# Ranking of factors influencing customer satisfaction in telecommunications industry employing AHP

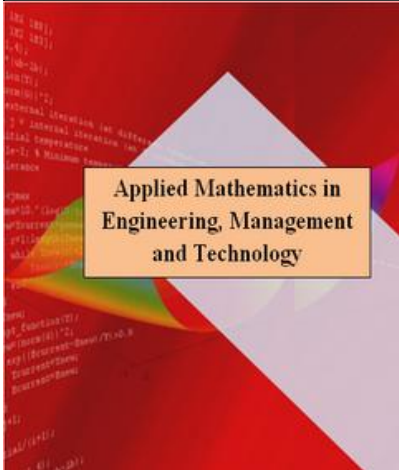**Farzad Firouzi Jahantigh[1]\*, Masoumeh Neshat [2]**

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**Abstract**

Competition in value creation, endeavors made to grasp consistent competitive advantage as well as strategic superiority over the competitors, all have brought about much importance for having concern for customer and their satisfaction. Employing SERIMPERE model which deals with importance of product attributes in customer's evaluation, this research attends identification of those important product attributes which increase customer satisfaction. The research is a field study of applied type, and its population includes all the technical experts of maintenance departments of province capitals in Iran. First, factors which influence customer satisfaction are identified using existing resources as well as technical experts' ideas. The required data was also gathered. To weight and rank the factors, the Analytical Hierarchy Process (AHP) method and TOPSIS technique are applied.Results show that product functional factor alongside its conformity to the technical specifications which encompasses two sub-criteria of meeting target standards (structural attributes, electronic and mechanical properties, Environmental requirements, and product dimensions), as well as consumption appropriateness rank first in catching customer satisfaction in this industry.

**Keywords:** Ranking, Factors influencing customer satisfaction, telecommunications industry, Analytical Hierarchy Process (AHP)

## 1. Introduction

Those organizations which put their efforts in increasing products and services quality, customer satisfaction and its stability accompanying those which are capable of exploiting their information to boost customer satisfaction and try to pave the organization way to move from product-orientation toward customer-orientation [1]. In order to improve customer-orientation, many organizations have defined it as a primary performance indicator [2]. The more an organization is active in proposing value to its customers, the more their customers satisfaction level will be and the more it will be probable that this turns to a competitive opportunity for them. Hence, in measuring the level to which an organization product or service satisfies customers' needs and desires, one of the most popular methods is to measure customers satisfaction [3]. Even though that the term is a widely-used term in business environment, but doubtlessly development of satisfaction in customers, even making them delighted by quality, requires the producer to know customers needs and transfer them to the position in which products and services are produced [4]. Evaluation of customer satisfaction provides organizations with an effective tool to control the organization's general performance, helps them to diagnose their weaknesses and make efforts to eliminate them, and gives organizations the ability to identify their economic superiorities according to their particular time conditions [5].

Identification of customer's needs and desires and putting them to a ranking have been subject to some research works focused on automobile industries. In this research the problem is investigated in telecommunications industry. This is a high-tech industry, known as one of the key science consuming activities. Therefore it is an inevitable necessity to have a total industrial policy to expand and strengthen this industry.

The telecommunication technology is dependent to many universal standards and protocols. These standards are of consistently varying nature and led by the avant-garde, super powerful companies of the world. This doubles the technological dependency to the large companies. Thereupon, the specifications and attributes of a product are important and vital and the suppliers which do not satisfy the customer's needs will not be chosen. These specifications are developed according to universal standards [6]. Of the most important product specifications in this industry, the following could be mentioned: structural attributes, electronic and mechanical properties,

Environmental requirements, product dimensions, packing, and the product conformity in regard to technical specifications.

For this purpose, this study aims at:

1. Identification of the criteria influencing customer satisfaction
2. Proposing an optimal and appropriate method to rank the identified indices
3. Ranking important product attributes and comparing their influence on customer satisfaction vis-à-vis such indices as on time delivery, price, etc.

Among customers of telecommunication equipment industry.

