Quality analysis in the service sector of an electricity generating company according to Servqual's model

Análisis de calidad en el sector servicios de una generación eléctrica empresa según el modelo Servqual

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Abstract— Measuring the quality of service levels in self-service, rural and urban emergency services, as well as the wait time for a possible customer until connection offered by an electricity company continues as an objective, based on the perspective proposed by Parasuraman et al. (1985). In order to detect the sources of problems in service quality and seek improvement, this model is based on the principle of comparison between the perceived service and the expected service, considering that the expectations of customers is strongly influenced by their personal needs.The survey had participation from 2450 customers distributed in the 98 neighborhoods of the municipality, which were already familiar with the services provided, since, in the state of Paraná, this company is currently the only electricity utility to serve the population. To analyze the survey, dimensions related to Access, Efficiency, Receptivity, Ease of understanding, Flexibility, Customization, Privacy, Wait time for service, Trust and Security were considered. The perceived quality evaluation for these services was considered average for practically all dimensions. This study also presents a comparison between the ten dimensions evaluated and the method of the main components of factor analysis, responsible for extracting five new dimensions: Trust in the company, Flexibility in providing service, Ease of self-service, Security and Speed. And even though these new dimensions have significantly reduced the initial number of variables analyzed, there was no loss in relation to the importance of the services provided by the company.

Resumen— Medir los niveles de calidad de servicio en autoservicio, atención de emergencia rural y urbana, así como el tiempo de espera de un posible cliente hasta que la conexión ofrecida por una empresa eléctrica sigue el objetivo del estudio basado en la perspectiva propuesta por Parasuraman et Alabama. (1985). Para detectar las fuentes de problemas en la calidad del servicio y buscar la mejora, este modelo se basa en el principio de comparación entre el servicio percibido y el esperado, considerando que las expectativas de los clientes están fuertemente influenciadas por sus necesidades personales. La encuesta contó con la participación de 2.450 consumidores, distribuidos en 98 barrios del municipio, que ya conocían los servicios prestados, ya que, en el estado de Paraná, esta empresa es actualmente la única concesionaria eléctrica para atender a la población. Para el análisis de la investigación se consideraron las dimensiones relacionadas con Acceso, Eficiencia, Receptividad, Facilidad de comprensión, Flexibilidad, Personalización, Privacidad, Tiempo de espera para el

servicio, Confianza y Seguridad.

La valoración de la calidad percibida de estos servicios se consideró media para prácticamente todas las dimensiones. Este estudio también presenta una comparativa entre las diez dimensiones evaluadas y el método de los principales componentes del análisis factorial, responsable de extraer cinco nuevas dimensiones: Confianza en la empresa, Flexibilidad en la prestación del servicio, Facilidad de autoservicio, Seguridad y Velocidad. Y aunque estas nuevas dimensiones han reducido significativamente el número inicial de variables analizadas, no hubo pérdida en relación a la importancia de los servicios prestados por la empresa.

I. INTRODUCTION

The advance of local and international competition, resulting from the globalization of the economy and coupled with the instability of the socio-economic environment, has been growing at an accelerated rate in recent decades. These changes impel practically all organizations (public or private, large or small, that aim or not to profit) to search frantically to obtain and maintain an important competitive advantage byManzi (2019).

As the competitiveness between the companies becomes more fierce, analysis of the factors that contribute to the maintenance and conquest of markets becomes essential(CALICCHIO; MARCONDES, 2016) Therefore, measurement and analysis of the service provided to consumers and potential customers is essential, since perception and concern on behalf of customers about the quality of service is what ensures the company's success in the market where it operates.

Service quality is, therefore, a factor of strategic relevance for the company and should be measured and analyzed, especially considering its growing relevance in an increasingly competitive context(SANJEEV BORDOLOI, 2019).

For companies, monitoring the evolution of the market has resulted in a growing concern with the quality of the service (the risk of loss of competitiveness is recognized, with consequences that are never negligible, resulting from the neglect of this aspect). At the same time, companies seek to rationalize investment in quality control and/or improvement activities, in order to ensure a favorable cost/benefit ratio.

In this context, the translation of the basic concepts of Total Quality in developing technical and human skills constitutes one of the main actions adopted by organizations in the search for sustainable competitive advantages. Recognition of the fact that the role of each individual is to receive the work of others, add value to it and provide it to the next person in the process (FERNANDES; LOURENÇO; SILVA, 2014) and, thus, enable the delivery of the product in accordance with the demands of the final consumer, increases the need to promote and develop human resource skills and values. This need is common to organizations in general, including those in the area of electricity (KHARUB; MOR; SHARMA, 2019). The electricity service sector is constantly undergoing major changes, always focused on customer satisfaction(DROSOS *et al.*, 2020). This phenomenon favors increased competitiveness and the constant search for new guidelines so that companies can achieve success in their journeys. To be successful in the new economy, a history needs to be created, it has to be a place where the customer likes to be, to choose and to buy from.

In the last few years, companies in the electricity sector have been trying to understand their own customers in order to be able to serve them better and, consequently, build customer loyalty over time. This loyalty comes from perfecting the services provided to customers and, mainly, through the forms of access available to customers for these services (LINDEN, 2016).These innovations in forms of distribution go through various types of solutions, some that significantly reduce the direct costs of operating services, and others, more remote, that can reach customers wherever they are(ENGLAND, 2015; LEE, T. B., 2018).

