



Developing a 3-Dimensional Model of Importance-Performance-Cost Analysis for Prioritizing the Quality Attributes of Mobile Phone Operator Services

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ABSTRACT

In today's competitive world, discovering the needs and desires of customers and fulfilling them before competitors is the condition for success for companies. Therefore, organizations and business enterprises try to achieve a privileged position compared to other competitors by achieving unique advantages. This study aims to develop the importance-performance analysis by adding the cost dimension. Then, measure and compare the quality of the services of two communication networks, Hamrahe Aval, and Irancell, using the developed approach of Importance-Performance-Cost Analysis (3-D IPCA) and proposing the optimal strategy to improve service quality. For this purpose, we identified the relevant attributes by studying the literature, then provided to the experts in the form of a questionnaire for final confirmation. Finally, 20 attributes were identified in determining the quality of mobile phone operators' services. The questionnaire was distributed among 400 Ferdowsi University of Mashhad students as a convenience sample. Then it was analyzed using three-dimensional IPCA analysis. The results showed that among the users of the Hamrahe Aval network, the quality of providing services and customer support, and among the users of the Irancell network, network coverage and ease of use of services have the highest and lowest priorities for improvement, respectively. Also, Irancell's performance has been better considering the cost aspect. The comparison of IPA and IPCA shows that IPCA considering the cost as a third dimension can obtain more accurate analyzes of customers' opinions. Moreover, managers can make more rational decisions with this tool.

Keywords

Importance-Performance analysis, Cost dimension, Service quality, Mobile operator.

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1. Introduction

The telecommunications industry is becoming one of the most important industries in the world and has affected the global economy. Increasingly, with the advancement of technology in this industry, the transfer of photos, audio, images, and data is done with high speed and quality. Following these developments, the environment of the companies in this industry becomes turbulent. Furthermore, the marketers of this industry seek to create a sustainable competitive advantage through innovation and customer satisfaction ([Haghighi et al., 2013](#)) to the extent that these mobile phone operators have focused their marketing strategies on attracting new customers and customers from other operators.

Researchers in the mobile phone service industry have proven the quality of mobile phone service providers on customer satisfaction and loyalty. Therefore, mobile phone operators should not only provide services according to the needs and expectations of customers but also continuously strive to improve the quality of their services to achieve a competitive advantage. Also, at the same time as attracting new customers, increase the loyalty of their existing customers. Therefore, mobile phone operators must identify and prioritize service attributes to manage communication with customers effectively.

The literature study shows that some studies such as [Wen and Hilm \(2011\)](#), [Rahhal \(2015\)](#), [Loke et al. \(2011\)](#), [Hosseini et al. \(2013\)](#), [Dharmadasa and Gunawardan \(2017\)](#), and [Palladan and Ahmad \(2019\)](#) have used Seroquel and Seroperf While using general quality-service models such as Seroquel will not result in practical and effective results and suggestions for managers.

Some studies as [Faria et al. \(2015\)](#), used the AHP method, and [Kargar \(2016\)](#) used Dimtel and ANP techniques to prioritize service attributes. Nevertheless, using these methods does not determine the weakness and strength of the relevant organization in each of the priorities. At the same time, function-importance is a low-cost, easy-to-understand method for organizing information about the attributes of a product or service. It presents attractive, intuitive strategies for the industry. It determines their priority for implementation so that they can ultimately provide more customer satisfaction and is one of the tools for managing relationships with customers. Also, IPA simultaneously identifies the most important attributes affecting customer satisfaction as well as the low-performance attributes of the organization that must be quickly improved and thus recommends strategies to the management to provide better customer service. Therefore, in this research, performance-importance-cost analysis is used to prioritize the services of mobile phone operators.

On the other hand, [Petrick \(2004\)](#) states the need for more customer satisfaction measurement if it needs to be supported by in-depth learning about the perceived value of the customer and related issues that form the basis of their evaluations. It may need to guide managers enough to hear the customers' Voice of Customer and how to respond to them. The perceived performance of a product or service equals the perceived value, or perceived level of perceived quality, concerning the price or prices paid ([Johnson et al., 2001](#)).

When a consumer buys a product, he exchanges one value with another. The value he loses is the price he pays for the goods, and the value he gains is the benefits of owning the goods ([Shabanipour et al., 2016](#)). Customer perception of price fairness directly affects customer satisfaction. However, less attention has been paid to the price acceptance factor than other customer satisfaction attributes ([Martin-Consuegra et al., 2007](#)). Price is an important factor in the purchase process and after purchase, and the central role of price in services can be understood considering the complex pricing structure. The studies of [Hossain and Suchy \(2013\)](#), [Wen and Hilm \(2011\)](#), [Munnukka \(2006\)](#), [Hassan et al. \(2013\)](#), [Chakraborty and Sengupta \(2014\)](#), [Liang et al. \(2013\)](#) and, [Chee and Husin \(2020\)](#) have stated cost as an effective factor in customer satisfaction. However, the above studies are statistical and have investigated and confirmed the effect of price on customer satisfaction.

