshki V., 2009) , (Santouridis I., 2010)

Evaluation importance of quality characteristics is one of important selection process in new services in mobile operators which many researchers pay attention to. Estimation methods and identify important features can be placed in two general categories: The first, so-called direct or indirect methods in which customers are asked directly, Care about their properties from their point of view. Second, are implicit methods in which effects of each feature on customer satisfaction is evaluated with statistical and data mining (Pezashki, 2009). Some researchers have noted that customers using direct comments on the assessment of properties, due to high uncertainty and differences will reduce the predictability and reliability analysis (Ling, 2008). On the other hand, common statistical methods like regression and structural equation modeling have some limitations and assumptions and since in related studies predict customer behavior and attitude cannot be sure there are all these assumptions, the use of these methods in the calculation of features, reliable and dependable results will follow.

Although many studies have been done on the quality of mobile services, but research in the field prioritize these aspects was not found. Prioritizing qualitative indicators based on the quality of mobile services that enable companies due to higher priorities, provide a higher percentage of satisfied customers. . This study attempts to prioritize customer satisfaction qualitative characteristics of mobile operators. Lack of access to information from the minds of customers and sometimes contradictory comments on their behalf conditions for the decision to prioritize quality indicators is uncertain. One of the proposed methods for dealing with this situation, the use of gray number theory is that this research aims to use it to solve the problem.

RESEARCH METHODOLOGY

Participants

The study population consisted of all mobile phone subscribers in Iran. The sample consisted of 450 individuals (46% women, 54% men) from IRANCELL operator (Iran) in 2015 which selected randomly. Their ages ranged from 18 to 35 years ($M = 24.61$, $SD = 2.13$).

Measures

In this study, data collection tools included two questionnaires, which is designed to be closed. The first issue questionnaires to identify the most important indicators of the quality of the operators phone service provider is used. The questions based on Likert 5 option was analyzed. The second questionnaire was designed based on the concept of ANP techniques and paired comparisons to assess the importance and weight of the most important indicators of the quality of the study. In each section of tables paired comparisons questionnaire 2, the number of questions in accordance with the rules of proportion to the number of elements that are to be compared will be considered, ie if the number of elements compared n assumes the number $(n(n-1)) / 2$ Compare been incorporated in the table. In order to collect demographic data of respondents also were asked in the questionnaire information such as age, gender and education to determine.

Procedure

ANP integrated approach method and gray theory in this study is not composed of the following major steps:

- 1) Identify the most important indicators of quality mobile operators
- 2) Formulated a causal network of the indicators
- 3) Extraction of paired comparisons
- 4) Calculate the relative importance (weights)
- 5) Primary super Matrix formation
- 6) Computing final weight of the super matrix
- 7) Identify strategies for quality management
- 8) Evaluating strategies than the index
- 9) Prioritize strategies

RESULTS

Identify indicators of customer satisfaction in mobile phone

To identify customer satisfaction indices based on American customer satisfaction model a questionnaire was designed and asked respondent to identify importance level of each of them. Respondents used 1, 2, 3, 4, 5 numbers to determine the importance of each indicators. Table 2. shows customer satisfaction indices with their P-values. Results shows that all of extracted indices are statistically significant.

Table 2: Scoring indicators of customer satisfaction in mobile phone

Code	Quality index	Index name	Scores					Total	P-value	Result
			1	2	3	4	5			
1	Overall expectation of the services	X1	20	50	140	120	120	450	0.674	Yes
2	Expectation of the extent services meet user requirements	X2	30	60	110	40	0	450	0.774	Yes
3	Expectation of the reliability of services	X3	80	150	130	70	20	450	0.674	Yes
4	Overall evaluation of services	X4	20	70	130	150	80	450	0.674	Yes
5	Evaluation of the extent services meet user requirements	X5	10	60	70	180	130	450	0.560	Yes
6	Evaluation of the reliability of services	X6	10	60	120	190	70	450	0.99	Yes
7	Quality based on price	X7	30	60	120	160	80	450	0.674	Yes
8	Perception of services to provide customers' expectations	X8	0	60	70	150	170	450	0.854	Yes
9	Distance between actual and ideal situation	X9	20	70	120	150	170	450	0.674	Yes
10	Customer complains	X10	20	70	120	150	90	450	0.674	Yes
11	Network and covering antenna	X11	40	80	90	140	100	450	0.674	Yes
12	Continue to using services	X12	30	70	110	110	130	450	0.674	Yes
13	Endurance of increasing prices	X13	20	70	110	160	90	450	0.99	Yes
14	Introduce services to others	X14	20	80	110	170	70	450	0.99	Yes

Now, after identification of effective factors, network structure was determine. This was done with DEMATEL technique. Expert opinions about the amount of relationship between this factors was asked. It did with a questionnaire with 4 scale; zero (without any impact), one (low impact), two (high impact) and three (very high impact). The resulting matrix in this step shows with Z and components Z_{ij} illustrate degree of impact factor i on j. Table 3. shows mentioned matrix.

