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Service Quality and Mobile Phone Customer Satisfaction in a Region in Peru

Rudy Arpasi Pancca[1], José Huanca Frías[2], José Morales Rocha[3], Enrique Parillo Sosa[2], René Huanca Frías[4], Samuel Pérez Quispe[5], Danny Villegas Rivas[6]*

[1] Professional School of Industrial Engineering. Universidad Nacional Mayor de San Marcos, Peru.
[2.] Professional School of Public Management and Social Development. Universidad Nacional de Juliaca, Peru.
[3.] Professional School of Public Management and Social Development. Universidad Nacional de Moquegua, Peru.
[4.] Faculty of Engineering. Universidad Nacional Amazónica de Madre de Dios, Peru.
[5.] Professional School of Statistical and Informatics Engineering. Universidad Nacional del Altiplano. Puno, Peru.
[6.] Faculty of Civil Engineering. Universidad Nacional de Jaén. Cajamarca, Peru.

*Corresponding author: Danny Villegas Rivas. Email: danny_villegas1@yahoo.com

ABSTRACT:
One of the problems that exists today is the poor service provided by mobile phone operators to users who make use of these services. Therefore, the present research aims to analyze relationship between the service quality provided by mobile phone operators and users satisfaction, as well as to design the service quality metrics for mobile phone companies in region of Puno, Peru in 2017. A 490 users sample was used. Factor analysis was used for service quality metrics and Spearman correlation to determine relationship between service quality and user satisfaction was used. Four factors were obtained that determine the mobile phone service quality metrics. It was evidenced that there is a relationship between quality service and its characteristic dimensions (physical evidence, service reliability, responsiveness and empathy) with user satisfaction.

Keywords:
Service quality, metrics, relationship, satisfaction, mobile phone.

INTRODUCTION

At present, the teleinformatics development provides the living conditions improvement of the population, proof of this, worldwide there is evidence of a permanent effort to implement communication networks, connectivity and penetration of their use, as well as integration of human groups and the information dissemination on science and technology that contributes to socioeconomic development. Currently, there are alternative solutions to communication requirements presented by a population with increasingly sophisticated solutions in the field of telecommunications, in particular the existence and popularization of the mobile telephony use as a profitable alternative from an economic approach is evidenced. and feasible from the technical point of view, for the provision of voice communications services, from anywhere in the world. The mobile telephony use has become an indispensable instrument for the human being, which serve as a communication tool, however, the multiple communication companies that provide service to all people who use cell phones do not provide a service suitable to the customer. Services provided by telecommunications companies in Peru are regulated by OSIPTEL, the telecommunications regulator. Thus, in terms of quality and suitability in the service provision, including information veracity provided to the user, it is established that customers can claim the following: Problems derived from an inadequate network functioning, which generate user dissatisfaction, such as imperceptible communication, noise and interference on the line, the impossibility of being heard and intermittent service, as well as problems that arise as a result of service provision itself or of breach of Operating Company obligation to truthfully inform users about the service or about the status of the reports and claims they have made (OSIPTEL, 2015).

Regarding satisfaction with the mobile service, which is basically referred to: service signal availability (making / receiving calls), telephone service quality during the call (no noise, interference, cuts, etc.), service coverage of mobile telephony in general (signal outside the home). Regarding time, user waits to be attended when he calls the company to make a query or claim, the solution to his problem, the ease that the operating company gives him to file a claim by phone, is generally pending, such as a shows that no operator has been able to satisfy needs of its customers, because they are in transit and it is not known if they are

satisfied, therefore quality of suitability and perceived waiting time is unknown. According to OSIPTEL reports, in 2003 there were 37,699 users and as of June 2017 there are 1,117,758 Mobile Telephony users. What makes the telecommunications service with the greatest growth potential, being mobile phones and broadband internet access. Most requested products and services seek to expand in the market by offering additional next-generation services to the most demanding users. In addition, these mobile phone companies provide these services in provinces, rural areas and in segments with lower income levels. However, as penetration increases, the average revenue per user will tend to decrease OSIPTEL, 2017).

OSIPTEL promoted greater user access to mobile phone service, so that currently 80 out of 100 inhabitants have a mobile line to communicate. Peruvians have at least one mobile phone and in many cases they have more than one phone line. The exponential leap in mobile telephony in Peru has made it possible to go from 9 million lines in 2006 to just over 32 million mobile lines as of December 2011. Mobile telephone coverage in districts of Peru has tripled, because more than five years ago only 433 districts were served. Competition level in the Peruvian market has taken a great leap with the entry of a fourth competing mobile operator; which further streamlines the telecommunications market. New regulations established by the Supervisory Body for Private Investment in Telecommunications (OSIPTEL) seek to promote healthy competition between different mobile phone companies, especially in services provided to mobile phone users. An important fact has been the application of Number Portability regulations for mobile services as of January 2010, which allows a user to change mobile phone operator while keeping her phone number. This has generated a higher level competition in mobile segment.