As mentioned earlier, the importance and performance analysis approach is a low-cost and attractive method for prioritizing mobile operator services. Furthermore, several studies, including [Hosseini et al. \(2012\)](#) and [Pezeshki et al. \(2009\)](#), have used this approach to analyze service quality. Nevertheless, this approach does not cover the cost dimension, and its analysis will not be based on cost. Quality and price are two important and influential factors in a buyer's decision to cooperate or continue with a supplier. Therefore, prioritizing the features of a product based on performance and importance without considering its cost and increasing the price of the product will not be the correct strategy. Business managers need to know how much a customer is eager to pay to obtain a high-performance feature. Therefore, due to the importance of the cost factor, there is a gap in the importance and performance approach, and none of the research background studies need to pay attention to the cost dimension in the importance-performance analysis. So in the present study, the mentioned approach has been developed, and the third dimension of cost has been added to this approach. Moreover, the prioritization of mobile phone operator service features based on performance and importance concerning cost is also analyzed.

2. Theoretical foundations and research background

2.1. Quality of service

According to [Parasuraman et al., \(1998\)](#) service quality is defined as ‘the consumer’s judgment about an entity’s overall excellence or superiority’ of the service; the authors use the concept of ‘perceived service quality’, which differs from objective quality ([Parasuraman et al., 1988](#)). Service quality measures how an organization delivers its services compared to the expectations of its customers. Customers purchase services as a response to specific needs. They either consciously or unconsciously have certain standards and expectations for how a company's delivery of services fulfills those needs. A company with high service quality offers services that match or exceed its customers' expectations ([Indeed, 2022](#)).

2.2. Service cost

Price plays an important role in buying and after buying. The results of the qualitative research showed that more than half of the customers of one of the services started buying from the competitors due to a weak perception of the price (compared to competitors) ([Keaveney, 1995](#)). [Varki and Colgate \(2001\)](#) reached similar results with research in the banking industry, significantly since price perception directly affects customer satisfaction. Based on the research of [Matzler et al. \(2006\)](#), the fairness and unfairness of the price is a psychological factor that has an important effect on the customer's reaction to the price. Customers do not want to pay a price that they think is unfair.

Value perception sets the price ceiling, while cost sets the price floor for what a company can charge for its goods or services ([Kotler and Armstrong, 2014](#)). In setting prices, the primary objective of most companies is to recover input costs and then make a profit. As a result, customers have to pay the set price in recompense for the total benefits they receive from the goods or services bought, which also allows the seller to recover input costs and make a profit ([Porter and Kramer, 2011](#)). Customers must experience good quality in the service received to perceive it as good value for money. The perceived value has been conceptualized as the difference between total benefits and total costs of service ([Kotler et al., 2012](#)). Total benefit has also been defined by [Lee and Cunningham \(2001\)](#) to include economic benefit (the lower price paid compared to alternatives), functional benefit (the good service performance that satisfies the desired need), and psychological benefit (the good feeling of satisfaction after service experience).

2.3. Background research

[Hosseini et al. \(2013\)](#), in their research, using the importance-performance analysis of service features based on customer segmentation with a data mining approach, classified mobile phone subscribers in Yazd province into three segments. [Sheikhzadeh et al. \(2013\)](#) compared the satisfaction of customers from the value-added services of two companies, Moharb and Irancell. They concluded that although value-added services create customer satisfaction, they cannot determine the operator's decision.

[Taghizadeh and Meskarian \(2013\)](#) investigated female customers' satisfaction levels with the mobile phone services of two companies, Irancell and Hamrahe Aval, in Urmia City. The results of their study showed that the Hamrahe Aval company is ahead of Irancell in the field of quality service, after-sales service, and proper antenna service in the city. [Faria et al. \(2015\)](#) measured and investigated customer satisfaction with mobile phone services using the fuzzy AHP approach. They examined customer satisfaction indicators in four main groups: price, perceived service quality, customer experience, and service and product development and creativity. [Hosseinzadeh and Hatami Ghoshchi \(2014\)](#) evaluated and compared customer satisfaction with the quality of telecommunication services provided by Irancell in Urmia and concluded that customer satisfaction with service quality is the same.

[Wang and Lu \(2002\)](#) researched service quality, customer satisfaction, and behavioral tendencies in the Chinese telecommunications industry using the SERVQUAL model. They concluded that all the attributes affecting service quality, except for the responsibility factor, play an important role in customers' perception of service quality in the mobile phone market. [Ojo \(2010\)](#) investigated the relationship between service quality and customer satisfaction in the telecommunications industry, focusing on the Nigerian mobile communication network. [Wen and Hilmi \(2011\)](#) used five dimensions of the SERVQUAL model and four other dimensions, i.e., perceived quality of the network, pricing structure, convenience, and value-added services, to measure service quality in the mobile telecommunications industry in Malaysia were used. This study shows that dimensions of service quality such as reliability, empathy, customer-perceived network quality, pricing structure, and value-added services have a positive relationship with customer satisfaction. [Loke et al. \(2011\)](#) investigated the effect of reliability, responsiveness, assurance, empathy, and tangible aspects on customer satisfaction in a telecommunications service provider using the Cerval model.