Examine the importance of customer satisfaction indexes based on ANP

Based on customer satisfaction indexes America and indicators outlined in the previous section hierarchical structure is plotted below:

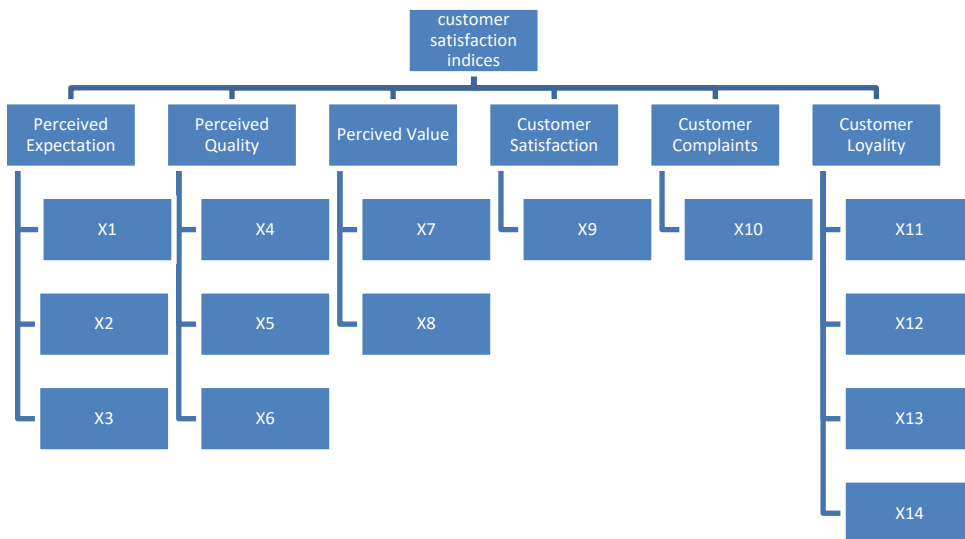


Figure 1: Hierarchical structure for customer satisfaction

Table 5: Name the main indicators

Perceived Expectation	C1
Perceived Quality	C2
Perceived Value	C3
Customer Satisfaction	C4
Customer Complains	C5
Customer Loyalty	C6

Integrated matrix of paired comparisons

To merge matrix of paired comparisons we use the geometric mean. Table 6. displays integrated matrix. This calculation procedure for pair wise comparison matrices to calculate the weight of the primacy of matrices done by the following formula:

- A) The integration of pair wise comparison matrices
- B) Normalization matrix of paired comparisons
- C) Average of line
- D) Calculating the rate of incompatibility

Table 6: immersed paired wise comparison

	C1	C2	C3	C4	C5	C6
C1	1.000	2.993	3.286	1.906	4.711	3.086
C2	0.334	1.000	1.698	0.588	2.139	1.414
C3	0.304	0.589	1.000	0.337	2.289	1.259
C4	0.525	1.701	2.967	1.000	5.139	6.227
C5	0.212	0.468	0.437	0.195	1.000	0.436
C6	0.324	0.707	0.794	0.161	2.294	1.000

Normalizing pair wise matrix

To normalize each element of the matrix is divided by the sum of the column. Table 7. normalized matrix of pair wise comparison matrix shows the main indicators.

Table 7: Normalized pair wise matrix

	C1	C2	C3	C4	C5	C6
C1	0.370	0.401	0.323	0.455	0.268	0.230
C2	0.124	0.134	0.167	0.140	0.122	0.105
C3	0.113	0.079	0.098	0.081	0.130	0.094
C4	0.194	0.228	0.291	0.239	0.292	0.464
C5	0.079	0.063	0.043	0.046	0.057	0.032
C6	0.120	0.095	0.078	0.038	0.131	0.075

Average of Row: From before mentioned matrix, average was calculated from each row. If the of incompatibility for matrix be smaller than 0.1, obtained vector in the table 8. shows final weight of the main indicators. 00

Table 8: Final weights for pair wised main customer satisfaction factors

Factors	Final weights
C1	0.341
C2	0.132
C3	0.099
C4	0.285
C5	0.053
C6	0.089

Incompatibility rate is equal to 0.026 which is under 0.1, so, matrix is incompatible.