One year after beginning to apply portability, a total of 153 thousand mobile line subscribers have exercised the right to change their mobile phone service provider without losing their phone number, with which there is no longer the risk of losing their mobile phone number, network of contacts. In 2012, 14.00% of mobile phone owners had internet on their mobile device and other additional services (free Facebook). However, text messages (SMS) represent the most widely used service of those offered by the mobile platform. From point of view of user, service quality is a dynamic concept, it fluctuates according to the current experiences that will conceive the future expectations of user; Therefore, one way to obtain the necessary information to increase and maintain the quality of the service provided is through its constant measurement. It is also a complex construct which depends on many aspects or dimensions present in the provision of services, linked to user satisfaction, which gives it a higher level of complexity. Such a link has been pointed out by numerous authors such as Münch (1998), Pizam & Ellis (1999), Oliver (1980), Deming (1986), Hoffman and Bateson (2012) and Lovelock et al. (2010), who have evidenced the existence of distinctions and disagreements in terms of the impact of service quality on user satisfaction. That is why there is a need to investigate the level of user satisfaction since the entry of new mobile operators to the market, in order to contribute as an analysis tool for future research will be based on the results obtained in the present investigation; and this rapid growth of users of the service provided by the new mobile phone operators in such a short time of operation is motivated to investigate the degree of customer satisfaction.

MATERIALS AND METHODS

Design of the Investigation

This Research was carried out in the Puno Region, Peru in 2017. According to the National Institute of Statistics and Informatics (NISI), it is the ninth most populated place in Peru, as indicated by the census carried out by the NISI on October 22 from 2017; However, according to the OSIPTEL report in 2017 there are 1,117,758 users who use a Mobile Phone, in this case according to Mitacc M. (1996); in his book he points out that in practice a finite population with a large number of elements is considered an infinite population. The sample to apply in the factor analysis should be used a sample 10 times greater than the number of variables or items (N = 10k where k is the number of items or variables; Nunnally, 1978; Thorndike, 1982), so the sample will be 490 users.

For this research, service quality metrics have been designed that were subsequently validated and as a consequence these service quality metrics sheets were applied to mobile phone customer, to measure the relationship between service quality and customer satisfaction, and then measure each dimension of service quality (Physical Evidence, Service Reliability, Responsiveness, Empathy) with User Satisfaction.

Statistical analysis

For the statistical analysis, the KMO test was used to compare the magnitudes of the general or simple correlation coefficients with respect to the magnitudes of the partial correlation coefficients. If the sum of the squared partial correlation coefficients between all pairs of variables is low compared to the sum of the squared correlation coefficients, then the KMO index will be close to one and this will be considered positive and

indicate that you can continue with factor analysis. But if low values are obtained with the KMO index, then it indicates that the correlations between variables pairs cannot be explained by the other variables and, therefore, it is not feasible to carry out the factor analysis since the KMO index will move away zero. Similarly, the Bartlett Sphericity Test was used to test the Null Hypothesis that states that the variables are not correlated in the population. That is, it checks if the correlation matrix is an identity matrix. Those results that present a high value of the test and whose reliability is less than 0.05 can be considered as valid. In this case, the null hypothesis is rejected and the analysis continues.

The analysis of the relationship between the Service Quality and the Physical evidence dimensions, Service Reliability, Responsiveness, Empathy with mobile phone user satisfaction in Puno, Perú, 2017 was carried out using Correlation by ranges of Spearman and factorial analysis, whose model is defined as follows (for details Montoya (2007)):

$$X_1 = l_{11}F_1 + l_{12}F_2 + ... + l_{1m}F_m + \varepsilon_1$$
$$X_2 = l_{21}F_1 + l_{22}F_2 + \cdots + l_{2m}F_m + \varepsilon_2$$
$$X_p = l_{p1}F_1 + l_{p2}F_2 + \cdots + l_{pm}F_m + \varepsilon_p$$

that we can express in a matrix form as: $\boldsymbol{X} = Lf + \varepsilon$ where:

X is the vector of the original variables.

L is the factor matrix. Collect the factorial loads or (saturations).

l_{ih} is the correlation between variable j and factor h.

f is the vector of common factors.

ε is the vector of unique factors.

Since both common and specific factors are hypothetical variables, it is assumed, to simplify the problem, that:

a. The common factors are variables with zero mean and variance 1. Furthermore, they are assumed to be unrelated to each other.

b. Unique factors are variables with zero mean. Their variances can be different. They are supposed to be unrelated to each other. Otherwise the information contained in them would be in the common factors.

c. Common factors and unique factors are unrelated to each other. This hypothesis allows inferences to be made that distinguish between common and specific factors.

