
Evaluation the Servicing Quality of Cell & Fixed Phones by the Use of TOPSIS & Fuzzy Logic at Telecommunication Company (Case Study: Telecommunication Company- South Khorasan Province)**TEKSTIL**
ISSN: 0492-5882**Behrouz Riahi¹, Morteza Farhadi(corresponding author)², Abolfazl Dalir², Bagher Kord³, Iman Mehrban,² Petvan Papen⁴**¹Faculty Member, Zahedan Branch, Islamic Azad University, Zahedan, Iran²MSc Student, Zahedan Branch, Islamic Azad University, Zahedan, Iran³Faculty Member, Sistan&Baluchestan University, Zahedan, Iran⁴ KWPA , Ahwaz, Iran**Abstract:**

Undoubtedly any progress in industry and technology is the most important factor among different areas. Regarding development of industrial & technological fields of today world and also limited resources of each area including human force, capital, physical resources and infra-structures recently there is a great emphasis on program-based development and determining of handling priorities. Quality in servicing organizations is possible through a servicing process and interaction with customer and service provider. In order to measure services quality it is really necessary for customers to feel any differences between what they receive and what is really presented as well. Therefore after evaluation of subject literature, we will evaluate services quality of Telecommunication Company in a fuzzy environment by the use of SERVQUAL model and ideas of specialists in the field of services classification and by the use of TOPSIS method as a decision making technique as well. Then it is possible to propose a method for classification of special services quality of an organization.

Keywords: Servicing quality, Gap model, TOPSIS, Fuzzy collections theory, Fuzzy data**Introduction**

Today most organizations concluded that in lack of customer satisfaction even the most suitable and successful products may not find any demands. Customer satisfaction is one of the major principles of business in the field of economic activities. Any lack of attention to this important rule, may cause omission of competition scene and market as well. As a result if it is assumed for an organization to increase customer satisfaction, beneficiary rate, profitability rate and also market share, it is necessary to pay enough attention to quality. Therefore if we consider services quality in comparison with conceptions and expectations of persons to person of customers, we will notice that traditional marketing strategies are no more applicable in product sale. In order to encourage all organizations in the field of quality and its increase, we need to recognize quality measuring tools and also weak points of organization in submission of high quality services and manner of removing mentioned problems. Today telecommunication is a key element for information society. Any development of telecommunication services based upon a modern network could transfer audio and data with high quality and speed as well. Important developed countries started to renovate their structure for finding the concerned goal and create powerful telecommunication networks. Most of developed countries consider any development of telecommunication just by transferring required activities to private sector. Considering the wideness of industrial & technological fields in today world and also limited number of resources including human force, physical resources and infrastructures there is great emphasis on program-based of this progress and also leading priorities in this field.

Services quality measurement makes it possible to have a comparison between conceptions and expectations. Therefore we can endeavor to establish required standards for providing quality services and compare the concepts and expectations as well. Then it is possible to specify required standards. SERVQUAL attitude is the most common method for measuring of service quality. For this purpose this research is an effort for submission a model to make a practical evaluation of service quality of telecommunication centers. The result of this research is to classify services by a powerful mathematical method of decision making. Therefore there is a model for making easy and low-cost investments.

Research importance

Any determining of priorities for allocation of the best resources and facilities is the first step in world & integrated markets of today. Then with regard to limited financial limitations for investment in producing activities and high risks of investment it is inevitable to have a good programming and classification as well. If an organization intends to increase customer satisfaction, productivity, profitability and market share, it should pay special attention to quality. In addition, all managers should pay attention that service quality is a profitable strategy for an organization. Therefore meeting ever-increasing expectations of customers is one of the most important challenges for today servicing companies. (6). Then most of servicing companies are attracted by suitable programs for betterment of service quality. (7)

Research records

According to the studies about service quality, it is obvious that there is not a general agreement for measuring of service quality. SERVQUAL method is the most applicable tool for measuring of service quality and customer's expectations prior to comparing any received services and customer concepts about real ones. Followings are previous researches in the field of service quality.