Knowing what customers, enlightened consumers, value in quality service provided that meets their minimum quality standards, and knowing their tolerance levels for the services provided is paramount so that services are increasingly provided under their point of view to add value to the customer(FARAH *et al.*, 2006).

In this new scenario of increasingly sophisticated services, a closer approach to each customer is essential through a careful analysis of their individual behavior and peculiarities. And the result of this deeper investigation serves to guide segmented and personalized actions, according to what customers think and value in having electricity services provided(LI *et al.*, 2020).

Measuring the quality of service levels in self-service, rural and urban emergency services, as well as the wait time for a possible customer until connection offered by an electricity company continues as an objective, based

on the perspective proposed by Parasuraman et al. (1985), *Service Quality Gap Analysis*, one of the first methods to take the expectations of customers in relation to a given service into account. In order to detect the sources of problems in service quality and seek improvement, this model is based on the principle of comparison between the perceived service and the expected service, considering that the expectations of customers is strongly influenced by their personal needs.

II.   MATERIAL AND METHODS

Aiming at the search for savings, time, data reliability and operability (BARBETTA, 2014) this work opted for inferences about the population of a city in the countryside of the State of Paraná, using probabilistic sampling. According toRoss (2019), this technique allows the maximum acceptable sampling error to be determined.

The sampling plan of this survey was *simple random sampling,* with allocation of the sample size proportional to the size of the population (FÁVERO; BELFIORE, 2017; MINGOTI, 2007) resulting in a sample corresponding to 3.047% of the total user population of the services provided by the energy company, in other words, 2450 respondents. The fieldwork for data collection was carried out between February 17 and March 26, 2020 and included face-to-face methods.

To determine the indicators for evaluation the quality of service provided by the energy company, the dimensions were checked according to the construction of a specific questionnaire adapted to the language of the services provided by the company.

Initially, two specific questions were prepared for each dimension, but as the idea would be to contemplate only ten dimensions in the survey instrument applied to users of the services provided by the company, it was necessary to assign three specific questions to the privacy dimension and three specific questions to the wait time for service dimension, since the questionnaire was organized containing twenty-two questions, as shown in Table 1.

Table 1 - The main dimensions proposed by Parasuraman et al. (1985)

Dimension	Questionnaire stimuli
Access	1. Ability to locate self-service stations. 2. Ease of accessing self-service.
Efficiency	3. Certainty of trust in self-service. 4. Simplicity of use.
Receptivity	5. Quick service response. 6. Ease of getting information.
Ease of understanding	7. Ability to interpret easily. 8. Adaptation to customer preferences.
Flexibility	9. Recognizes and adapts to your usage history. 10. Offer consumer manual to meet customer needs.
Customization	11. Quality in billing. 12. Ability to simulate rates and allow the total price to be determined.
Privacy	13. Ability to compare the service provider's products and services. 14. Provides personal information protection. 15. Clarification meetings with customers.
Wait time for service	16. Average emergency service time - urban. 17. Average emergency service time - rural. 18. Average time of possible customer until connection.

Trust	19. Ability to solve your needs.
	20. Service accuracy.
Security	21. Trust in connecting with the website.
	22. Simplicity and security in clarifying doubts about the services provided by the company.

Source: Prepared by the authors (2020).

The questions were designed with the aim of portraying the concept of each dimension proposed by Parasuraman et al. (1985) as much as possible using a language appropriate to the services provided by the energy company, object of this work.

For eight dimensions, two questions were developed and for two dimensions, three questions were developed. For the access dimension, two stimuli were used, one referring to the ability to locate self-service stations and another that observes the ease of accessing self-service(LEE, T. B., 2018; LEMON; VERHOEF, 2016). The two incentives related to the efficiency dimension included the confidence that customers have in accessing self-service and the ease (whether it is simple or not) in using it. For the receptivity dimension, two stimuli were used, one related to the quick response in the service and the other related to the ease of getting information. The stimuli related to the ease of understanding dimension sought to portray the ability to easily understand and adapt to customer preferences. For the flexibility dimension, questions were used regarding the recognition and adaptation to the history of use and the options for searching for information through a consumer manual(SON; HA; KHUYEN, 2018). The questions related to the customization dimension were designed to evaluate the quality of billing and the provider's ability to allow comparisons between products and services and provide customers with rate simulations to determine the total price. For the privacy dimension, three stimuli were used: one related to the ability to compare products and services, another for the protection of personal information and another for the clarification meetings with customers(LEE, J. *et al.*, 2013). The Wait time for service dimension was also addressed with three issues related to the average time in urban emergency service, the average time in rural emergency service and the average wait time of a potential customer until connection. In order to evaluate the trust dimension, stimuli were used regarding the ability to solve customers' needs and the accuracy of the services provided by the company's electricians. Finally, for the security dimension, two questions were prepared that dealt with trust in connecting to the company's website and simplicity and security in clarifying doubts regarding the services provided(KHADEMLOO; MOOSAZADEH; KHOSRAVI, 2019).

