



## Identifying and prioritizing the factors effective in customer satisfaction using the TOPSIS method

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### ABSTRACT

**Introduction:** Customer satisfaction has been suggested as one of the interesting and challenging issues of management in the new millennium. In addition, oral and dental health and the quality of the services the health centers delivered to the patients directly affect the customer satisfaction. Therefore, the present study aimed to identify, investigate, and rank the factors affecting the customer satisfaction in the department of dentistry of Shiraz Farhangiyen health center.

**Method:** The present descriptive study was conducted on the specialists and patients of the department of dentistry of Shiraz Farhangiyen health center. The validity of the questionnaire utilized in the study was confirmed by expert professors and its reliability was approved using the Cronbach's alpha formula. Finally, the study data were analyzed in SPSS statistical software (v. 16), using inferential statistics.

**Results:** All the hypotheses were confirmed by the results of the statistical analyses and quality, services, and expenditures revealed to affect the customer satisfaction in the department of dentistry of Shiraz Farhangiyen health center. Moreover, these factors were ranked using the TOPSIS method and the results showed quality and expenditures as the most and the least effective factors in customer satisfaction, respectively.

**Conclusion:** Since restoring and arranging the organization based on the customer needs is among the main priorities of designing an organization, managers are suggested to take measures for organizational reformation based on the customers' priorities. Of course, conducting such programs is of utmost importance in health and treatment environments, leading to provision of better services and facilitation of learning, education, and research. Thus, identifying the effective factors in customer satisfaction and ranking them are highly important.

**Keywords:** Customer, Customer satisfaction, Decision making

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### Introduction

Variety has passed a vicissitudinous way in humans' life and its speed as well as intensity is one of the major features of today's world. This is in fact the difference between the developed and the developing world. Nowadays, competitions in different fields have put the survival of societies and organizations at a high risk and, as a result, their survival requires utilization of novel techniques as well as special capabilities. In addition, permanent, increasing presentation of goods and services is considered as a continuous attempt toward this survival. In general, production and presentation of novel services of unique features require organizations with novel ideas and strategies, i.e. the organizations whose speed and intensity of internal change are arranged in accordance

with the market requirements understand the market needs, and are able to provide the needs timely. Today, the organizations' survival cannot be guaranteed by having a broad market since new competitors appear quickly. These competitors do not wait for you to know them and implement the necessary strategies for dealing with them; on the other hand, you will understand them after they have occupied a part of your market and if you do not take action, you may even be omitted from the market. Therefore, even if you are the first, you need to create varieties.

There are always customers with changing tastes who get close to or far from you by evaluating three indexes of expenditures, quality, and services. The more you are able to present these indexes, the more contribution you will have to the market, your products will be more attractive

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to the customers, and they will be more satisfied by your products. Of course, reaching this aim requires making great attempts in all the processes whose starting point is developing a correct understanding of the market as well as the customers and its end point is providing the needs and moving toward perfection. By gaining the customers' satisfaction, the difficulty of competition and dealing with the complexities of the market will be easier for you and this is exactly what the organizations look for - more contribution to the market and more economic outcome. Nevertheless, gaining the customers' satisfaction requires strategy, planning, and using techniques as well as operational models in order to help the organizations reach their goals (1).

The department of dentistry of Shiraz Farhangiyan health center is planning to organize its future programs. In doing so, the best way is referring to the clients' as well as the experts' opinions to organize their financial and spiritual resources. In this way, two conditions may be faced, similarity of the experts' opinions and the organization's performance and the difference between the two. It is quite obvious that the best condition is the experts' opinions and the organization's performance to be matched. However, if these two are different, the organization must modify its performance based on the experts' opinions. Of course, if there is conformity among the opinions and the performance, the organization's effectiveness is still under question. In fact, the main question is whether the customers' opinion is the priority of the organization or just making an organization is intended. Obviously, the second condition is cancelled and the conformity between the customers' and the experts' opinions must be assessed. The answer to this question shows the distance between the present and the ideal conditions. If conformity is there, the organization must be appreciated for efficiency. On the other hand, if a difference is observed between the customers' and the experts' opinions, the customers' opinions show the ideal situation, while the experts' opinions reveal that the present status and the organization's future policies should cover these distances. Considering the fact that customer satisfaction is affected by the factors which are different from one organization to another, these factors should be identified and prioritized based on the scientific criteria. The present research can be an appropriate pattern providing the managers as well as the specialists with information for evaluating and prioritizing the factors affecting customer satisfaction and, at the same time, motivate them toward customer reverence and improvement of their service provision system. This study aims to investigate the major factors affecting the customer satisfaction, as one of the main components of organizational change and prioritizing them in one of the dentistry clinics of Shiraz, Iran.