Table (1)- Previous researches about servicing quality measuring (16,15,12,10,21,20,18,17)

No.	Research name	Used method	Conclusion
1	Evaluation models of cell phone service quality at China	SCI & SERVQUAL	According to the current 4 dimensions of this method, the results show a gap between customers' satisfaction and presented services.
2	Various dimensions of service quality in Telecommunication Company at China	SERVQUAL	There is a significant difference between expectations and functions of Telecommunication Company
3	Network service quality of cell phone at Ghana	SERVQUAL	There is a significant difference between expectations level and customer's concepts about service quality.
4	Service quality measurement of subscribers of cell phone at Pakistan	SERVQUAL	According to the results, there is a gap in all dimensions of SERVQUAL.
5	Service quality at Nigeria, along with relevant notes & documents (Cell phone study)	SERVQUAL	There is a gap between expectations and concepts in all dimensions of SERVQUAL.
6	Effective factors on customer's satisfaction in QFD model of cell phone by the use of Telecommunication Company- Tehran Province	QFD	The real goal of this research was application of cell phone, and organizing any recognition process and analysis of customers' requests from Telecommunication Company through some questions of QFD method including 7 steps. All mentioned steps are for better recognition of customers' requests and satisfying their orders for cell phone services.
7	Service quality evaluation at Thailand Telecommunication Company	SERVQUAL	According to the results, there is not a significant difference between customer's expectations and concepts about service quality. Furthermore customers consider more importance for physical appearance especially personnel clothes. Their least satisfaction was about intimacy of personnel especially any difference in interests of service providers.
8	Service quality in Telecommunication Industry of China by the use of SERVQUAL method	SERVQUAL	According to the results, all effective factors on service quality are: Intimacy, quality of any call with others, physical appearance, guarantee and reliance except for responsibility.

It is really important to note that in spite a long-term history of service quality and concerned evaluation methods, not only there is not any reduction of its importance but also it has found a great role in economy of countries due to increasing of its importance of services.

Research questions

Since there are various facilities at different centers of Telecommunication Company, it is necessary to present a model not only for evaluation of quality exit but also evaluation of other facilities at different centers. Then we are intending to answer to the following basic questions:

What is the service quality evaluation model?

How much is the presented services quality?

What are the effective factors for classification of services?

Whether customers' attitudes about service quality are equal with service providers?

Research literature

Quality & Services

Quality is the most important criteria for evaluation of any services. It is a wide concept with various obligations for different parts of an organization. The real goal of quality is upgrading total efficiency of organization with minimum costs and increasing competition facilities for more compatibility with concerned specifications of customer. (8). Quality of services has multi-variant meanings from customers' viewpoints. (13). Quality of services has various difficulties for measuring of it resulted from special properties of services. Followings are the mentioned properties.

- 1- Changeable service. It means a person who performs its service at two different times. It means it is not affected by wide range of standards.
- 2- Service is a non-obvious activity.
- 3- Service is finishing. It means it is impossible for reserving it and is used upon submission.
- 4- Service is not dividable. It means it is non-separable from service provider. (11).

Quality specifications for communicative services

There are two levels for quality of telecommunications according to recommendations of International Union of Telecommunications (Standardization) in E-800 standard as follows:

- Service quality which is recognized directly by users
- Quality of network function by the organization.

Service quality from viewpoint of customer is focusing on conceptual and receivable results out of services according which International Union of Telecommunication has divided communicative services into four groups: Service supports, Benefiting from services, Servicing facility and safety of supports. (1)

Services Support

It means the ability of a part of organization for presenting various services and utilization which are measured via following criteria:

Percentage of installation the equipment within expected due time, More information for presenting of services, Management of customer claims.

Benefiting from services

It means any limited access upon request of user and its continuation without any defects for a special term which is divided into three parts as: Access to services, Service survival and Integrate presentation of services.

Servicing function

It means any limited access upon request of user and its continuation without any defects for a special term which is divided into three parts as: Access to services, Service survival and Integrate presentation of services.

SERVQUAL

Various models are proposed in this literature for service quality measurement. One of the mentioned methods which had been quickly developed is SERVQUAL which is applied for evaluation of service quality.

Deep attitude and experimental attitude of Parasuraman et al. (14) resulted in proposing of SERVQUAL as a conceptual model in the form of a questionnaire of 22 questions. After evaluation of customer expectations, this model intends to determine any gaps between presented services quality and concerned expectations. SERVQUAL has five general dimensions as follows (19):

- 1- Tangibles including physical equipment and facilities, appearance of personnel and physical environment of the organization
- 2- Reliability for presenting promised services in a correct, reliable and continuous form.
- 3- Responsibility and more interests to help customer and present on-time services
- 4- Guarantee, knowledge of personnel, their ability for maintenance of confidence feeling including competency, respect, honesty and confidence.
- 5- Intimacy including accessibility, communications, better understanding of customer and special attention of company to customers.