## 2. Literature review

### 2.1. Definition of customer satisfaction

The definition widely accepted by the experts is as follows: Customer satisfaction is a result which is obtained through customer's comparison of pre-purchase expected performance with that of the real post-purchase perception, and the cost paid [8]. Jamal and Nasser define customer satisfaction as a feeling or attitude about the product or service taken by the customer after use. They state that customer satisfaction is the primary outcome of a marketer activity which acts as a linking pin between different stages of consumer's buying behavior. For example, if customers become satisfied by some particular service, they most probably repeat their shop. Furthermore, satisfied customers probably talk to others about their experiences and consequently, they get engaged with word of mouth marketing (verbal-oral). On the contrary, unsatisfied customers probably break their contact with the company and get engaged with negative word of mouth marketing. Behaviors like repeat shopping and word of mouth marketing have an influence on survival of a company, as well as profitability [9]. Findings implicate that customer satisfaction is the fundamental basis for perceived quality. Some findings also demonstrate the importance of biding level evaluation in perceived relationships quality. Customer's efficient involuntary reactions and social effect of shopping are two of the factors that determine perceived value quality. Commitment is given a particular consideration as well [10]. Both application and product appearance have direct impact on satisfaction and dependency. Product dependency is itself a decisive factor between aforementioned factors [11].

The most important methods to keep customers:

1. Customer-oriented culture creation
2. Employee empowerment
3. Performance evaluation
4. Attending every customers' perpetual value
5. Highlight the importance of services for customers
6. Asking customers what they want from the company and what the company can do for them.
7. Lost customer cost identification

He urges that a very clever way of having satisfied customers is to take corrective action before any problem emerges.[12]

### 2.2. Ranking of factors influencing customer satisfaction

Table 1 - Ranking of factors influencing customer satisfaction

| Researcher(s) | Year | Key findings |
|---|---|---|
| Nabavi et al[13] | 2012 | Identification and prioritization of the factors affecting customer satisfaction in cabinet manufacturing industry, employing AHP |
| Zhao and Dholakia[14] | 2009 | Weighting and ranking of factors influencing customer satisfaction in library services, using Kano model and AHP |
| Li et al[15] | 2008 | ranking of factors influencing customer satisfaction in transportation services, using Kano model and AHP |
| Bayraktaroglu & ozgen[16] | 2008 | Evaluation of customer satisfaction in banking services applying a combination of Kano model, AHP, and GFD model |
| Saidi and Mehrabian[17] | 2007 | Measuring consumers' satisfaction in Rafsanjan Pistachio Co. using AHP |
| Firouzian et al[18] | 2006 | Proposing of a model to weight and rank the effective factors on customer satisfaction in automobile industry, exploiting AHP |
| Akgunduz et al[19] | 2002 | Choosing the best combination of sub-component alternatives to increase customer satisfaction and decrease product cost, using ILP model; In this research AHP is used to obtain objective function coefficients. |

A review on the literature reveals that identification and ranking of customers needs have been mostly investigated in industries other than telecommunication equipment. Table 1.


## 2.3. Customer satisfaction evaluation models

Table 2 - Comparison of the important models for customer satisfaction evaluation

| Model | Advantages | Weaknesses | References |
|---|---|---|---|
| SERVQUAL[1] | Considering customer expectations from services (Ideal state in customer's view) | Lack of adequacy for cases including tangible products, being multi-dimensional, Lack of validity, different gaps | (Gronroos & Christian ,2000)[20] |
| SERVPERF[2] | Easy method to apply as well as higher evaluation validity | Neglecting customer expectations, Missing information about which quality points possess weaknesses and need to be improved | (Cronin & Talor ,1992)[21] |
| SERIMPERE[3] | High pace in finding strengths and weaknesses related to customer satisfaction | Evaluation of criteria importance is not easy, So many more questions in compare to SERQUAL because of using two single scales; However, this is probably an advantage itself. Because this case gathering more information is more probable. | (Haller & Sabin,1998)[22] |
| CSI[4] | Computation of customer satisfaction index for different periods and comparing them | Acquiring customer expectations through market research | (Toepfer & Armin ,1999)[23] |
| Customer satisfaction formation based on Expectation Disconfirmation Theory | Considering customer expectations as SERVQUAL | The concept of expectation disconfirmation is not entered to the model as a variable, but constructing only a part of variables to evaluate customer satisfaction | (Hayes, Jenny and Dredge ,1998)[24] |