Based on the model and the hypotheses formulated, it can be shown that the variance (information contained in a variable) of each variable can be decomposed into: that part of the variability that is explained by a series of common factors with the rest of variables called the commonality of the variable and the part of the variability that is specific to each variable and that, therefore, is not common with the rest of the variables. This part is called the unique factor or specificity of the variable.

$$Var(X_j) = l = l_{j1}^2 Var(F_1) + l_{j2}^2 Var(F_2) + \cdots + l_{jm}^2 Var(F_m)$$
$$Var(\varepsilon_j) = l_{j1}^2 = l_{j2}^2 + l_{jm}^2 + Var(\varepsilon_j)$$

l_{jh}^2 represents the proportion of total variance of the variable X_j explained by the factor h.

$h_j^2 = l_{j1}^2 = l_{j2}^2 + l_{jm}^2$ is the commonality of the variable X_j and represents the proportion of variance that the different factors as a whole explain of the variable X_j. It is, therefore, the portion of that variable that comes into contact with the rest of the variables. It varies between 0 (the factors do not explain anything of the variable) and 1 (the factors explain 100% of the variable).

$Var(\varepsilon_j)$ is what we call specificity and represents the contribution of the single factor to the total variability of X_j.

$l_{1h}^2 + l_{2h}^2 + \cdots + l_{ph}^2 = g_h$ It is what is called eigenvalue (eigenvalue) and represents the ability of the factor h to explain the total variance of the variables. If the original variables were typified, the total variance would be equal to p and g_h/p would represent the percentage of total variance attributable to factor h.

The objective of the factor analysis is, therefore, to obtain the common factors so that they explain a good part of the total variability of the variables.

Initial factors extraction.

At this stage the main factors (principal components) are selected using the principal components method. The components whose eigenvalues (Eigenvalues) are greater than 1 (eigenvalues> 1) are chosen.

Initial factors rotation.

In practice, the rotation methods goal is to simplify rows or factor matrix columns to facilitate interpretation. The rotation method used is VARIMAX which seeks to redistribute the variance throughout all the components in the load matrix. With this, the model is simplified and clearer results are obtained to identify the factors in each component, since this method approximates the high loads to 1 or -1 and the low loads of the unrotated matrix to 0, thus eliminating the existing ambiguities in the unrotated matrix. All analyzes were performed using R software (R Core Team, 2020).

RESULTS AND DISCUSSION

Table 1 shows that KMO (0.876) is greater than 0.5, which indicates that it is acceptable for factor analysis, considering that the closer it is to one (1), the better. Bartlett's sphericity test suggests the rejection (P≤0.05) of the null hypothesis of unrelated initial

variables, therefore, it is appropriate to perform factor analysis.

Table 1. KMO and Bartlett test on the correlations matrix of service quality data and the satisfaction of mobile phone users.

KMO and Bartlett test		
Kaiser-Meyer-Olkin sampling adequacy measure		0.876
Bartlett's sphericity test	Aprox. Chi-square	8927.762
	Gl	435
	P-Value	0.000

Table 2 shows that as many factors as eigenvalues greater than 1 has the analyzed matrix. Likewise, it is shown that there are 4 eigenvalues greater than 1, so the procedure extracts 4 Factors that manage to explain 75.6% of the original data variance. The information in this table will be used to make a decision on the ideal number of factors to extract. Therefore, for a minimum of 95% of the variability contained in the data, it would be necessary to extract four (4) factors. The variance-covariance matrix analyzed represents the correlation matrix of the independent variable (Quality of Service) among the 30 indicators included in the analysis. Since this matrix is 30 x 30 dimensions, it is possible to extract up to 30 independent factors. As shown in the column of accumulated percentages (% accumulated variance), with the 30 factors that can be extracted, it is possible to explain 100% of the total variance, but this does not achieve the objective of reducing the number of dimensions necessary to explain the data.

Table 2. Factor analysis on service quality data and mobile phone user's satisfaction.

Total variance explained									
Component	Initial eigenvalues			Sums of loads squared from extraction			Sums of rotation loads squared		
	Total	% variance	% cumulative variance	Total	% variance	% cumulative variance	Total	% variance	% cumulative variance
1	11.740	39.135	39.135	11.740	59.135	59.135	4.038	13.462	13.462
2	2.067	6.890	46.025	2.067	6.890	66.025	3.830	12.766	26.228
3	1.557	5.191	51.215	1.557	5.191	71.216	2.925	9.750	35.978
4	1.315	4.384	55.599	1.315	4.384	75.6	2.701	9.004	44.983