Fuzzy collections

In new mathematics we have fuzzy collections in which there is not a clear and specified membership for one or whole members and their elements averagely belong to it. A fuzzy collection means a classic collection entitle a person to have any quantities in a concerned limitation of $[1,0]$.

Natural language is mostly uncertain and wage for explaining of judgments. Since words in comparison with digits are little approved, linguistic variants are very complex phenomenon or with little description. In order to solve these types of confusions, wage and conceptual judgments, Lotfi Zadeh introduced relevant theory of fuzzy collections. Some of the mentioned FUZZI collections are semi-happy persons in entrance exam, a collection of tall persons, a collection of those figures close to 5 and so on. (5).

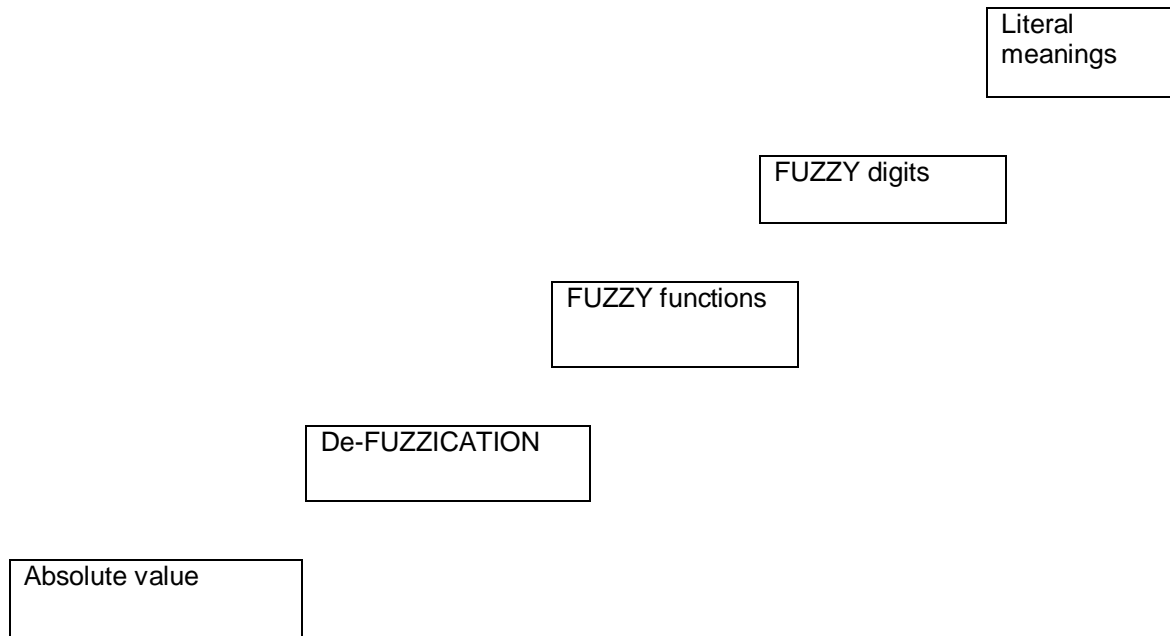


Figure (1)- Changing process of wage conceptual definitions of customer into understandable numbers for the organization (4)

TOPSIS method

Hwang & Yoong introduced TOPSIS method for the first time (9). TOPSIS is a compatible technique of multi-criteria decision making. The real meaning of compatible techniques is relevant methods in which the base of classification of any options is the basic compatible of them with ideal solution. It is a multi-criteria method for recognition of solutions from among limited collection of options based upon minimum distance from ideal positive solution and maximum distance from ideal negative one. In order to use this method, it is just enough to summarize relevant information of a decision making process in the format of a decision matrix.

Therefore it may include various options of decision (A_i) and decision indexes (X_j) along with quantities of indexes for each option (x_{ij}) and total weight of indexes (W_j).