Considering results of table 2, the SERIMPERE model is used to measure customer satisfaction and evaluates the importance of product attributes. This model in fact uses two main elements to judge quality:
1. Evaluation element or the effective element of company real services (performance)
2. Importance element (importance)

[1]- Service Quality
[2] - Service Performance
[3] - Service Importance-Performance
[4] - Customer Satisfaction Index

These two elements are asked about for all the company services and are used to obtain the overall customer judgment. Instead of a double scale, a single scale is used in this model. Using this scale, the importance and quality of the services is evaluated. In other words, every attribute is reviewed and perceived in a different way [22].

Given the importance of product attributes in telecommunications industry and considering the fact that the SERIMPERE model is based on the assumption that some of the attributes are more important than others, to identify and rank the effective factors on customer satisfaction the SERIMPERE model is applied [22].

## 3. Research Method

Since this research is an effort to identify and prioritize the most important factors influencing customer satisfaction in form of a case study in telecommunication equipment industry, and given that the principles and techniques which are obtained from this research are applied for real and practical problems, therefore this study is a field study of the applicable type.

### 3.1. Population

The number of customers in telecommunication equipment industry includes all the telecommunications authority centers in province capitals. Not having access to all the above centers, sampling from finite population method is applied.

$$n = \frac{z_{\alpha/2}^2 \, \delta_x^2}{\varepsilon^2}$$

To determine the standard deviation of the sampling population, a preliminary sampling was applied. For this purpose, the questionnaire was distributed among 5 telecommunications authority centers. The results obtained from questionnaire analysis demonstrated that the population maximum standard deviation is equal to 0.02. Thereupon, considering the concluded standard deviation, the estimated maximum sample size at the error level of 5% will be equal to 29 technical experts of the maintenance department. Hence, 29 complete questionnaires were considered as the basis for analysis.

$$n = \frac{(1.96)^2 \times 0.021}{0.05^2} = 29$$

### 3.2. Information collection method

In this research, the information was collected in three stages. First, to explore the effective criteria and indices on customer satisfaction, interviews were held with proficient managers and experts of telecommunication equipment. Secondly, to exert the pair wise comparison between criteria themselves as well as their associated indices, a questionnaire was offered to the proficient managers and experts of the industry. In the third stage, to collect the ideas of customers for ranking the criteria, the questionnaire was used. In designing the questionnaire, the required delicacy is paid, and to evaluate the ideas the Likert scale is employed. Since the results are more precise and valid when the Likert scale is applied, many of the field studies use this scale. The questionnaire is constituted by 13 questions each having 5 options (Very high, High, Moderate, Low, Very low). To evaluate the accuracy of information, a preliminary questionnaire was formed. Subsequently, the questionnaire was handed to some of the experts of the industry. It was tried to poll as much ideas of the experts as possible and then asking for final opinions, the corrective action was taken. Afterwards, to evaluate the reliability of the questionnaire, a pre-test was done. 5 Questionnaires were distributed between technical experts of the telecommunications authority of Tehran province and then collected. After importing the gathered data to the SPSS software, the reliability coefficient (Cronbach's Alpha) was calculated. Table 3.

Table 3 – The questionnaire reliability test

| Test | Process summary | | |
| --- | --- | --- | --- |
| | | Frequency | percentage |
| | Valid sample | 5 | 100 |
| | Eliminated | 0 | 0 |
| | Total | 5 | 100 |
| | Reliability | | |
| | Cronbach's Alpha | Frequency | |
| | 0.908 | 13 | |
| | Descriptive statistics | | | |
| | Average | Variance | Standard deviation | Frequency |
| | 10.6 | 43.3 | 6.58 | 13 |
| Results | Since the resulted Cronbach's Alpha (=0.91) is more than 0.7, it could be concluded that the reliability of the questionnaire is acceptable. | | |

## 3.3. Data Analysis

Analysis of the gathered data is performed using Analytical Hierarchy Process (AHP) to weight the criteria, and TOPSIS to rank them.