Frequent power and deliver it to build a super matrix

In this section, according to the results of the previous section to the Super matrix problem. However, to determine the final weight of indicators to stage the matrix must be equal numbers in each row together (converging Super matrix problem) was multiplied. After 68 times the power delivery and prioritize the factors converged.

Table 9: Priorities of factors

code	Quality index	Index name	weight
4	Overall evaluation of services	X4	0.235
5	Evaluation of the extent services meet user requirements	X5	0.175
6	Evaluation of the reliability of services	X6	0.154
1	Overall expectation of the services	X1	0.141
3	Expectation of the reliability of services	X3	0.081
2	Expectation of the extent services meet user requirements	X2	0.068
7	Quality based on price	X7	0.054
9	Distance between actual and ideal situation	X9	0.015
12	Continue to using services	X12	0.014
8	Perception of services to provide customers' expectations	X8	0.009
10	Customer complains	X10	0.009
14	Introduce services to others	X14	0.008
11	Network and covering antenna	X11	0.007
13	Endurance of increasing prices	X13	0.004

Among 14 quality indexes, overall evaluation of services, Evaluation of the extent services meet user requirements and Evaluation of the reliability of services have higher weights. Based on indexes priorities, it will be designed 4 strategies for improving customer satisfaction:

S1: More services beyond customer expectations

S2: Decreasing Internet and MMS prices

S3: Increasing Antenna covering

S4: Increasing reliability of services

Selection Strategies

This section uses the results to the theory of ANP gray and ranking strategies will be discussed. Evaluating strategies gray than the index through assessments done. At this point the need to evaluate each strategy is based on each indicator. The way to do this is to assess the mental scores in the range of "non-favorable impression" to "to great effect" for each strategy to consider each indicator. In this case, five levels of gray will have numbers in the table 10. have been brought.

Table 10: linguistic gray scale for assessing strategies

Linguistic terms	Gray number
No propensity of involvement(N)	[0,0]
Very low propensity of involvement (VL)	[0,0.25]
Low propensity of involvement(L)	[0.25, 0.5]
High propensity of involvement (H)	[0.5,0.75]
Very high propensity of involvement(VH)	[0.75,1]

The evaluation was conducted by four experts. Tables 12 to 15 to assess the desirability of four expert groups to enhance customer satisfaction strategy based on 14 qualitative indicators to show.

Table 11: First decision maker's evaluation from strategies utility in enhancing customer satisfaction

Index \	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14
S1	VL	H	H	VH	H	H	L	L	VH	L	H	H	N	N
S2	H	L	H	N	L	VH	N	N	N	VL	N	VL	L	H
S3	L	L	L	N	VL	N	VH	L	H	VH	N	VL	L	H
S4	L	VH	N	L	VH	H	N	L	L	H	L	VH	VL	L

Table 12: Second decision maker's evaluation from strategies utility in enhancing customer satisfaction

Index \	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15
S1	L	H	H	VH	H	H	VL	L	VH	H	H	VH	L	N	N
S2	H	VL	H	N	L	VH	L	N	N	VL	L	L	L	VH	L
S3	L	VL	L	L	VL	N	VH	L	VH	VH	N	VL	N	H	VH
S4	L	VH	L	L	VH	H	N	L	L	H	VL	VH	VL	N	VH

Table 13: Third decision maker's evaluation from strategies utility in enhancing customer satisfaction

Index \	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15
S1	L	L	VH	VH	H	L	L	L	VH	L	H	L	L	VH	L
S2	H	H	H	L	L	VH	H	N	H	L	VH	VL	L	H	L
S3	L	VL	L	L	L	N	VH	N	H	VH	N	VH	L	VH	VH
S4	L	VH	N	VL	H	H	N	VH	N	H	L	VH	L	L	VH

Table 14: Fourth decision maker's evaluation from strategies utility in enhancing customer satisfaction

Index \	d1	d2	d3	d4	d5	d6	d7	d8	d9	d10	d11	d12	d13	d14	d15
S1	L	VH	VH	VH	H	VH	N	VL	H	N	H	N	L	L	L
S2	N	L	H	N	L	VH	L	L	VH	VL	VL	VL	L	H	L
S3	L	VL	N	N	VL	L	VH	VL	H	H	H	H	H	H	VH
S4	L	VH	N	L	VH	H	L	L	L	H	VL	VH	VL	H	H

Table 15. shows mean of four experts judgments about each strategy.