Data analysis

Statistical population of this research includes all subscribers of Telecommunication Company-South Khorasan province in relation with fixed telephone, cell phone and data lines. Cochran's C test is used for estimation of sample volume. Then about 300 questionnaires were distributed among subscribers. The standard questionnaire of SERVQUAL method includes 22 parameters in which two or more questions will evaluate various dimensions of model according to Likert Five Options scope (Very little, Little, Average, High and Very high). After primary modification and adjustment and considering the ideas of specialists, the number of mentioned questions reduced to 20 options. Then it was specified that alpha quantity with regard to Cronbach's alpha is 0.758 which is more than 0.65. Furthermore the mentioned alpha rate is 0.934 for reliability of questionnaire. As a result, it is possible to confirm reliability of mentioned questionnaire. Followings are evaluation criterion of services quality:

Table (2)- Evaluation criteria for servicing quality

C ₁	Easy access to advanced equipment (Antenna situation, Successful calls rate, Quality of connections at various areas.	C ₁₁	Readiness of personnel for responding and enough number of them.
C ₂	Elegant appearance of personnel	C ₁₂	Attracting the customers confidence by personnel
C ₃	Attractive physical facilities (Superficial location and work environment for presenting of services)	C ₁₃	Polite conduct of personnel
C ₄	Suitable form of documents and notes	C ₁₄	Safety feeling of customer through any contacts with organization
C ₅	Honestly efforts for removing any problems of customers	C ₁₅	Personal attention to customers
C ₆	Performing on-time jobs on relevant due times	C ₁₆	Pay attention to customers profits (Reasonable pricing, correctness issuance of statements, on-time statements.
C ₇	Presenting of services in first refer	C ₁₇	Understanding specific necessities of customers by personnel
C ₈	Enough knowledge of personnel for responding the customers	C ₁₈	Servicing through web site and easy application
C ₉	Specifying exact time of service presentation by personnel	C ₁₉	Presence of servicing offices at various geographical areas
C ₁₀	Quick presentation of services	C ₂₀	Easy access to servicing offices in shortest possible period of time

Upon data analysis of information, we may obtain relevant priorities of Telecommunication Company by the use of TOPSIS multi-criteria technique.

Creating a Fuzzy Decision Matrix

We should define any required evaluation criteria and options for making a Fuzzy Decision Matrix. Relevant method of finding out any options was defined in previous part. Since we just study fifth and sixth gaps in our research, therefore table three illustrates relevant options as well.

Table (3)- Options

Customer’s conceptions of services	A1
Customer’s expectations of services	A2
Personnel conceptions of services	A3
Personnel expectations of services	A4

In order to have a Fuzzy decision matrix, about 250 questionnaires were distributed among subscribers and personnel for evaluation of options along with 70 questionnaires for evaluation of options A3 and A4 according to 20-folded criteria (C1, C2,.....C,20). The respondents were entitled to select their answers from among linguistic terms. By the use of table No. 4 all these linguistic variants were changed into triangular Fuzzy digits. Then we combined obtained answers with each other and create Fuzzy decision matrix according to table No. 5.

Table (4)- Linguistic variants for criteria values

Triangular Fuzzy digits	Linguistic variants
(0*1*3)	Very little
(1*3*5)	Little
(3*5*7)	Average
(5*7*9)	High
(7*9*10)	Very high

Table (5)- Fuzzy decision matrix (D̃)