Using structural equations, [Nimako \(2012\)](#) investigated the impact of service quality on customer satisfaction and customer behavioral intention in the mobile telecommunications

industry. [Hossain and Suchy \(2013\)](#) investigated the effect of customer satisfaction on customer loyalty in Bangladesh. The results of their study show that five attributes: communication, price structure, value-added services, convenience, and customer service/care have a positive relationship with customer loyalty. [Hassan et al. \(2013\)](#) investigated the effect of service fairness, service quality, and price fairness perception on subjective customer satisfaction and customer loyalty in the mobile telecommunications sector of Pakistan. The results of their study show that service fairness, service quality, and perception of price fairness are valid and reliable for measuring customer satisfaction and loyalty. [Hosseini et al. \(2013\)](#) conducted a multidimensional measurement model (MS-Qual) to measure the quality of mobile telecommunication services. The findings of this study showed that customers perceive their service quality based on their evaluation of seven main dimensions, including network quality, value-added services, pricing plans, staff competence, billing system, customer service, and service convenience. [Liang et al. \(2013\)](#) surveyed 400 customers to investigate the importance of service quality from various aspects and customer switching behavior in China's mobile service sector. [Chakraborty and Sengupta \(2014\)](#) developed a customer satisfaction model for mobile phone network providers in Kolkata. Their findings show that general requirements (combination of product quality and perceived value), flexibility, and price determine customer satisfaction. [Rahhal \(2015\)](#) analyzed the effects of service quality dimensions on customer satisfaction in Syrian mobile phone companies. The findings of this study show the direct and significant effect of service quality on customer satisfaction from three dimensions (network quality, responsiveness, reliability), and other dimensions did not affect customer satisfaction. [Dharmadasa and Gunawardane \(2017\)](#) investigated the effect of service quality on customer satisfaction in the mobile communications industry in Sri Lanka to increase customer satisfaction. They used the Serkerval model. Their study shows that the main dimensions of service quality affecting customer satisfaction are empathy, tangible, and reliability. Other dimensions of responsiveness, reliability, and technical quality do not affect customer satisfaction. [Mpwanja and Letsoalo \(2019\)](#) used partial least squares structural equation modeling to examine the relationships between Service Quality (SQ), Customer Satisfaction (CS), and Behavioral Intentions (BI) in South Africa. The results of this study show that tangible items (TAN), customer relationship (CR), real network quality (RNQ), picture quality (IMQ), as well as CS, are significantly related in the South African mobile telecommunications industry. [Palladan and Ahmad \(2019\)](#) investigated the moderating effect of customer satisfaction on the relationships between dimensions of service quality and customer loyalty in the mobile telecommunications industry in Nigeria. The results of their study show that

confidence, empathy, reliability, and tangibility have a positive relationship with customer loyalty. [Chee \(2019\)](#) has presented a conceptual framework that links the relationship between service quality, customer satisfaction, customer loyalty, and customer retention in measuring the quality of services provided by telecommunication phones.

[Hapsari et al. \(2020\)](#) conducted a study to verify the dimensions of customer interaction and investigate the effect of service fairness, customer trust, and customer interaction on customer loyalty. The results of their study show that customer trust and interaction have a direct effect on customer loyalty. [Chee and Husin \(2020\)](#) investigated the service quality, satisfaction, and loyalty to care retention in the telecommunications industry in Malaysia. Their study results show a significant relationship between customer satisfaction and service quality measured network utilization, service delivery, and price evaluation.

[Karimi and Boley \(2022\)](#) conducted a study to identify the service quality perceptions tourists and residents have of the domestically and internationally significant cultural heritage tourism attraction of Shandiz, located within the Khorasan Razavi province of Northern Iran. To address this aim, they use traditional and contemporary approaches to IPA, such as gap analysis, Impact Range Performance Analysis (IRPA), and Impact Asymmetry Analysis (IAA).

The literature review results show that different dimensions are considered for service quality. In this study, previous research was comprehensively examined to identify the dimensions and indicators of service quality in mobile phone operators, and the common items, according to Table 1, were considered as dimensions of service quality. Also, a review of the research background shows that most of the research, such as [Wang and Lu \(2002\)](#), [Nazari et al. \(2014\)](#), [Dharmadasa and Gunawardan \(2017\)](#), [Mpwanyana and Letsoalo \(2019\)](#), [Palladan and Ahmad \(2019\)](#), and [Chee and Husin \(2020\)](#) have used the SERVQUAL model and statistical methods in examining service quality and customer satisfaction.

While according to [Song and Shepperd \(2011\)](#), statistical methods could be more efficient in the face of more information. Also, in statistical methods such as multiple regression or structural equations that require assumptions such as normal distribution, the data under investigation, and the existence, there is a linear relationship between independent and dependent variables and low collinearity between independent variables. At the same time, in most studies, it is impossible to be sure of the existence of all these assumptions ([Deng et al., 2008](#)). Also, one of the shortcomings of the SERVQUAL model is not paying attention to the importance of each index and the existence of expectations in the evaluation ([Noorossana et al., 2018](#)). To solve this problem and rank the indicators IPA technique can be used. When

increasing service quality and customer satisfaction, importance/performance analysis can be valuable for prioritizing service indicators (Deng and Pei, 2009). The IPA technique is a type of multi-criteria decision-making. Multi-criteria decision-making techniques are more suitable tools (Fazli et al., 2011; Shaffi et al., 2016). In studies such as Pezeshki et al. (2009) and Hosseini et al. (2012) used the usual IPA technique, the indicators were examined in only two dimensions: performance and importance. At the same time, cost is also an effective factor in customer satisfaction. Therefore, this research developed the usual IPA into a three-dimensional IPCA.