After structuring the 22 questions, the data collection instrument was designed according to four aspects:

Introduction. This aspect was characterized by presenting what the questionnaire intended to evaluate, as well as the name of the respondent, the neighborhood to which they belonged and the date of the interview. This first step also includes an explanation of the rules for the correct completion of the questionnaire, in a clear and precise manner.

Frequency of use of services provided by the company. In this second aspect, we sought to identify the degree of proximity of the customer to the services available by the service provider company and their degree of use. It is worth mentioning that option 6 (do not use) was included, which would serve as a filter, since the preamble already stated the condition that the respondent had used the services at least once(PARASURAMAN; BERRY; ZEITHAML, 1991). According to Bitner et al. (2008), this proximity to the evaluated services is indispensable for the customer to be more certain about the positive and negative aspects resulting from the transaction.

Customer evaluation of the dimensions of the quality of services provided by the company. This aspect can be characterized as the culmination of the survey, as it was there that the respondent was able to measure the performance levels of the services offered by the company according to their expectations, which were verified under two approaches(LEMON; VERHOEF, 2016; MAHMOUD; HINSON; ANIM, 2018). The first approach considered the minimum level of service performance, in other words, the service considered adequate by the customer. The second approach considered the level of performance actually desired. As the questionnaire was prepared containing twenty-two questions and in the format of three columns, these two stimuli also started from the focus given to the dimensions of Servqual's model, already reported in more detail. As the columns used the nine-point *Likert* scale, varying from "low" to "high", the third column that focused on the perception of

the service provided had to contain the option "don't know", predicted by Parasuraman et al. (1985) for cases in which the customer did not want or could not comment on the performance of the service provided in that specific stimulus.

Personal data. In this last aspect, the profile of the respondents was established through identification of demographic variables(KOTLER, 1998; KOTLER; AMSTRONG, 2008) such as sex, education level, income range and age.

III.   RESULTS AND DISCUSSIONS

After a final cleanse, the data collection instrument was reproduced and distributed to potential users of the services provided by the energy company.

In the data tabulation, each column gave rise to a 2350x22 dimension matrix (two thousand three hundred and fifty lines per twenty five columns). The matrices will be referred to from then on by the MA (minimum acceptable) matrix, MD (maximum desirable) matrix and NP (perceived level) matrix, reflecting the expectations of users in relation to the levels considered. In order to relate

the service quality measures proposed by Parasuraman (ZEITHAML; BERRY; PARASURAMAN, 1996), the difference between the NP and MA and NP and MD columns was made and the quality perceived by the user was obtained through the column of the perceived service and the appropriate service (NP-MA), characterized as MAS, or even, measure of adequacy of the service(PARASURAMAN, 2002; PARASURAMAN; BERRY; ZEITHAML, 1991; ZEITHAML; BERRY; PARASURAMAN, 1996). On the other hand, the desired quality was obtained through the column of the perceived service and the desired service (NP-MD), characterized as MSS, or even, a measure of service superiority. As the matrix referring to the perceived level (NP) is in the do not know option, and this would also affect the subtraction between the matrices, so it was decided to first determine the average among the respondents who assigned scores to the services and then make the replacement through this column, since of the 51700 responses obtained by the sample, 27%, or 13959 did not evaluate the services provided by the company, while 37741, or 73% evaluated these same services. To have a better view of the number of unanswered questions, as shown in Figure 1.
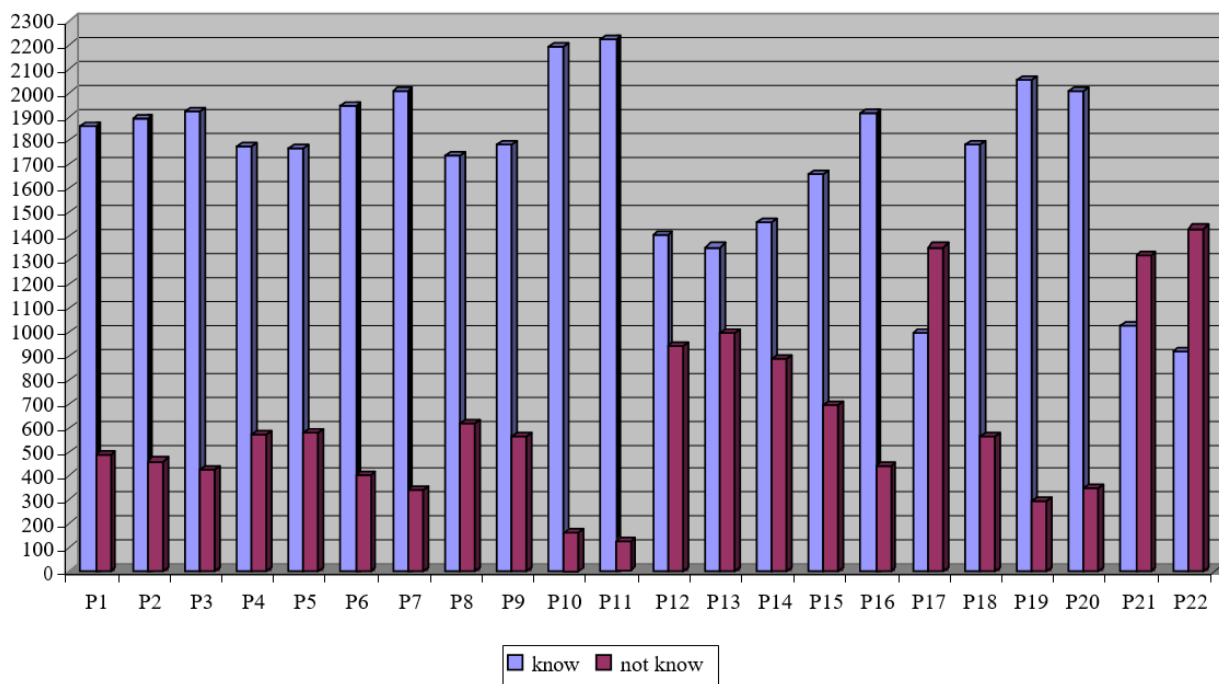