Criterion	A1		A2		A3		A4	
C1	(261.4 8.196)	123.6	(042.6 465.9)	8.046	(339.3 278.7)	383.5	(253.6 579.9)	363.8
C2	(452.4 346.8)	465.6	(788.5 236.9)	871.7	(556.3 556.7)	556.5	(263.6 589.9)	8.158
C3	(216.4 050.8)	180.6	(830.5 333.9)	823.7	(474.4 316.8)	474.6	(263.6 632.9)	263.8
C4	(566.3 397.7)	529.5	(803.5 289.9)	789.7	(053.4 000.8)	053.6	(812.5 368.9)	842.7
C5	(094.4 862.7)	068.6	(423.5 021.9)	463.7	(278.4 111.8)	242.6	(737.5 366.9)	737.7
C6	(914.3 721.7)	871.5	(864.5 336.9)	857.7	(579.4 421.8)	579.6	(421.5 9.051)	461.7
C7	(663.3 463.7)	574.5	(634.5 252.9)	727.7	(674.4 474.8)	664.6	(000.5 684.8)	000.7
C8	(364.4 079.8)	309.6	(766.5 248.9)	766.7	(789.3 684.7)	737.5	(632.5 263.9)	632.7
C9	(4.057 841.7)	053.6	(552.5 049.9)	545.7	(684.4 421.8)	684.6	(526.5 105.9)	526.7
C10	(058.4 841.7)	043.6	(699.5 203.9)	699.7	(947.3 842.7)	947.5	(421.5 10.9)	421.7
C11	(813.3 703.7)	866.5	(937.5 359.9)	930.7	(316.5 053.9)	316.7	(947.5 47.9)	947.7
C12	(597.3 482.7)	576.5	(845.5 296.9)	865.7	(947.3 8.087)	947.5	(842.5 368.9)	462.7
C13	(969.3 751.7)	4.900	(965.5 376.9)	965.7	(4.287 749.8)	6.452	(842.5 368.9)	852.7
C14	(036.3 912.6)	956.4	(852.5 317.9)	845.7	(474.4 316.8)	464.6	(632.5 158.9)	632.7
C15	(493.3 331.7)	408.5	(224.6 545.9)	217.8	(105.5 947.8)	105.7	(526.5 105.9)	536.7
C16	(869.2 7.564)	679.4	(979.5 408.9)	972.7	(579.4 474.8)	579.6	(842.5 316.9)	842.7
C17	(145.3	087.5	(979.5	952.7	(263.4	263.6	(7.105	7.106

	007.7)		401.9)		211.8)		9.737)	
C18	(846.2 7.654)	716.4	(542.5 049.9)	521.7	(474.4 368.7)	474.6	(632.5 105.9)	632.7
C19	(128.3 014.7)	072.5	(622.5 147.9)	625.7	(895.4 737.8)	895.6	(441.5 947.9)	471.7
C20	(336.3 212.7)	307.5	(944.5 364.9)	937.7	(000.5 789.8)	000.7	(737.5 211.9)	737.7

Calculation of weighted criteria-less matrix decision

In this step, Fuzzy decision matrix of relation 15 is changed into criteria-less Fuzzy decision. Then with regard to the important weights of criteria, we will find weighted criteria-less matrix decision by the use of relation 16.

$$\check{n}_{ij} = \left(\frac{a_{ij}}{\sqrt{\sum_{i=1}^m (a_{ij}^2 + c_{ij}^2)}}, \frac{b_{ij}}{\sqrt{\sum_{i=1}^m (b_{ij}^2)}}, \frac{c_{ij}}{\sqrt{\sum_{i=1}^m (a_{ij}^2 + c_{ij}^2)}} \right) \quad i=1,2,3,\dots,m$$

$$J=1,2,\dots,2$$

$$v_{ij} = \check{n}_{ij} \cdot \hat{w}_{ij}$$

Then, \hat{w}_j is criterion weight or J^{th} index.

Calculation of options' distance through Fuzzy positive/ negative ideal solution

Since we have Fuzzy positive ideal solution for all criteria as $v_i^+ = (1,1,1)$ and also Fuzzy negative ideal solution as $v_i^- = (0,0,0)$, therefore options' distance is measured by formulas 21 and 22 for both positive and negative ideal solution.

Relevant distance of options is measured by Fuzzy positive/negative ideal solutions and by measuring distance of both Fuzzy digits.

$$1 \quad d_i^+ = \sum_{j=1}^n d(v_{ij}, v_{ij}^+) \quad i = 1,2, \dots, m$$

$$2 \quad d_i^- = \sum_{j=1}^n d(v_{ij}, v_{ij}^-) \quad i = 1,2, \dots, m$$

$$3 \quad C_i = \frac{d_i^-}{d_i^- + d_i^+}$$

Estimated closeness index for classification of options

According to three above-mentioned relations, closeness index and classification of options are mentioned in table No. 6.

Table (6)- Estimated closeness index & classification of options

Evaluation options	d_1^+	d_1^-	C_1	Classification
Customer's conceptions of presented services	16.08	4.44	0.21	4
Customer's expectations of services	14.79	5.74	0.27	1
Personnel conceptions of services	15.60	4.94	0.240	0
Personnel expectations of services	14.84	5.69	0.27	2

Various statistics & mathematical methods are used in order to analysis the gap in SERVQUAL model. For instance it is possible to apply non-parametric tests like Chroskal walis & Yumen Witney along with simple SERVQUAL, weight SERVQUAL and ... in gap analysis. Since mathematical methods are more applicable than statistical ones, there is a mathematical method in this research for measuring of service quality.