Table 1. Extraction of attributes affecting service quality

NO	Attribute Name	References
1	Conversation quality	Taghizadeh and Meskarian (2013), Chakraborty and Sengupta (2014), Liang et al., (2013), Gautam (2011), Gunjan et al., (2011), Santouridis and Trivellas (2010), Rahhal (2015), Nimako (2012), Mpwanya and Letsoalo (2019), Hossain and Suchy (2013), Hosseini et al., (2013), Mathiraj et al., (2019)
2	Network coverage	Taghizadeh and Meskarian (2013), Chakraborty and Sengupta (2014), Rahhal (2015), Palladan and Ahmad (2019), Wen and Hilmi (2011), Nimako (2012), Mpwanya and Letsoalo (2019), Hossain and Suchy (2013), Dharmadasa and Gunawardane (2017)
3	Diversity and innovation	Taghizadeh and Meskarian (2013), Gunjan et al., (2011), Palladan and Ahmad (2019), Hassan et al., (2013), Chee and Husin (2020), Hossain and Suchy (2013), Mathiraj et al., (2019), Ojo (2010)
4	Quality in service delivery	Hosseini et al., (2013), Nimako (2012)
5	Service Convenience	Rahhal (2015), Nimako (2012), Liang et al., (2013), Wen and Hilmi (2011), Palladan and Ahmad (2019)
6	Sufficient number of agencies	Rahhal (2015), Hossain and Suchy (2013), Nimako (2012), Mpwanya and Letsoalo (2019), Liang et al., (2013)
7	billing accuracy	Dharmadasa and Gunawardane (2017), Santouridis and Trivellas (2010), Chee and Husin (2020), Chakraborty and Sengupta (2014)
8	cost clarification	Hossain and Suchy (2013), Hassan et al., (2013), Santouridis and Trivellas (2010), Chee and Husin (2020), Chakraborty and Sengupta (2014), Mathiraj et al., (2019)
9	Fix possible billing problems	Santouridis and Trivellas (2010), Chee and Husin (2020), Hosseini et al., (2013)
10	Competence and skill in responding	Rahhal (2015), Wen and Hilmi (2011), Palladan and Ahmad (2019), Loke et al., (2011), Nimako (2012), Ojo (2010), Hassan et al., (2013), Dharmadasa and Gunawardane (2017), Mpwanya and Letsoalo (2019)
11	Courtesy and respect	Rahhal (2015), Ojo (2010), Hassan et al., (2013), Dharmadasa and Gunawardane (2017), Loke et al., (2011), Nimako (2012)
12	Efforts to solve audience problems	Rahhal (2015), Ojo (2010), Loke et al., (2011), Nimako (2012), Hassan et al., (2013), Dharmadasa and Gunawardane (2017)
13	Tariff diversity	Hossain and Suchy (2013), Gunjan et al., (2011), Chakraborty and Sengupta (2014)
14	Easy to choose and change tariffs	Gunjan et al., (2011), Hossain and Suchy (2013), Hosseini et al., (2013)
15	Provide sufficient information related to the tariff	Ojo (2010), Loke et al., (2011), Chakraborty and Sengupta (2014), Gunjan et al., (2011), Hossain and Suchy (2013)
16	Customer support	Rahhal (2015), Nimako (2012), Santouridis and Trivellas (2010), Gautam (2011), Gunjan et al., (2011), Loke et al., (2011), Dharmadasa and Gunawardane (2017)
17	Convenience in transferring problems	Ojo (2010), Gautam (2011), Gunjan et al., (2011), Loke et al., (2011), Santouridis and Trivellas (2010), Hossain and Suchy (2013)
18	Handling complaints	Rahhal (2015), Loke et al., (2011), Gautam (2011), Gunjan et al., (2011), Hossain and Suchy (2013), Santouridis and Trivellas (2010)
19	Internet network quality	Nimako (2012), Mpwanya and Letsoalo (2019), Chakraborty and Sengupta (2014), Dharmadasa and Gunawardane (2017), Chee and Husin (2020)
20	Internet network coverage	Nimako (2012), Mpwanya and Letsoalo (2019), Chakraborty and Sengupta (2014), Chee and Husin (2020)

3. Research methodology

Research is an analytical survey in terms of practical purpose and according to data collection. After studying the background of the research, twenty attributes in determining service quality have been identified and approved by experts in the second stage (Table 1). The method of data collection in the developed approach of IPCA is a questionnaire. Ten experts checked and confirmed the validity of the questionnaire. The experts in this research are active managers in Hamrahe Aval service networks and Irancell. A five-point Likert scale is used in this questionnaire. The data analysis was done based on the IPCA and IPA analysis approach. The statistical population included all students at Ferdowsi University of Mashhad in the academic year of 2019-2020. The questionnaire was distributed among 400 students of the Ferdowsi University of Mashhad in the form of an available sample.

3.1. Developed IPCA methodology

Importance-performance analysis (IPA) has been widely utilized in brand optimization, service quality, and customer satisfaction applications since its initial introduction by [Martilla and James \(1997\)](#). IPA is a popular tool because it is easy to operate, and its results are easily interpretable ([Feng et al., 2014](#)). The original IPA model relies on data typically collected via survey. After calculating the performance and importance of various attributes, the means of performance and importance can be plotted onto the four quadrants of a two-dimensional (2D) matrix grid. On this matrix grid, the performance of a given attribute is plotted on the X-axis, and the importance of the attribute is plotted on the Y-axis; in this research, the third axis of Z, which is the cost, was added to it.