### 3.1.1. Analytical Hierarchy Process

AHP is one of the multiple criteria decision making methods which are used to decide and choose one out of a number of alternatives regarding the criteria determined by the decision maker [25]. This methodology was invented and presented as the result of Thomas Saati efforts in 1980. AHP is one of the best-known and most applied decision making models and a powerful decision making method to determine priorities in cases where there are inconsistent criteria. AHP reflects the natural behavior and human thinking. Complicated problems are investigated according to their interactions, transformed to simple form and then solved.

### 3.3.2. TOPSIS technique

TOPSIS is one of the applied multiple decision making techniques. It is based on determining the alternative which has the least distance from the positive ideal solution and maximum distance from negative ideal solution. This method was first proposed by Hang and Yun [27].
The required data for this method are as follows:
1. Weight vector
2. Decision matrix

**TOPSIS algorithm**

Step 1. Developing the decision matrix according to the questionnaires sent to customers.
Step 2. Transforming of the existing decision matrix to a normalized matrix using following formula:

$$n_{ij} = \frac{r_{ij}}{\sum_{i-1}^{m} r_{ij}}$$

In which $r_{ij}$ represents decision matrix elements.

Step 3. Development of a weighted normalized matrix assuming W as the weights matrix.

$$V = ND.W_{n*n}$$

ND is a matrix in which scores of the criteria are normalized and $W_{n*n}$ is a diagonal with merely its main diagonal elements non-zero.

$$A^+ = \{(maxV_{ij}|j \in J), (minV_{ij}|i \in J'|i = 1,2,..,m)\} = \{V_1^+, V_2^+, ..., V_j^+, ..., V_n^+\}$$

$$A^- = \{(minV_{ij}|j \in J), (maxV_{ij}|i \in J'|i = 1,2,..,m)\} = \{V_1^-, V_2^-, ..., V_j^-, ..., V_n^-\}$$

As:

$$J = \{j = 1,2,..,n\} \qquad \text{Associated with profit}$$
$$J' = \{j = 1,2,..,n\} \qquad \text{Associated with cost}$$

Step 4. Calculate distance
Using the Euclidean method, distance of the i'th alternative from the ideal solution is as follows:

$$d_i^+ = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^+)^2} \qquad i = 1,2,...m$$

$$d_i^- = \sqrt{\sum_{j=1}^{n} (V_{ij} - V_j^-)^2} \qquad i = 1,2,...m$$

Step 5. Calculating relative proximity of $A_i$ to the ideal solution: The relative proximity is defined as below:

$$GL_i^+ = \frac{d_i^-}{(d_i^+ - d_i^-)} \qquad 0 < CL_i^+ < 1 \qquad i = 1,2,...,m$$