In order to compare any results of the present research with previous ones, here we present any obtained results out of applying of statistical techniques. Since the real goal of this research is to study gaps of 5 & 6, we should examine both following mentioned theories.

First theory: There is not a significant difference between customers' expectations and concepts about service quality.

Second theory: There is not a significant difference between customers' expectations and concepts of managers and personnel of their expectations.

Table (7)- The results of relevant theories of gaps 5 & 6

Test parameter	Test statistics	Significant level	Type of test
First theory	-12.062	0.000	Wilcoxon
Second theory	-5.042	0.000	Mann-Whitney

Since relevant data of expectations and concepts provide dependent pairs, we used Wilcoxon nonparametric test. Mann-Whitney non-parametric test was applied for testing second theory. The mentioned test will evaluate any differences between independent pairs. According to table No. 7, it is obvious that all research theories are rejected and we should approve any presence of gaps 5 & 6 as well. But the results of statistical theories are not the signs of any gaps since the results of this research shows that gap 5 is more than 6.

Determining key parameters of Telecommunication Co. & Recognition of Critical parameters

Hereinafter and by the use of TOPSIS technique we may specify all key parameters in previous step and also determining of critical factors. As a result we could specify any parameters which are really necessary for betterment of services management system. Finally there is a betterment program for services quality management at Telecommunication Company.

Following table shows the obtained results out of classification of key parameters of different dimensions by the use of TOPSIS technique.

Table (8)-The results of classification of quality parameters

Dimensions	Grade	Distance to negative ideal	Distance to positive ideal	CCi
Accessibility				
Easy access to advanced equipment (Antenna situation, Successful calls rate, Quality of connections at various areas).	1	0.545	0.455	0.545
Servicing through web site and easy application	2	0.355	0.645	0.355
Access to servicing facilities and offices in shortest possible time	3	0.344	0.656	0.344
Presence of servicing offices at various geographical areas	4	0.299	0.701	0.299
Intimacy				
Personal attention to customers	1	0.537	0.463	0.537
Pay attention to customers profits (Reasonable pricing, correctness issuance of statements, on-time statements.	2	0.535	0.465	0.535
Pay attention to special needs of customers by personnel	3	0.475	0.55	0.475
Responsiveness				
Specifying exact due time for presenting service by personnel	1	0.357	0.643	0.357
Quick servicing	2	0.341	0.654	0.341
Personnel interests in responding & enough number of them	3	0.336	0.665	0.336

Reliability				
Sincere efforts for removing any problems	1	0.437	0.563	0.437
Performing any promises at special time	2	0.384	0.617	0.384
Presenting of services upon first refer	3	0.365	0.641	0.365
Enough knowledge of personnel for responding to customers	4	0.351	0.653	0.351
Trust				
Attracting the customers confidence by personnel	1	0.767	0.233	0.767
Polite conduct of personnel	2	0.642	0.358	0.642
Safety feeling of customer through any contacts with organization	3	0.556	0.482	0.556
Physical factors				
Elegant appearance of personnel	1	0.217	0.746	0.217
Attractive physical facilities (Superficial location and work environment for presenting of services)	2	0.215	0.759	0.215
Suitable form of documents and notes	3	0.202	0.783	0.202

As a result and according to the above-mentioned results, critical parameters of service quality management process are access to advanced equipment (Antenna, situation, Successful calls rate, Quality of connections at various areas).

Conclusion

Major goal of this research was measurement of services quality as the real difference between customers' expectation of services and received ones by SERVQUAL method and TOPSIS technique. Therefore we analyzed the subject by the use of systematic technique. According to the estimated closeness index for customers' expectations and concepts from presented services show that there is a significant difference between these two concepts. This is a sign of incomplete quality of services from view of customers. Then it was possible to evaluate gap 6 for confirming that considered systematic model could be applied for all gaps of relevant model. According to the results, it was obvious that there is a gap between customers' expectations and personnel concepts.