This original IPA model (quadrant model) has been applied in many previous studies, including [Zhang and Chow \(2004\)](#), [Hudson et al. \(2004\)](#), [Prajogo and McDermott \(2011\)](#), [Sorensson and Friedrichs \(2013\)](#), [Pan \(2015\)](#), [Hanssen and Mathisen \(2018\)](#), and [Birendra et al. \(2018\)](#). In addition to this original quadrant model, the diagonal line model has also been widely used, including in studies by [Slack \(1994\)](#), [Nale et al. \(2000\)](#), [Levenburg and Magal \(2005\)](#), [Sirdifield et al. \(2016\)](#), [Sulaiman Al Jahwari et al. \(2016\)](#), and [Boley et al., \(2017\)](#). But for the first time in this research, the third dimension is added cost.

3.1.1. Steps of performance-importance-cost analysis

The new Performance-Importance-Cost Analysis is calculated according to the following steps:

The first step: The quality attributes that play a role in service quality have been identified and extracted. This work has been done by studying the subject literature and asking for opinions from experts and customers.

The second step: The degree of importance of service quality attributes and the degree of performance and cost of that quality attribute are determined. b_{jp} , c_{jp} , h_{jp} ($j=1,2,\dots,m$, $p=1,2,\dots,n$) respectively, represent the value of importance, performance value, and cost value, which are for attribute j and by the decision-maker or customer p . M is determined. These values can be determined using a Likert scale. A five-level Likert scale was used in this research.

The third step: The geometric mean, is used, and the opinions of all decision-makers or customers are integrated. In this way, b_j is the final value of importance, c_j is the final value of the performance, and h_j is the final value of cost j^{th} attribute of service quality, which results from the collective opinion of p customers or experts. Equation 1 shows this step.

$$c_j = \left(\prod_{i=1}^n c_{jp} \right)^{1/n}, \quad b_j = \left(\prod_{i=1}^n b_{jp} \right)^{1/n}, \quad h_j = \left(\prod_{i=1}^n h_{jp} \right)^{1/n} \quad (1)$$

Thus, each j^{th} quality attribute has an important degree, a performance degree, and a cost degree.

The fourth step: The threshold value is calculated. The threshold value is used to determine the cells of the IPCA matrix. The arithmetic average is used to determine the threshold value. μ_b , μ_c , and μ_h represent the importance threshold values and the performance threshold values.

$$\mu_b = \frac{\sum_{j=1}^m b_j}{m}, \quad \mu_c = \frac{\sum_{j=1}^m c_j}{m}, \quad \mu_h = \frac{\sum_{j=1}^m h_j}{m} \quad (2)$$

Where m is the number of quality attributes to measure service quality.

The fifth step: The relative position of each of the quality attributes of the service is determined on the IPCA matrix.

The sixth step: Discovering the voice of the customer helps to gain the weight of the customer's wishes. The gap between the importance value and performance of the j^{th} attribute multiplied by its importance value can show the weight of the j^{th} quality attribute. Equation 3 shows that the weight of the j^{th} attribute is denoted by ow_j . Of course, in the developed approach of this research, it will be changed according to Equation 4 due to the addition of cost.

$$OW_j = |(b_j - c_j) \times b_j| \quad (3)$$

$$OW_j = \frac{|(b_j - c_j) \times b_j|}{h_j} \quad (4)$$

For more ease of analysis, it is normalized as follows.

$$sw_j = \frac{ow_j}{\sum_{j=1}^m ow_j}, \quad 0 \leq sw_j \leq 1, \quad \sum_{j=1}^m sw_j = 1 \quad (5)$$

The attributes with more sw_j should be prioritized for improvement (Azar et al., 2016). Therefore, in the IPCA approach, in the same way, attributes with more sw are given higher priority.

4. Results

This research aims to measure and compare the quality of services of two communication networks, Hamrahe Aval and Irancell, using the developed approach of importance-performance-cost analysis and proposing a suitable strategy to improve service quality. The sample includes two groups of users of the Hamrahe Aval network and Irancell. Table 2 shows the results obtained from the IPCA and IPA.

Table 2. The results of attribute ranking from the perspective of Irancell users

	Attribute name	Importance	Performance	Cost	IPCA		IPA	
					Normalized weight	Rank	Normalized weight	Rank
1	Conversation quality	4.197	3.340	4.046	0.0907	5	0.0550	8
2	Network coverage	5.000	3.474	3.395	0.1613	1	0.1165	3
3	Diversity and innovation	4.257	3.330	2.097	0.0515	7	0.0602	7
4	Service Convenience	5.000	5.000	3.426	0.0000	20	0.0000	20
5	Quality in service delivery	5.000	3.330	3.008	0.1564	2	0.1274	2
6	Sufficient number of agencies	2.397	3.707	2.269	0.0444	9	0.0479	10
7	Billing accuracy	2.397	4.318	2.276	0.0652	6	0.0703	5
8	Cost clarification	3.584	3.494	2.982	0.0060	18	0.0049	19
9	Fix possible billing problems	4.186	2.671	3.000	0.1184	3	0.0968	4
10	Competence and skill in responding	2.419	4.318	1.431	0.0409	10	0.0701	6
11	Courtesy and respect	3.524	3.707	1.322	0.0053	19	0.0099	16
12	Efforts to solve audience problems	4.197	3.707	1.891	0.0242	12	0.0314	12
13	Tariff diversity	4.197	4.504	1.891	0.0152	13	0.0197	13
14	Easy to choose and change tariffs	4.197	4.504	1.690	0.0135	14	0.0197	13