Customer satisfaction index model was proposed by Martin and Handerson (2000) in Malaysia. This model includes 6 variables in a way that customer satisfaction factors consist of 3 variables of perceived quality, customer expectations, and perceived value, while customer satisfaction outcomes include 2 variables of perceived

image of the product or service and customer loyalty. Moreover, Dwayne et al. presented the factors affecting customer satisfaction through a model which included two new concepts of trust and relationships as well as their effects on customer satisfaction. Thus, by considering the two mentioned variables, the extended model of the European model has presented new causality relations: 1- Trust: In fact, trust plays a critical role in strengthening and increasing the customers' loyalty. Trusting the products or services not only includes the perceived positive revenues of the product, but also it creates the expectation that these revenues continue in future, as well. Therefore, there is a positive relationship between the customers' trust and their satisfaction and loyalty. 2- Relationships: In this model, relationship refers to the written relations and the effect of face-to-face relationships before, at the moment of, and after presenting the services.

Furthermore, Sedghi et al. (2009) identified the effective factors in satisfaction and loyalty of customers and taxpayers and finally presented the factors affecting customer satisfaction through a model including staff, expectations, relationships, law, and culture (2). In the same line, Kazemi and Mohajer (2009) prioritized 24 factors which had been revealed to be effective in satisfaction of the customers of Mashhad Eghtesad Novin bank according to the importance of satisfaction with the factors based on the customers' points of view. According to the results, the customers considered the staff's responsibility and accountability as the most important factors and publication of bulletins and magazines and sending them to the customers as the least important ones (3).

Hesket (1994) proposed the profit-service chain model which focuses on maintaining the staff as well as their productivity. This will, in fact, lead to the staff's satisfaction which results in increasing the customers' satisfaction and finally improves the performance of the organization (4).

#### **Research hypotheses**

Based on the effective factors in customer satisfaction in Shiraz Farhangiyan health center, the following hypotheses were considered in the present study:

- 1-1. Quality factors are effective in customer satisfaction in Shiraz Farhangiyan health center.
- 1-2. Service factors are effective in customer satisfaction in Shiraz Farhangiyan health center.
- 1-3. Expenditure factors are effective in customer satisfaction in Shiraz Farhangiyan health center.
- 1-4. There is a significant difference between the impact rates of the factors affecting customer satisfaction in Shiraz Farhangiyan health center.

#### **Customer satisfaction**

Deming, one of the pioneers of Total Quality Management (TQM), considers quality to be the same as customer satisfaction. In fact, by improving the quality of the services, customer satisfaction is increased and the organizations' effectiveness will be enhanced. Therefore, customer satisfaction can be considered as one of the indicators of organizations' effectiveness. Nowadays, both service and manufacturing organizations

consider customer satisfaction as an important criterion for assessing the quality of their deeds. Overall, the importance of customers and their satisfaction is involved in global competitions (5).

Customers are individuals or operations which consume, need, or benefit from the products or outcomes of a performance. Since each organization's performance has a goal, it has customers (6).

#### Customers' needs and expectations

Some people consider the customers' points of view as the main criterion in assessing the organizations' performance and some others believe knowing the customers' needs as one of the important features of successful organizations. Concerning the systemic perspective, investigation of the customers' satisfaction and loyalty is considered as one of the major indicators of organizational health (7).

#### TOPSIS method

TOPSIS method was proposed by Hwang and Yoon in 1981. This model is one of the best methods of multi-criteria decision making which is mostly efficient in case the goal of solving a problem is group decision making. This method requires a decision making matrix whose rows and columns represent options and the criteria, respectively (8, 9). In this method, the selected option should have the lowest distance from the positive ideal solution and the greatest distance from the negative ideal one. Of course, the technique has some assumptions as well.

The desirability of any index should have a steadily increasing or decreasing trend. In other words, the best existing value of an index shows the positive ideal status, while its worst existing value represents the negative ideal situation.