Step 6. Having alternatives ranked with their $CL_i^+$ sorted in an descending order.
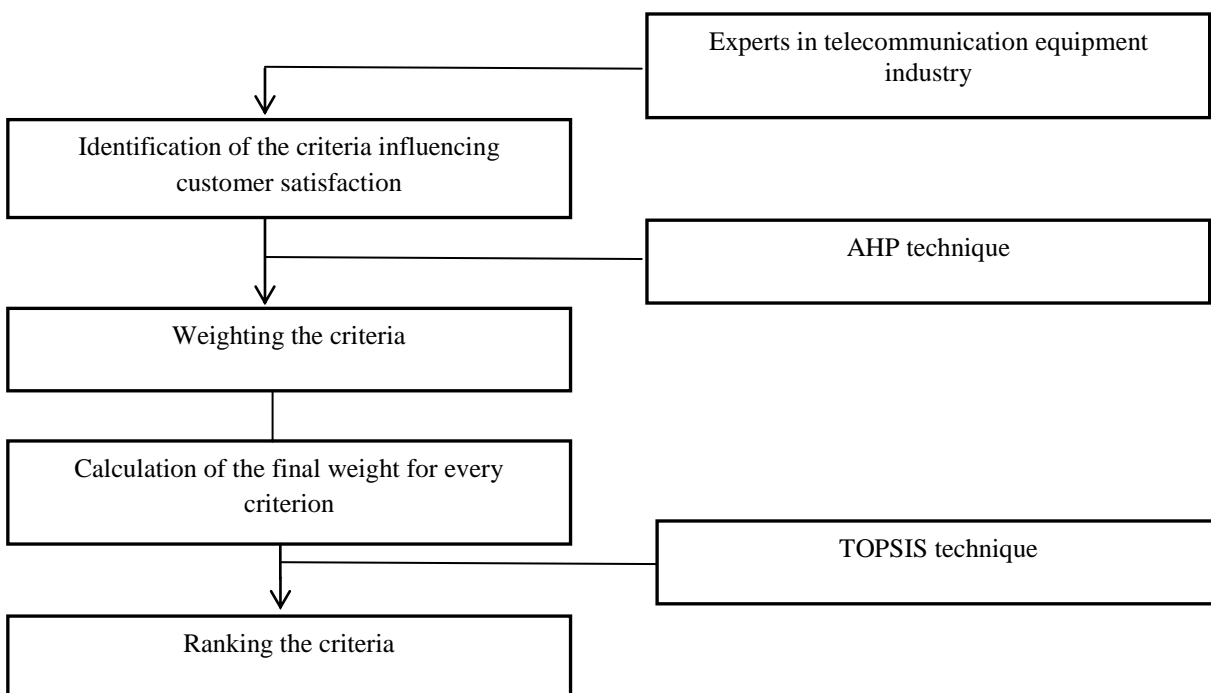
## 4. Research stages



**Chart 1: research stages**

### 4.1. Identification of the criteria and indices influencing customer satisfaction

To identify the criteria and indices influencing customer satisfaction interviews were managed with managers and experts of telecommunication equipment manufacturing and the following factors were found. Table 4.

Table 4. Identified the criteria and indices influencing customer satisfaction

| | Criterion | Index |
|---|---|---|
| Customer satisfaction | Quality improvement procedure | Product quality |
| | | Reliability |
| | | Product life |
| | | Packing and transportation |
| | Customer relationship | Behavior of people in charge for quality |
| | | Contact channels to communicate responsible employees if necessary |
| | Functional and product conformity in regard to technical specifications | Product appropriateness |
| | | Meeting target standards |
| | Flexibility | On time delivery |
| | | On time exertion of requested changes |
| | Post-sale services | Product corrigibility |
| | | Product traceability |
| | | Complaint handling process |

### 4.2. Weighting the criteria and indices influencing customer satisfaction

According to the ideas of managers and experts of telecommunication equipment, every criterion and index is compared in a pair wise manner. Subsequently, a pair wise comparison matrix is developed for every criterion and the related indices, and to acquire the weights, the AHP, total row method is employed. Tables 5 and 6.

Table 5: The criteria weights

| Product quality | Customer relationships | Functional and product conformity in regard to technical specifications | Flexibility | Post-sale services |
|---|---|---|---|---|
| 0.35 | 0.22 | 0.32 | 0.13 | 0.22 |

Table 6. Weights of the indices

| Criteria | Index | Index weights |
|---|---|---|
| Quality improvement procedure | Product quality | 0.25 |
| | Reliability | 0.29 |
| | Product life | 0.29 |
| | Packing and transportation | 0.17 |
| Customer relationship | Behavior of people in charge for quality | 0.26 |
| | Contact channels to communicate responsible employees if necessary | 0.24 |
| Functional and product conformity with technical specifications | Product appropriateness | 0.24 |
| | Meeting target standards | 0.26 |
| Flexibility | On time delivery | 0.21 |
| | On time exertion of requested changes | 0.29 |
| Post-sale services | Product corrigibility | 0.31 |
| | Product traceability | 0.24 |
| | Complaint handling process | 0.2 |

## 4.3. Calculation of final weight of every index

To calculate final weights of the indices, weight of the associated criterion is multiplied by weight of the index. Table 7.