	Attribute name	Importance	Performance	Cost	IPCA		IPA	
					Normalized weight	Rank	Normalized weight	Rank
15	Provide sufficient information related to the tariff	2.460	2.188	1.690	0.0070	16	0.0102	15
16	Customer support	3.524	4.318	1.891	0.0329	11	0.0427	11
17	Convenience in transferring problems	2.881	2.704	2.982	0.0095	15	0.0078	17
18	Handling complaints	2.881	2.704	1.903	0.0060	17	0.0078	17
19	Internet network quality	5.000	4.293	2.255	0.0496	8	0.0539	9
20	Internet network coverage	5.000	3.062	1.690	0.1019	4	0.1479	1
	The value of the province	3.815	3.634	2.357				

Based on the results in Table 2, "Network coverage", "Quality in service delivery", "Service Convenience", "Internet network quality ", and "Internet network coverage" are the most important attributes among Irancell network users. The attribute of Service Convenience has the highest performance. The "Conversation quality" costs the most. The "network coverage" attribute is the most important. In contrast, according to Irancell users, this attribute has a relatively high cost and low performance, which according to Table 3, is in the " Concentrate on cost and performance" quadrant. Finally, "Network coverage" and "Service convenience" have the highest and lowest weights in the IPCA approach. However, in the IPA approach, "Network coverage" ranks third in prioritization.

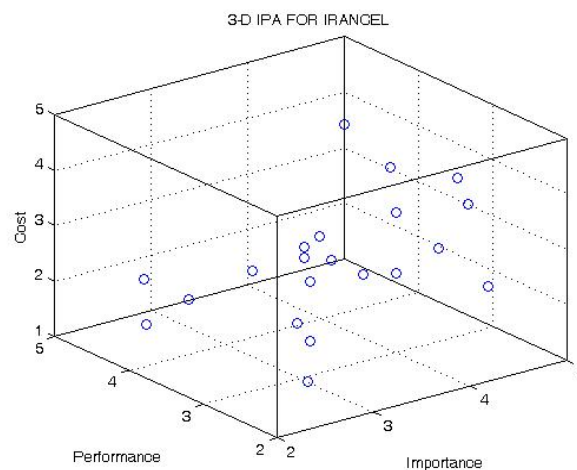


Figure 1. Three-dimensional diagram of Irancell network service quality attribute ranking

It can also be seen in Figure 1 that the cost of most attributes is relatively low. As a result, the threshold value is also low, so it can be concluded that Irancell has successfully implemented cost-reduction policies.

Table 3. The results of ranking the indicators from the perspective of Hamrahe Aval users

	Attribute name (attribute)	Importance	Performance	Cost	IPCA		IPA	
					Normalized weight	Rank	Normalized weight	Rank
1	Conversation quality	4.203	2.662	3.569	0.0552	7	0.0637	5
2	Network coverage	4.949	2.634	3.569	0.0976	2	0.1128	2
3	Diversity and innovation	4.246	3.055	1.728	0.0209	15	0.0498	9
4	Service Convenience	4.949	3.000	4.203	0.0968	3	0.0950	3
5	Quality in service delivery	5.000	1.790	4.203	0.1610	1	0.1580	1
6	Sufficient number of agencies	2.405	3.000	5.000	0.0171	18	0.0141	18
7	Billing accuracy	2.484	3.933	5.000	0.0430	10	0.0354	12
8	Cost clarification	3.551	3.000	5.000	0.0233	14	0.0193	15
9	Fix possible billing problems	4.203	3.000	4.203	0.0507	9	0.0498	10
10	Competence and skill in responding	2.458	3.933	3.000	0.0260	13	0.0357	11
11	Courtesy and respect	3.533	3.000	4.203	0.0189	17	0.0185	16
12	Efforts to solve audience problems	4.157	2.347	5.000	0.0898	4	0.0741	4
13	Tariff diversity	4.224	3.814	5.000	0.0207	16	0.0171	17
14	Easy to choose and change tariffs	4.181	5.000	3.569	0.0292	12	0.0337	13
15	Provide sufficient information related to the tariff	2.471	3.000	5.000	0.0156	19	0.0129	19
16	Customer support	3.569	3.814	5.000	0.0104	20	0.0086	20
17	Convenience in transferring problems	2.940	5.000	3.569	0.0516	8	0.0596	6
18	Handling complaints	2.940	3.814	5.000	0.0307	11	0.0253	14
19	Internet network quality	5.000	3.814	5.000	0.0708	5	0.0584	7
20	Internet network coverage	5.000	3.814	5.000	0.0708	5	0.0584	7
	The value of the province	3.823	3.371	4.291				

Based on the results in Table 3, the "Internet network coverage", "Internet network quality", and the "Quality in service delivery" among the users of the Hamrahe Aval network have the highest importance. The highest performance was related to "Easy to choose and change tariffs" and "Convenience in transferring problems". Finally, "Quality in service delivery" and "Customer support" have been given the highest and lowest priority, respectively. As shown in Figure 3, the Hamrahe Aval service network has high costs in several indicators and should take steps to reduce them.