Fig.1: List of accepted and unaccepted responses

Source: Prepared by the authors (2020).

It is important to note that the respondents were very knowledgeable about the services provided by the company in relation to explanatory manuals provided and the quality provided in billing. On the other hand, services

provided onlineproved to be quite ineffective, in other words customers are unaware of the advantages of accessing the company's websiteand obtaining useful information.

To analyze the frequency of use of the services provided by the company and the demographic data obtained in the application of the questionnaires, a Matlab R12□ 17.0 software program was also developed, which, in addition to providing the percentage of each item considered, also presented the graphical analysis representation of all aspects considered, facilitating interpretation and minimizing the analysis time of the service.

Thus, according to the completion of the second aspect related to the frequency of use of services provided by the company, it was observed that the highest rate of use of services was with the variable "less than once a month", which reached 40% of the frequency and "don't use" with 30%. Together, they made up a total of 70% of respondents, as shown in Figure 2. Such percentages indicate that there is no great need to use the services provided by the company in shorter periods, since the respondents pointed out that there are no constant power outages or any other problem that requires technical assistance from electricians.

The analysis also suggests that only 1% of respondents marked the option "once a week" and 2% marked the "once every fifteen days" option. It is important to highlight that a total of 14% mentioned using the company's "daily" services, which means they are using onlineand self-service services to keep themselves more informed, as shown in Figure 2.

Regarding the fourth aspect of the information obtained in the questionnaire area, where the respondent's identification information is found, in other words, the information capable of allowing its characterization according to demographic data. First, the result of the frequency of use by gender of the interviewee is observed. The results show that the number of male respondents, 41%, was lower than that of women, 59%.

The reason women are the biggest users of services is due to the fact that they are closer to the problems related to the service and maintenance of their homes, since they are more dedicated to domestic work than to external work. The educational level variable was divided into five groups: first grade, second grade, higher education, incomplete higher education and post-graduation. The highest concentration of respondents (46%) is in the high school segment and that, of the total of 2350 respondents, 32% have only finished elementary school.
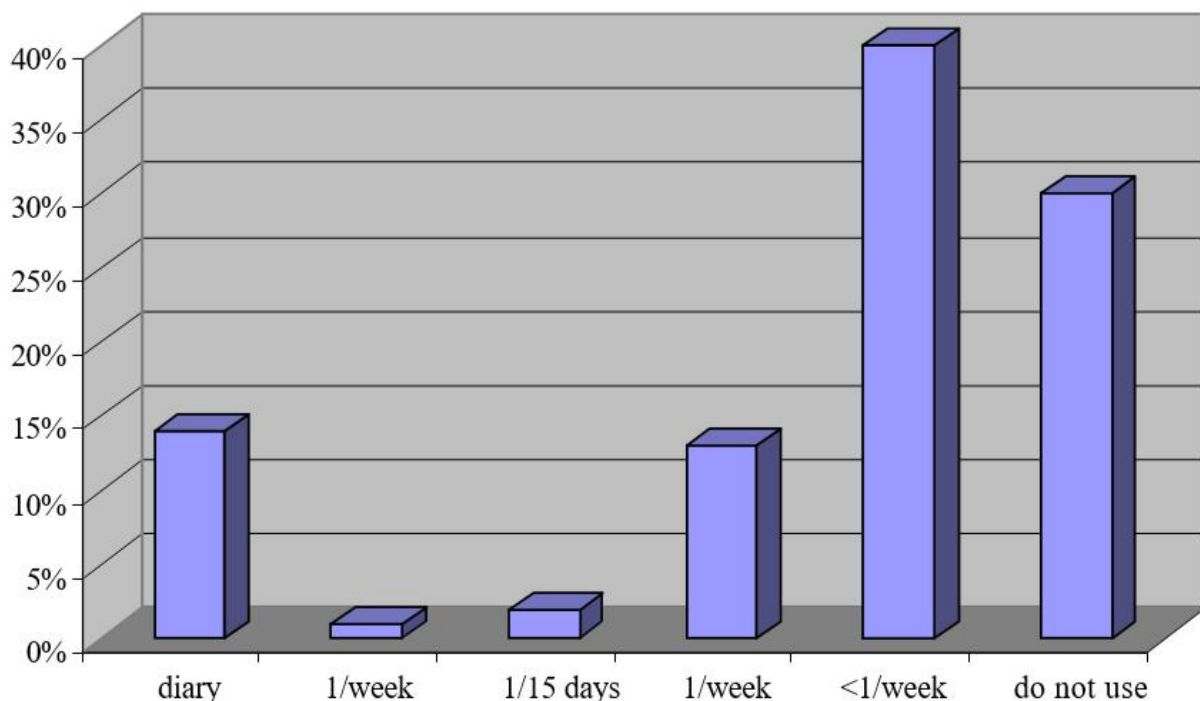

Fig.2: Frequency of use in services
Source: Prepared by the authors (2020).