This is resulted from incorrect concepts of personnel about customers' expectations. TOPSIS technique was applied for classification of these dimensions through specifying importance degree of all dimension of services quality of telecommunication. According to the results,

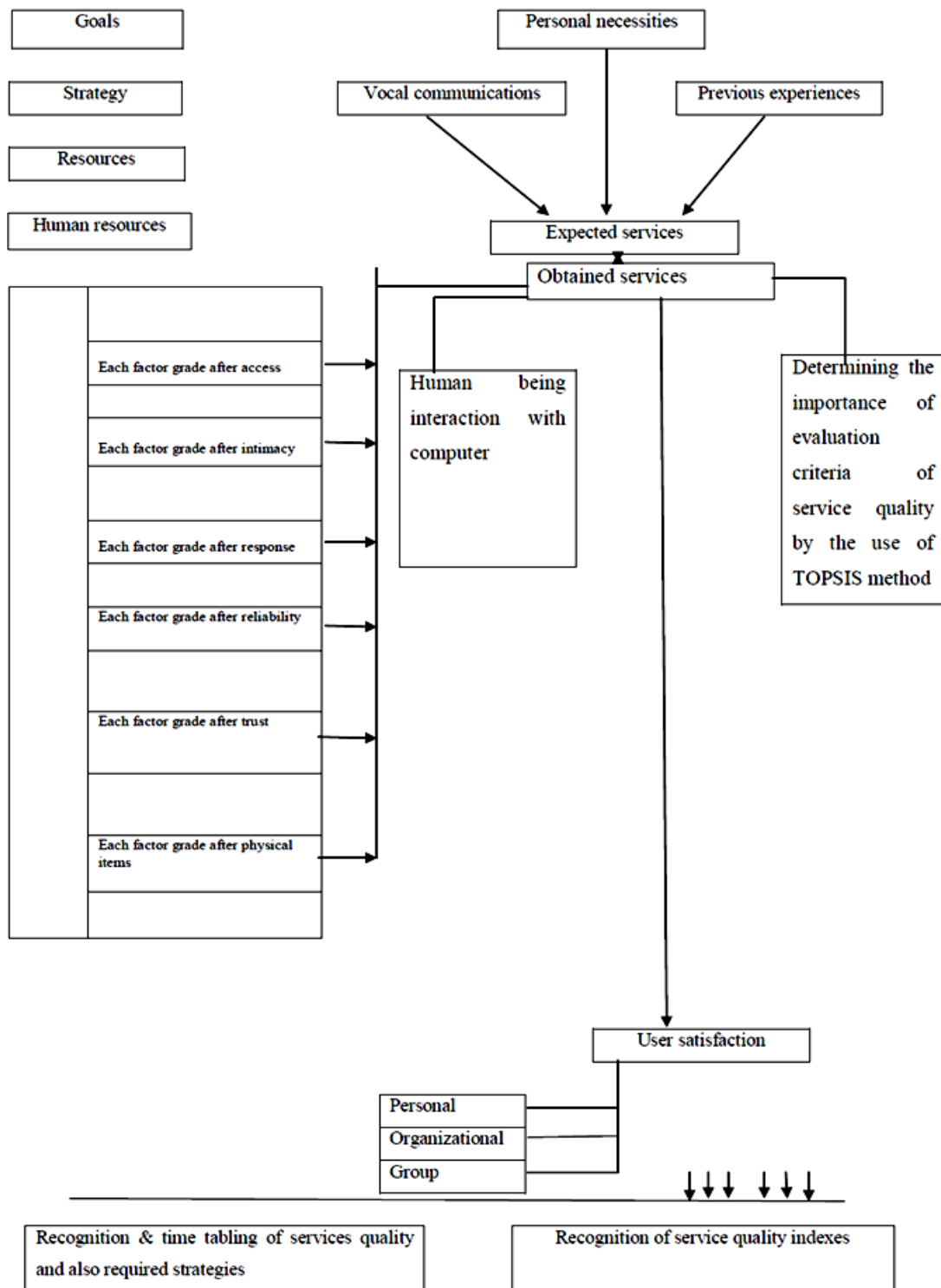


Figure (2)-Presented model

Perhaps all five dimensions would be evaluated separately in future researches. Therefore all dimensions are considered in relevant gap. This paper was only about any presence or absence of gaps in gap model. Any similar researches may evaluate betterment of service quality by the use of obtained analysis and also applying various techniques like Quality Function Deployment (QFD).

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