Table 7: Final weights of the indices

| Criterion | Weight of the criterion | Index | Weight of the index | Index final weights |
|---|---|---|---|---|
| Quality improvement procedure | 0.35 | Product quality | 0.25 | 0.088 |
| | | Reliability | 0.29 | 0.102 |
| | | Product life | 0.29 | 0.102 |
| | | Packing and transportation | 0.17 | 0.06 |
| Customer relationship | 0.22 | Behavior of people in charge for quality | 0.26 | 0.057 |
| | | Contact channels to communicate responsible employees if necessary | 0.24 | 0.053 |
| Functional and product conformity with technical specifications | 0.32 | Product appropriateness | 0.24 | 0.077 |
| | | Meeting target standards | 0.26 | 0.083 |
| Flexibility | 0.13 | On time delivery | 0.21 | 0.027 |
| | | On time exertion of requested changes | 0.29 | 0.038 |
| Post-sale services | 0.22 | Product corrigibility | 0.31 | 0.068 |
| | | Product traceability | 0.24 | 0.053 |
| | | Complaint handling process | 0.2 | 0.044 |

## 4.4. Ranking of the indices

In this section, the weights matrix acquired from the AHP on weights of the indices is multiplied by the decision matrix obtained from the 29 questionnaires sent to the technical maintenance experts of the province capitals. Then indices are ranked using TOPSIS. Table 8.

Table 8: Ranking of indices

| Index | Weight | Priority |
|---|---|---|
| Product quality | 0.773 | 1 |
| Reliability | 0.363 | 2 |
| Product life | 0.331 | 3 |
| Packing and transportation | 0.205 | 4 |
| Behavior of people in charge for quality | 0.170 | 5 |
| Contact channels to communicate responsible employees if necessary | 0.167 | 6 |
| Product appropriateness | 0.137 | 7 |
| Meeting target standards | 0.121 | 8 |
| On time delivery | 0.085 | 9 |
| On time exertion of requested changes | 0.074 | 10 |
| Product corrigibility | 0.046 | 11 |
| Product traceability | 0.029 | 12 |
| Complaint handling process | 0.018 | 13 |

## 5. Discussion and conclusion

This should be admitted that funding the measurement of customer satisfaction on scientific principles is so vital. But what is more vital is to utilize the obtained results in order to determine the improvement priorities in organizations. In fact, more important attributes could be found and strengthened using the importance coefficients of the attributes. So far, there has been few research works and papers in which the customer satisfaction subject is explored in the particular area of telecommunication equipment. Since the SERIMPERE model evaluates effects of the important product attributes on customer satisfaction, we attended evaluation of the effective product attributes influencing customer satisfaction. According to table 8, in relation to ranking of the indices, product conformity in regard to technical specifications which encompasses two sub-criteria of meeting target standards (structural attributes, electronic and mechanical properties, Environmental requirements, product dimensions), as well as consumption appropriateness are placed first and second. After these, ranking from third to sixth, there is the product quality criterion which includes the indices of product life, reliability and quality improvement process. Criteria associated with post-sale services as well as behavior to customers are placed in next priorities. Results show that what matters for the customers of telecommunication equipment is product conformity to the technical specifications. This factor has a great importance in customer satisfaction. Unlike most of the industries where quality, on time delivery, post-sale services and price are of the most important attributes in customer satisfaction, in telecommunication equipment the product conformity with technical specifications registered by international organization for standardization is one of the most important indices in customer satisfaction. Table 8. Results indicate that managers have to perpend the structural attributes, mechanic and electronic properties, environmental requirements, and product dimensions which are all introduced in product technical specifications. It is also implicated that developing check lists for every product, recording the product technical specifications, and sending them to the customer along with the product could assure the customer that all the important attributes of the product are under control by the manufacturer.

To mention some of the research limitations, we may note lack of adequate sources for customer satisfaction in telecommunication equipment industry as well as limited access to technical maintenance experts of telecommunications authority in province capitals.

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