Likewise, the percentage of respondents in the postgraduate segment is not important, as it accounts for only 2% of the segment's total. Customers in the incomplete higher and complete higher education segments total just 20%, which leads to the belief that customers with a higher level of education are also less

frequent users of self-service and online services. The results shown reflect the country's education: few manage to enter higher education and complete it according to their expectations. Even less is the number of people who are specialized in an area. Another major problem identified is related to the respondents' income, which were divided into six groups: (1) up to R$ 1500.00, (2) between R$ 1501.00 and R$ 2500.00, (3) between R$ 2501.00 and R$ 3500.00, (4) between R$ 3501.00 and R$ 5000.00, (5) between R$ 5001.00 and R$ 10000 and (6) over R$ 10,000. It was found, in this section, that a large number of people concentrated in the lower income brackets, in other words, of the total of 2350 respondents, 1974 receive monthly salaries below R$ 1500.00, and among those interviewed 0% receive income above ten thousand reais and 0.04% earn between five and ten thousand reais.

But even in the lowest income bracket, below R$ 1500.00, the frequency of use of the company's services is relatively high, as the interviewees stated that they use the services at least once a week or even every fifteen days. It should also be noted that many respondents, despite having an income below R$ 1500.00, made a point of showing the exact amount they receive monthly: of the 1974 respondents who are in this group, 1300 receive something just around R$ 1000.00.

The analysis of the last demographic data, age, shows that this variable was distributed in five age groups, with intervals of ten years. The first group includes people up to 20 years old and the last group includes all people over 50 years old.

There is a concentration of the sample in the age group between 31 and 40 years old, with 31% of respondents, followed by the group between 21 and 30 years old, with 26%. The age group above 50 years old had the second smallest representation of the sample, behind only the group up to 20 years old. Although the survey was carried out at times that did not coincide with

lunch and dinner, when there is the highest concentration of people in their homes, it can be seen that the highest attendance of people at home is concentrated in the age group of 31 to 40 years, with 734 people from the total interviewed.

The results verified for the group with less representation in the sample, people under 20 years old, demonstrate that even in this age group, the youngest, are not home as often in relation to the rest of the sample, which certainly proves that, the older you are, the more difficult it is to get a job. In addition, it must be considered that the 14% of respondents over 50 years old already receive their pensions or have some health problem that prevents them from working.

3.1 Analysis of the dimensions of the quality of services provided by the company

As the quality of the services provided by a company can be considered as the difference between the expectations that customers have of the service performance, both for the service itself and for the perceptions of the service received(BITNER; OSTROM; MORGAN, 2008; LEMON; VERHOEF, 2016; MAHMOUD; HINSON; ANIM, 2018), its measurement is obtained through the difference between the desired and the observed score. And from this difference, the idea of service superiority can be detected, considering that the first two columns (Table 2), acceptable minimum and desired maximum, define a limited range between them, the so-called tolerance zone, where the evaluations considered within the limits established for the quality must be found, according to the expectations of the users(PARASURAMAN; BERRY; ZEITHAML, 1991).

In this sense, Table 2 presents the score for each of the twenty-two questions, now called variables, that evaluated the quality of the services provided by the Paraná energy company and which have already been mentioned during the development of this work.

Table 2 - Average scores for MA, MD and NP matrices

Variables	Minimum accepted	Maximum desired	Perceived level
v1	4.2983	7.5557	5.6632
v2	4.2362	7.4774	5.5972
v3	4.4574	7.4911	5.7060
v4	4.4757	7.5745	6.2053
v5	4.5055	7.5889	6.0678
v6	4.4740	7.5221	6.2894
v7	4.4728	7.4681	6.4643
v8	4.4333	7.4434	6.0738

v9	4.2945	7.4004	6.1156
v10	4.3915	7.5715	6.5847
v11	4.6864	7.8498	6.7470
v12	4.2979	7.3647	5.9015
v13	4.2353	7.3263	5.8157
v14	4.5919	7.5987	6.3820
v15	4.2334	7.2664	5.8312
v16	4.7468	7.6906	6.1699
v17	4.5770	7.8102	5.7138
v18	4.4813	7.5774	5.9066
v19	4.4566	7.5047	6.5981
v20	4.6481	7.5962	6.9036
v21	4.1887	7.4260	6.1210
v22	4.0800	7.4562	6.0894

Source: Prepared by the authors (2020).