The distance from a positive or negative ideal option may be computed through Euclidean distance (square) or sum of the absolute value of linear distances, which depends on the rate of exchange and substitution of the indexes (8).

In order to solve this model using the TOPSIS method, the following steps are followed:

1- The decision matrix is normalized using the following equation:

$$n_{ij} = \frac{r_{ij}}{\sqrt{\sum_{i=1}^m r_{ij}^2}}$$

Where  $r_{ij}$  is the value of the  $j$ th index for the  $i$ th option.

2- The weighted normalized matrix is created using the below formula. Moreover, weight is computed through the entropy method as follows:

$$v_{ij} = n_{ij} \times w_j$$

Where  $w_j$  is the weight of the related index.

3- Then, positive ideal ( $A^+$ ) and negative ideal ( $A^-$ ) options are identified.

$$A^+ = \{MaxV_{ij} | (J\&J^+), (MinV_{ij} | J\&J^-)\} = (V_1^+, V_2^+, \dots, V_a^+)$$

$$A^- = \{MinV_{ij} | (J\&J^+), (MaxV_{ij} | J\&J^-)\} = (V_1^-, V_2^-, \dots, V_a^-)$$

negative ideal ( $d^-$ ) option is measured using the following formulas:

$$d_i^+ = [\sum_{j=1}^n (V_{ij} - V_j^+)^2]^{\frac{1}{2}}$$

$$d_i^- = [\sum_{j=1}^n (V_{ij} - V_j^-)^2]^{\frac{1}{2}}$$

5- Finally, the relative closeness index ( $C_i$ ) is determined through the following formula (10).

#### Methods

The present research was in fact a functional case study. The present study was conducted on the specialists and patients of the dentistry department of Shiraz Farhangiyan health center which serves 2400 patients monthly. Considering the acceptable error of 0.05 for estimating the study sample, CI of %95, and the success ( $p$ ) to failure ( $q$ ) ratio of 0.5, a sample size of 331 subjects was determined for the study using the following formula. Therefore, 380 questionnaires were distributed 338 of which could be used for statistical analysis.

$$n = \frac{N \cdot Z_{\frac{\alpha}{2}}^2 \cdot pq}{e^2 (N - 1) + Z_{\frac{\alpha}{2}}^2 \cdot pq}$$

The first questionnaire which included 23 questions was distributed among 338 patients as well as 30 specialists who were asked to complete the questionnaires based on the Likert scale. The face validity of the questionnaire was confirmed by 6 professors of the fields related to oral and dental health. In addition, the reliability of the questionnaire was measured for the three factors of quality, services, and expenditures and the Cronbach's alpha of 82.33, 79.46, and 80.23 were obtained, respectively, which confirms the reliability of the questionnaire.

At first, open interviews were performed with the patients of the department of dentistry of Shiraz Farhangiyan health center in order to identify the dimensions of the research and the results revealed 14 criteria in 3 indexes of quality, services, and expenditures. In the second questionnaire, the same 14 criteria used in the first questionnaire were presented to 30 specialists as well as 30 patients through paired comparison tables. Then, the data extracted from the tables were used in order to rank the criteria according to the TOPSIS model. The experts were also asked to score the criteria from 1 to 9 (8).

#### Results

In order to investigate the study hypotheses, statistical hypothesis testing was used; the results are shown in Table

1. Considering  $\text{sig} < 0.05$ , hypotheses 1-1 to 1-3 were confirmed, which implies that the three mentioned factors were effective in customer satisfaction. The second hypothesis was also examined and the results revealed its significance level as 0.000. Considering  $\text{sig} < 0.05$  and its statistical index which was obtained as 35.439, the hypothesis was confirmed, which shows a significant difference between the impact rates of the factors affecting customer satisfaction. In case the factors affecting an index have various impact rates or there is a significant difference between the impact rates of the factors, the factors' impact rates should be assessed and ranked according to one of the multi-criteria decision making methods (11).