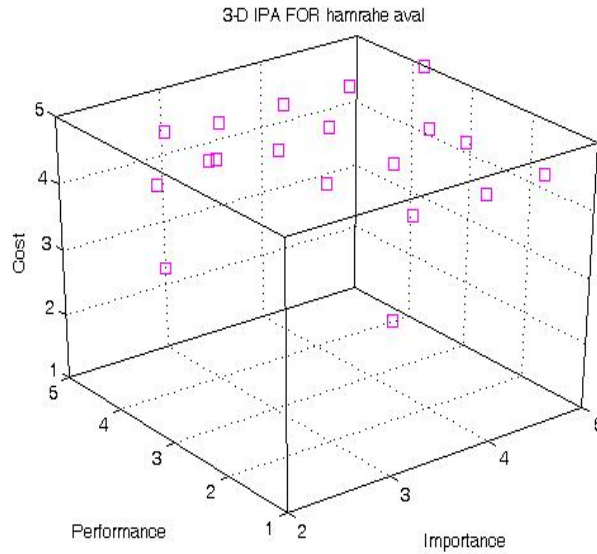


Figure 2. Three-dimensional diagram of the ranking of service quality indicators of the Hamrahe Aval network

According to the results obtained in Tables 2 and 3, it can be seen that among Hamrahe Aval users, the "Quality in service delivery" and "Customer support", and among Irancell users, "Network coverage" and "Service convenience" are respectively the highest and have been the least priority. According to Irancell's cost limit value of 2.35 compared to the cost limit value of 4.29 of the Hamrahe Aval and as can be seen from Figure 3, most of the attributes in the Hamrahe Aval phone have a high cost, so it is suggested to the mobile phone managers to pay special attention to reducing costs.

Table 4. importance-performance-cost matrix

The name of the quarter	Dimension status	Irancell	Hamrahe Aval
		Attribute number	Attribute number
Low priority	Low importance, low performance, low cost	15-8	-----
Possible overkill	Low importance, high performance, low cost	6-7-10-11-16	10-17
The situation is dire	Low importance, low performance, high cost	8-17	6-8-11-15-18
Useless	Low importance, high performance, high cost	-----	7-16
Concentrate on performance	High importance, low performance, low cost	3-20	1-2-3-4-5
Keep up the good work	High importance, high performance, low cost	12-13-14-19	14
Concentrate on cost and performance	High importance, low performance, high cost	1-2-5-9	9-12
Concentrate on cost	High importance, high performance, high cost	4	13-19-20

According to the results of Table 4, in terms of attributes of "Efforts to solve audience problems", "Tariff diversity", "Easy to choose and change tariffs", and "Internet network quality", Irancell is located in the quadrant of "Keep up the good work". Nevertheless, the

Hamarhe Aval company is in this quadrant only in terms of "Easy to choose and change tariffs". As can be seen in Table 4, Irancell Company is not placed in the worst quadrant, i.e., the useless quadrant (in the useless quadrant, the attribute is of little importance from the customer's point of view, but the desired attribute is offered at a high cost and high performance.) However, Hamrahe Aval company is in this quadrant regarding two attributes, 7 and 16. Therefore, according to the fact that the value of the cost base of the first companion company is higher than that of Irancell, and also according to the results of Table 4, it can be said that Irancell is in a better position from the perspective of students according to the attributes examined in this research.

Due to investigating the impact of cost on customer opinions, the performance importance matrix was also checked without the cost dimension, the results of which are given in Table 5.

The difference between Tables 4 and 5, the IPCA matrix with the IPA is as follows:

In the "Low priority" quadrant in the IPA, the specified features are of low importance in terms of importance. Also, the organization is weak in those criteria. In IPCA, the characteristics identified in this quadrant are low importance, performance, and cost. However, in the case that the cost is high, the situation is considered dire in IPCA, which, in addition to the low importance and low performance of its cost, is understood from the perspective of the high customer that this analysis does not exist in IPA.

In the "possible overkill" quadrant in IPA, the specified features are high performance but low importance. On the other hand, the features specified in the "possible overkill" quadrant in IPCA are high performance, low importance, and low cost. If the cost is high, it is placed in the "Useless" quadrant in the IPCA.

In the "Concentrate here" quadrant in the IPA analysis, the specified features are highly important, but the organization has low performance in those features. In contrast, in the IPCA, if the specified features are of high importance, low performance, and low cost, the organization is in the "Concentrate on performance" quadrant, and managers should improve performance. If in the IPCA, the specified features are of high importance and the organization is high in terms of cost and poor performance, it is placed in the "Concentrate on cost and performance" quadrant. In other words, managers should reduce the cost and improve performance. "Keep up the good work" quadrant in the IPA, the specified features are of high importance, and the organization also has a high performance in these features. While in the IPCA, the specified features are placed in the "Keep up the good work" quadrant, which in addition to high importance and the high performance of the organization in these features, the customer

perceived cost is also low, but with increased cost, it is placed in the "Concentrate on cost" quadrant and gives recommendations to companies to reduce costs. Moreover, IPA lacks this analysis.

Table 5. importance-performance matrix

The name of the quarter	Dimension status	Irancell	Hamrahe Aval
		Attribute number	Attribute number
Low priority	Low importance, low performance	8-15-17-18	6-8-11-15
Possible overkill	Low importance, high performance	6-7-10-11-16	7-10-16-17-18
Keep up the good work	High importance, high performance	4-13-14-19	13-14-19-20
Concentrate here	High importance, low performance	1-2-3-5-9-20	1-2-3-4-5-9-12

According to Table 5, it can be seen that the attributes 13-14-19 for Irancell company are placed in both the three-dimensional matrix and the two-dimensional matrix in the "Keep up the good work" quadrant. In other words, these attributes have been in a good position regarding cost, and by removing the cost effect, they are still in this dimension. In Irancell company, feature 4, which is in the two-dimensional matrix in the quadrant of "Keep up the good work", is located. However, considering the cost factor in the three-dimensional matrix, it is placed in the "Concentrate on cost" quadrant. Therefore, the best-proposed policy is the cost reduction policy.