In the matrix of rotated components (table 3), values above one (1) are shown that allow a better exposure of the initial variables obtained for each component. The following are the renamed components based on the initial variables: Component 1. This component encompasses the set of attributes associated with the physical evidence of the mobile phone operators service. This component has been called the Service Physical Evidence Factor, and in turn it alone explains 59.13% of the total variance (Table 1). Component 2. It contains some initial variables that are considered as reliability that the user has. This component has been called the Service Reliability Factor and explains 6,890% of the total variance (Table 2). Component 3. Includes the worker's characteristics, that is, communication skills and willingness to solve a problem and keep users happy. This component has been called the Service Response Capacity Factor, explaining by itself 5.191% of the total variance (Table 2), Component 4. Made up of eight variables associated with characteristics related to the cordial participation of the company worker mobile service to a user. This component has been called the Empathy Factor in the Service, explaining 4,384% of the total variance (Table 2). In this way, the Quality of Service must, in principle, have at least the appropriate combination of these four factors.

Table 3. Rotated Component Matrix on service quality data and mobile phone user's satisfaction.

Rotated Component Matrix				
	Component			
	1	2	3	4
Is the Office Facilities Appearance or Mobile Phone Service Centers consistent with the services they offer?	0.807			

Do you find comfort with the furniture and the spaces in the Authorized Offices or Service Centers?	0.761			
Do you find comfort with the personal appearance of the workers of the Authorized Offices or Service Centers?	0.772			
Is there a variety of mobile phone equipment according to each user needs?	0.776			
Are the telephone equipment offered by the Offices or Service Centers of good quality?	0.790			
For you. Is the service quality offered by mobile phone operators always adequate?	0.787			
Are workers well uniformed and / or presentable and neat in appearance?		0.797		
Are you satisfied with the service punctuality provided to you?		0.771		
Do the staff have adequate knowledge when carrying out their work?		0.794		
Do workers show a positive attitude towards customer service?		0.781		
The service signal availability (make / receive calls) is?		0.799		
Is the quality of the telephone service during the call (no noise, interference, cuts, etc.) is it?		0.764		
There is mobile phone service coverage within your home (signal within the home)		0.783		
There is coverage of the mobile phone service in general (signal outside the home)		0.752		
Are the workers communicative and assertive in the service provided?			0.752	
Do you consider that the staff is willing to solve the problems you have with the service?			0.791	
Do you consider that workers have the capacity to respond to your needs?			0.763	
Is the waiting time to be attended to when you call the company to make a query or claim is consistent?			0.753	
Did they give you a solution to your problem when you call the company to make a question or claim?			0.791	
Is there clarity of the information provided when you call the operating company?			0.795	
Does the operating company make it easy for you to file a claim over the phone?			0.773	
In the event that the purchased equipment is sold to you damaged: do they change your equipment or do they give you a provisional one while the equipment is verified?			0.756	
Do authorized offices or centers give personalized attention to customers?				0.765
Do workers show courtesy and kindness with care?				0.750
Do the workers demonstrate their skills in dealing with the client and knowing how to listen to their needs?				0.753
Are the workers always ready to help with your needs?				0.794
Do you find the waiting time for an official to attend to the company offices comfortable?				0.774
Do you find clarity in the answer to your query when you go to the company offices?				0.793
Did they give you a solution to your problem / attention to claims when you go to the company offices?				0.805
Did they make it easy for you to file a claim when you go to the company offices?				0.771

Relationship between Service Quality and user satisfaction

Table 4 shows the correlation coefficients by Spearman ranges to determine the relationship between the service quality and its characteristic dimensions with the mobile phone user satisfaction in the region of Puno, Peru. There it is observed that, in general, the service quality and its characteristic dimensions are significantly related (P <0.01) with the mobile phone users satisfaction.

Table 4. Relationship between service quality and dimensions associated with the mobile phone user's satisfaction.

Variable	Mobile phone user satisfaction	
	Spearman's coefficient	P value
Service Quality	0,765	0,000
Dimension		
Physical evidence	0,616	0,000
Reliability in service	0,746	0,000
Answer's capacity	0,634	0,000
Empathy	0,662	0,000

FINAL CONSIDERATIONS

A relationship was evidenced between the service quality and its characteristic dimensions, namely; physical evidence, service reliability, responsiveness and empathy with the mobile phone user's satisfaction in the Puno region in 2017. The quality metrics were defined and theoretically validated through factor analysis, which determined that; The first component encompasses the set of attributes related to the physical evidence of the mobile phone operators' service. In the same way, a second component was determined that contains some initial variables that are considered as the reliability that the user has in relation to the service. In that order, a third component was determined, which includes the worker's characteristics, including communication and the willingness to solve a problem and keep users happy. Finally, a fourth component was identified, which contains eight variables associated with the empathy factor.

Conflict of Interest:
Authors declare no conflict of interest

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