The variables involved in the evaluation were quoted below the acceptable minimum, since there was no coincidence of levels in any variable, as can be seen in Figure 3.
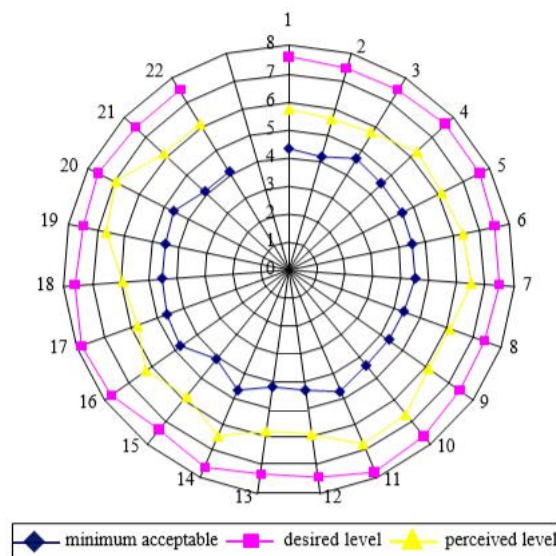

Fig.3: Mean scores for MA, MD and NP matrices

Source: Prepared by the authors (2020).

Prior to the analysis of the information according to each variable, it is important to present the basic statistics on the evaluation levels of the variables: the average of the scores attributed to the minimum level is 4.4083; the desired level is 7.5255; and the perceived level is 6.1340 (Figure 4). Considering that the average of the nine-point *Likert* scale is 5, then users have a high degree of expectation in relation to the services provided by the company(CHEN *et al.*, 2017).
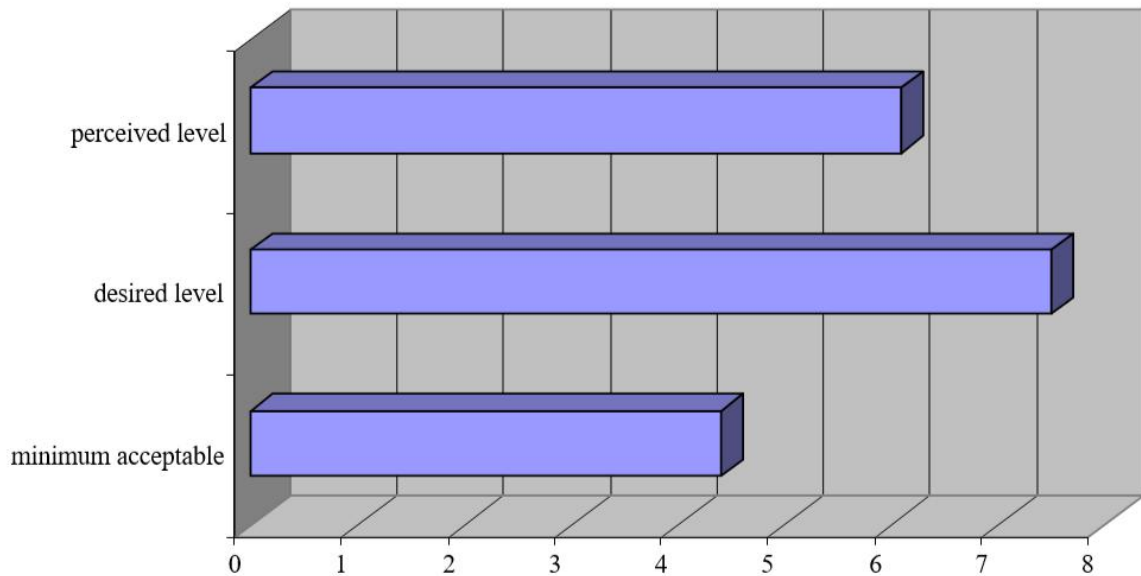
Fig.4: Average scores obtained by variable

Source: Prepared by the authors (2020).

From this information, it is possible to establish the tolerance zone for each of the surveyed variables. This tolerance zone, according to Parasuraman et al. (1994), has what the customer believes can be done, or that the service provider would be able to do, as limits. This constitutes the level of quality desired by the customer and what the customer is willing to accept, in other words, the minimum level of acceptance(PARASURAMAN; ZEITHAML; BERRY, 1994).

Comparing the score obtained in the perceived level fields, desired level and minimum level for each dimension, as shown in Table 5, it can be noted that the ease of clarifying doubts on the company website variable, with index 4.0800, was the one that had the lowest score in the field corresponding to the minimum expected service level, while the variable with the highest demand for the same field was related to the average wait time for urban emergency service variable, with an index of 4.7468.

On the other hand, in the analysis of the notes of the desired service, in other words, the one with the highest degree of expected quality, the quality in billing variable appears first, with an index of 7.8498, followed by the average wait time for rural emergency service variable, with a 7.8102 index (the maximum possible amount being 9.0000).

In the quality in billing variable, a problem arose during the application of the questionnaire in the neighborhoods of city. Several people, when answering

the questionnaire, asked about the service provided by the meter readers. However, it should be mentioned that this service was not part of the twenty-two variables analyzed, since it is a service that is outsourced by the company. However, in order for the company to become aware of this problem, a second questionnaire was prepared only containing questions related to the service provided by the meter readers. 10 neighborhoods in the city were randomly chosen and 20 people from each neighborhood were interviewed. The results are presented in Table 3.