In the Hamrahe Aval company, attributes 9 and 12 are located in the two-dimensional matrix in the "Keep up the good work" but in the three-dimensional matrix in the "Concentrate on cost and performance" quadrant. In other words, it is recommended to the managers of the first company to promote performance improvement and cost reduction policies. In this company, attributes 7 and 16 were in the "possible overkill" quadrant of the 2D matrix. However, the 3D matrix is in the "useless" quadrant. In other words, not only the company's good performance for these attributes is unimportant from the customer's point of view, but also the high cost may cause customers to be pessimistic about the company. Therefore, according to this research, managers can make more rational decisions using the developed IPCA tool.

5. Discussion and conclusion

In customer relationship management systems, the importance and performance and cost of service attributes are very important. Failure of managers to use the appropriate tools and methods to understand the needs and expectations of customers will cause a waste of resources and also turn customers away from the organization; Therefore, the use of customer relationship

management tools to design products and provide services according to the needs and demands of different customer segments has become a necessity for organizations. Analyzing the importance of performance is an effective tool for prioritizing service attributes based on customer needs and expectations and identifying the organization's strengths and weaknesses in the market. Nevertheless, this tool examines only two dimensions of importance and performance of a service attribute. Often heard from customers that the ratio of service quality to price is low compared to competitors, and business managers face the problem of buyers' orientation to competitors' services due to the understanding the unfair prices. So in this research, this tool was developed, and also added the cost dimension to measure the service attributes from all three dimensions of importance, performance, and cost. The method presented in this research to prioritize the services of the two companies, Irancell and Hamrahe Aval, in the mobile phone service industry is a new and practical method that, by adding the cost dimension, tries to determine the priorities from the users' point of view based on the three dimensions of importance, performance and there is an expense.

In order to investigate the effect of cost on the results of the survey, in addition to the IPCA, the IPA was also calculated. The comparison results of IPCA and IPA show that the attribute of "Network coverage" in Irancell company is the priority considering the three dimensions of cost, performance, and importance. This attribute has high cost and importance and low performance. Considering that the cost is high in this attribute, it can be expected that regardless of the cost dimension, the priority of this attribute will decrease, and it is clear from the Irancell results table that it has decreased to priority 3. This attribute is placed in the "Concentrate on cost and performance" quadrant in the three-dimensional matrix. Moreover, in the IPA matrix, it is placed in the "Concentrate here" quadrant here. In other words, focusing on performance without paying attention to the cost will increase the cost, and as a result, customer satisfaction will not be achieved.

For Hamrahe Aval users, the network coverage feature is in second place with low performance, high importance, and relatively lower cost than the provincial value. This feature was also ranked second in the IPA and the analysis and performance matrix, it is placed in the focus here quadrant. In the IPCA matrix, it is also placed in the focus on performance quadrant.

As shown earlier, the IPA approach for both companies suggested focusing on this "network coverage" feature. However, the results of the IPCA show that Irancell should reduce the cost in addition to improving performance, which is important from the IPA results that have yet to be discovered. Therefore, according to the results of IPCA, it is suggested that Irancell managers

improve network services and reduce or at least keep the costs constant. Nevertheless, this feature is a performance improvement for the Hamrahe Aval company.

Among other important and valuable features from the customers' point of view can be mentioned the Internet network coverage. The priority of "Internet network coverage" for Hamrahe Aval users has changed from rank 5 in IPCA to rank 7 in IPA, which means that cost is an influential factor in "Internet network coverage" in Hamrahe Aval. In other words, the cost has caused a higher priority (priority 5). In contrast, the results, regardless of the cost aspect, as can be seen, have been placed in a lower priority (priority 7). The proposal of IPCA for this feature is focused on cost; therefore, cost reduction policies are suggested to managers. However, this feature in the IPA approach is placed in the "Keep up the good work" quadrant, and company managers with this approach remain unaware of customer dissatisfaction with the cost and may lose their customers.

The status of the "Internet network coverage" feature is entirely different for Irancell users. The results of Table 4 for Irancell company show that the feature of "Internet network coverage" has high importance, low performance, and low cost, and it is placed in the quadrant of focus on performance. The priority of this feature in terms of IPA is in first place, while this feature is in the fourth place in terms of IPCA. In other words, the low cost of this feature has reduced customer dissatisfaction to some extent, and as a result, the rating of this feature has become the fourth for improvement. Therefore, the best policy for Irancell managers is to improve performance.

Therefore, according to the present research results, adding the cost factor to the importance and performance matrix will better show the existing reality and ultimately lead to better decision-making by managers. According to Table 4, Irancell company is placed in the "Keep up the good work" quadrant regarding four attributes 12-13-14-19, but the Hamrahe Aval company is only in this quadrant in attribute 14.

Also, Irancell performs better than the Hamrahe Aval company in the status of "useless" and "fatal" quarters. According to the results obtained from Table 4 and as seen in Figure 3, most of the attributes in the Hamrahe Aval company have a high cost, so in general, it is suggested that company managers pay special attention to reducing costs. Among the limitations of this research can be pointed out the statistical population, that the prioritization of the service features for two companies, Irancell, and Hamrahe Aval, has been done based on students' opinions. While the customers of these two companies are more than students, it is suggested that a wider statistical population should be selected and investigated in future research.

Disclosure statement

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