**Table 1.** The results of investigation of hypotheses 1-1 to 1-3

Hypotheses	Statistical Index(X2)	Significance Level	Decision Making
Quality factors are effective in customer satisfaction in Shiraz Farhangiyan health center.	28.528	0.000	Accuracy of the hypothesis
Service factors are effective in customer satisfaction in Shiraz Farhangiyan health center.	33.33	0.000	Accuracy of the hypothesis
Expenditure factors are effective in customer satisfaction in Shiraz Farhangiyan health center.	29.873	0.000	Accuracy of the hypothesis

Since the results of the present study showed that the impact rates of the factors affecting customer satisfaction in Shiraz Farhangiyan health center were different, the factors' impact rates should be evaluated and ranked using the TOPSIS method. The results of ranking the factors affecting customer satisfaction are presented in Table 2. As can be seen, quality and expenditures were respectively the most and the least effective factors in customer satisfaction in Shiraz Farhangiyan health center. Therefore, it can be concluded that the patients considered the quality of dental services to be more important than the expenditures or the conditions in which they are provided with the services.

**Table 2.** Rank of the effective factors in customer satisfaction using the TOPSIS method

Rank	Factors	Ci
1	Quality	0.627
2	Services	0.547
3	Expenditures	0.525

According to the specialists and experts of health and treatment, quality factors refer to workplace health, quality of the devices, satisfaction from the dentist, familiarity of the dentists with new treatment methods, and the patients' waiting time. Besides, service factors include 5 components of education, accessibility of the

patients' dental records, conditions of the place of service provision, having access to dental brochures, and welfare services. Finally, expenditure factors refer to the amount of discount, insurance, observing the government tariffs, and satisfaction from government tariffs in comparison to similar private health centers.

Furthermore, each component of the factors affecting customer satisfaction was ranked using the TOPSIS method and the results are presented in Table 3.

According to Table 3 which depicts the overall ranking of the components of quality, services, and expenditures factors and considering the value of  $C_i$ , the highest and the lowest ranks were related to workplace, health and waiting time, respectively.

### Discussion

Finding the similar points among the managers' and the customers' viewpoints are important regarding two aspects: occupational health and adjusting the continuation of the activity since both managers and customers tend to act in a similar manner. In this way, the maximum effectiveness can be expected.

According to the managers' and customers' points of view, the first 7 priorities obtained through the TOPSIS method were workplace, health, training oral and dental health, satisfaction from discount for those working in the educational system, satisfaction from insurance, quality of devices and dental appliances, accessibility of dental records, and satisfaction from the physical environment and facilities. Thus, the organization's management should arrange for allocation of resources and prioritization of policies at least for the first 3 components of Table 3 based on the value of  $C_i$ , i.e. workplace health, education, and satisfaction from discount for those working in the educational system. Moreover, finding the similar views of managers and customers is recommended to be used as the first method in decision making and if this is not possible, the customers' opinions should overcome the other ideas. It should be noted that the shared viewpoints are justified by ensuring the effectiveness accompanied by the lowest costs and predominance of the customers' opinions from the beginning is of great importance.

### Conclusion

Overall, identifying and prioritizing the factors are highly important and according to the study findings, these factors, as a comprehensive model, can help the successful execution of customer satisfaction.

**Table 3.** Ranking the components of the factors affecting customer satisfaction using the TOPSIS method

Factors quality	Rank	Components	Ci
	1	Workplace health	1
	2	Quality of devices and dental appliances	0.306
	3	Satisfaction from dentists	0.030
	4	Dentists' familiarity with new treatment methods	0.095
	5	Patients' waiting time	0.001
Services	1	Training oral and dental health	0.790
	2	Accessibility of dental records	0.227
	3	Satisfaction from physical environment and facilities	0.199
	4	Having access to brochures	0.002
	5	Having access to welfare services	0.002
Expenditures	1	Satisfaction from discount for those working in the educational system	0.595
	2	Satisfaction from insurance	0.441
	3	Satisfaction from government tariffs compared to similar private centers	0.099
	4	Observing the government tariffs	0.006

### References

### Suggestions

The results of the present study showed qualitative factors to be most effective in customer satisfaction. Therefore, the practitioners of the ministry of health are recommended to design programs regarding the standardization of oral and dental health according to the global standards in order to strengthen these factors. Moreover, considering the necessity of quality in health centers, authorities should take this issue into account and update it. Finally, the study findings revealed the effectiveness of workplace health in customer satisfaction; therefore, further studies are recommended to be conducted in order to identify this factor from the customers' points of view.

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