Table 3 - Outsourced service of the meter readers

Neighborhoods	a) Incorrect reading	b) Correct reading
Neighborhood 1	8	12
Neighborhood 2	10	10
Neighborhood 3	8	12
Neighborhood 4	8	12
Neighborhood 5	12	8
Neighborhood 6	9	11
Neighborhood 7	8	12
Neighborhood 8	10	10
Neighborhood 9	10	10
Neighborhood 10	10	10

Source: Prepared by the authors (2020).

In general, correct reading, characterized by

marking consumption and delivering the invoice by mail, took place in five neighborhoods. Incorrect reading, characterized by the consumption marking made by the meter readers only passing in front of the customers' house and not having contact with the meter, happened only in one neighborhood. This neighborhood showed the need for a second study. For the other neighborhoods analyzed, the amount remained practically the same for both readings, correct and incorrect. It is clear that it is important for the company to be aware of this fact and to verify what the factors are that lead the outsourced service of the meter readers to be performed incorrectly(CHEN *et al.*, 2017; LEMON; VERHOEF, 2016).

Resuming the analysis of the dimensions, in relation to the customers' perception of the services provided, in other words, the level of quality observed by the customers, it can be noted that the evaluations with lower indexes were related to the ease of accessing self-service variable, with a score of 5.5972. In turn, the variable best evaluated was accuracy of electricians' external service, with a score of 6.9036 (out of a maximum of 9.0000). This demonstrates that the body of local electrical technicians is very good, but there is room for improvement(ZEITHAML; BERRY;

PARASURAMAN, 1996).

Figure 5 shows the discrepancy observed between the *Perceived Service* and the *Desired Service* and between the *Perceived Service* and the *Minimum Adequate Service* for each of the variables. For MSS (NP-MD), the negative indices represent the distance found between the perception of the quality of a dimension and the maximum desired for it. No variable received a positive index, in other words, no variable was evaluated as having a higher measure of service. It is also observed that the worst evaluations were for the variables average wait time for rural emergency service (-2.0964) and consumer manual (-1.9868). As for MAS (NP-MA), the discrepancies capture how far a service is from being adequate, which Parasuraman (2002) called "a measure of the adequacy of the service." It is observed that all variables were evaluated as adequate to the minimum level of service expected by the respondents. For these variables, positive service adequacy measures were established, in the following order: accuracy of the electricians' external service (2.2555), consumer manual (2.1932) and ability to solve their needs (2.1415)(PARASURAMAN; BERRY; ZEITHAML, 1991).
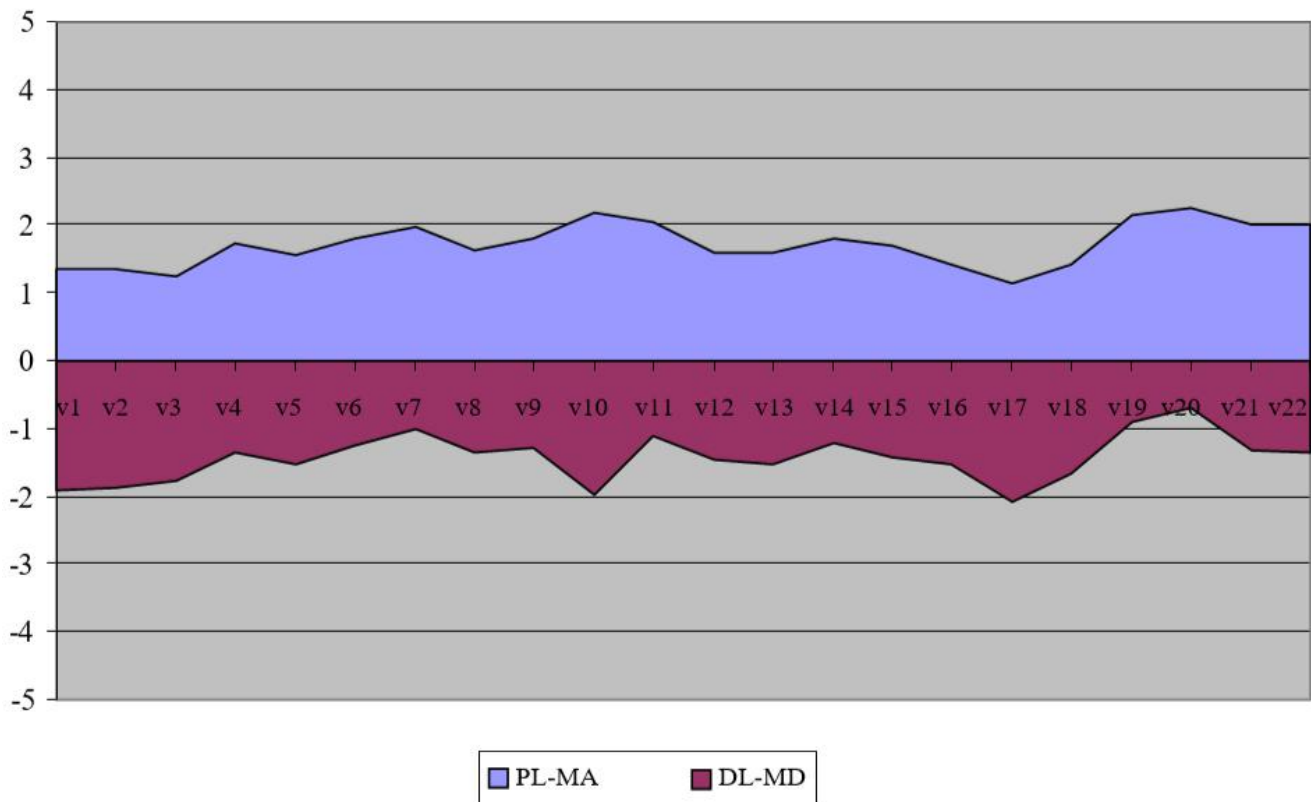