Table 15: Average of four experts' judgments

d1	d2	d3	d4	d5	d6	d7
0.188	0.438	0.500	0.750	0.625	0.875	0.750
0.375	0.563	0.250	0.500	0.500	0.750	0.063
0.250	0.500	0.063	0.313	0.188	0.375	0.125
0.250	0.500	0.750	1.000	0.063	0.125	0.188
d8	d9	d10	d11	d12	d13	d14
0.188	0.438	0.688	0.938	0.250	0.438	0.500
0.063	0.125	0.313	0.438	0.063	0.313	0.250
0.125	0.313	0.563	0.813	0.688	0.938	0.125
0.375	0.625	0.188	0.375	0.500	0.750	0.125

After calculating table 15., it has to be normalized based on equations 1 to 3. Table 16. shows normalized data.

$$\otimes \widetilde{x}_{ij}^k = \frac{(\otimes x_{ij}^k - \min_j \otimes x_{ij}^k)}{\Delta_{\min}^{\max}} \quad (1)$$

$$\overline{\otimes} \widetilde{x}_{ij}^k = \frac{(\overline{\otimes} x_{ij}^k - \min_j \overline{\otimes} x_{ij}^k)}{\Delta_{\min}^{\max}} \quad (2)$$

$$\Delta_{\min}^{\max} = \max_j \overline{\otimes} x_{ij}^k - \min_j \otimes x_{ij}^k \quad (3)$$

Table 16: normalized data

d1		d2		d3		d4		d5		d6		d7	
0.000	0.000	0.466	0.466	0.600	0.800	0.733	0.934	0.466	0.466	0.466	0.667	0.066	0.201
0.200	0.133	0.200	0.200	0.466	0.667	0.000	0.000	0.200	0.200	0.733	0.934	0.200	0.334
0.066	0.066	0.000	0.000	0.133	0.267	0.066	0.133	0.000	0.000	0.000	0.000	0.733	0.934
0.066	0.066	0.733	0.733	0.000	0.000	0.133	0.334	0.667	0.667	0.466	0.667	0.000	0.000

d8		d9		d10		d11		d12		d13		d14	
0.133	0.334	0.534	0.601	0.200	0.133	0.400	0.600	0.333	0.267	0.133	0.066	0.000	0.000
0.000	0.000	0.133	0.067	0.000	0.000	0.133	0.267	0.000	0.000	0.200	0.200	0.334	0.467
0.066	0.201	0.400	0.467	0.667	0.667	0.000	0.000	0.267	0.267	0.200	0.133	0.334	0.467
0.333	0.534	0.000	0.000	0.466	0.466	0.000	0.200	0.733	0.733	0.000	0.000	0.000	0.067

Then crisp results calculated based on equation (4) and finally, crisp values presented in table 17.

$$Y_{ij}^k = \frac{(\otimes \widetilde{x}_{ij}^k (1 - \overline{\otimes} \widetilde{x}_{ij}^k) + (\overline{\otimes} \widetilde{x}_{ij}^k \times \otimes \widetilde{x}_{ij}^k))}{(1 - \overline{\otimes} \widetilde{x}_{ij}^k + \otimes \widetilde{x}_{ij}^k)} \quad (4)$$

Table 17: crisp values

0.000	0.437	0.687	0.833	0.437	0.541	0.084	0.177	0.535	0.178	0.469	0.294	0.121	0.000	0.000
0.178	0.187	0.541	0.000	0.187	0.833	0.224	0.000	0.121	0.000	0.154	0.000	0.187	0.365	0.178
0.062	0.000	0.154	0.070	0.000	0.000	0.833	0.084	0.403	0.625	0.000	0.250	0.178	0.365	0.062
0.062	0.687	0.000	0.177	0.625	0.541	0.000	0.396	0.000	0.437	0.031	0.687	0.000	0.004	0.062

In the next step the final values calculated during previous stages multiply with the final normalized weights and sum of values for each strategy (sum of row) produced final score. Table 18. shows final scores for strategies.

Table 18: Final scores of strategies

Strategy	Score of strategy
More services beyond customer expectations	1.978
Decreasing Internet and MMS prices	1.119
Increasing Antenna covering	0.496
Increasing reliability of services	1.355

DISCUSSION

Customer satisfaction is the vital problem in all commercial activities such as telecommunication industry and identifying important factors in satisfying customers is the subject of many researches. Customer satisfaction is important because it is a leading indicator of consumer repurchase and loyalty, point of differentiation and it increase customer churn, reduce negative word of mouth and it is cheaper to retain than acquire new ones. However, the problem is that customers illustrate their satisfaction level with

linguistic terms which are often ambitious. To deal with this problem we examined gray system numbers to estimate priorities of strategies which we define in this research. Maximum score is belong to S1: More services beyond customer expectations. It shows that based on increasing customers needs, new services before their expectations should be prepared.

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