Fig.5: Scores of the differences: NP-MA and NP-MD

Source: Prepared by the authors (2020).

It is observed in relation to the tolerance zone identified for each variable, in other words, the interval between what the customer expects as the minimum adequate for the services and what they really want, the measure can be measured (PARASURAMAN; ZEITHAML; BERRY, 1994) through the difference between the MD and MA matrices of each variable in this study.

The sizes of these zones suggest the customer's willingness to tolerate different levels of quality for the same dimension(PARASURAMAN, 2002; PARASURAMAN; BERRY; ZEITHAML, 1991; ZEITHAML; BERRY; PARASURAMAN, 1996). Here,

the smaller the measurement, the lower the customer's tolerance for variations in service quality, and the greater the measurement, the greater the acceptance of variability in services without loss of quality. It is observed that the variables with the highest tolerance zones are, in order: ease of answering questions on thecompany's website(3.3762), onlineaccess for customers (3.3071), self-service stations (3.2574) and ease of accessing self-service (3.2412). The variables that have the smallest tolerance zones are, in order: average wait time for urban emergency service (2.9438), accuracy of the electricians' external service (2.9481) and need of little information for understanding (2.9953).

Table 4 - Adequate, desired and perceived score by dimension

Dimensions	Questions	Minimum accepted	Maximum desired	Perceived level
Access	P1	4.2983	7.5557	5.6632
	P2	4.2362	7.4774	5.5972
Efficiency	P3	4.4574	7.4911	5.7060
	P4	4.4757	7.5745	6.2053
Receptivity	P5	4.5055	7.5889	6.0678
	P6	4.4740	7.5221	6.2894
Ease of understanding	P7	4.4728	7.4681	6.4643
	P8	4.4333	7.4434	6.0738
Flexibility	P9	4.2945	7.4004	6.1156
	P10	4.3915	7.5715	6.5847
Customization	P11	4.6864	7.8498	6.7470
	P12	4.2979	7.3647	5.9015
Privacy	P13	4.2353	7.3263	5.8157
	P14	4.5919	7.5987	6.3820
	P15	4.2334	7.2664	5.8312
Wait time for service	P16	4.7468	7.6906	6.1699
	P17	4.5770	7.8102	5.7138
	P18	4.4813	7.5774	5.9066
Trust	P19	4.4566	7.5047	6.5981
	P20	4.6481	7.5962	6.9036
Security	P21	4.1887	7.4260	6.1210
	P22	4.0800	7.4562	6.0894

Source: Prepared by the authors (2020).

In Table 4, the questions are grouped according to their respective dimensions proposed by Servqual's model. In it, it is possible to verify the indicated indexes, in each

one of the twenty-two questions used in this work, to verify the perceived quality (that is the perceived level column) and the level of the customers' expectations of the

services provided by the company, both the desired level and the minimum level of adequacy of services(PARASURAMAN; ZEITHAML; BERRY, 1985; PARASURAMAN; BERRY, 2004).

3.2 Relative importance of dimension analysis

In the applied questionnaire, respondents were asked to assign a degree of importance to each of the twenty-two questions mentioned above, analyzing the appropriate service, the desired service and the perceived service. Now considering only the expectations of customers, as this is the main objective to achieve the quality of a service, the questions were grouped according to the dimensions initially proposed, as shown in Table 5.

Table 5 - Indicators of Servqual's model for the ten dimensions

Dimension	Minimum accepted	Maximum desired	Perceived level
Access	4.2667	7.5166	5.6302
Efficiency	4.4666	7.5328	5.9557
Receptivity	4.8989	7.5555	6.1786
Ease of understanding	4.4531	7.4558	6.2691
Flexibility	4.3430	7.4860	6.3592
Customization	4.4922	7.6073	5.8586
Privacy	4.3169	7.3971	6.0096
Wait time for service	4.6017	7.6927	5.9301
Trust	4.5524	7.5505	6.7514
Security	4.0994	7.4411	6.1052

Source: Prepared by the authors (2020).

From the analysis of this table, it appears that the respondents attribute a greater importance of expectations to the dimension that relates to wait time for service (7.6927) and also to that dimension they attributed a higher score to the adequacy of the service (4.6017), in relation to the others dimensions. In relation to the perceived service, the highest score was given to the Trust dimension (6.7514). However, as can be seen, the differences do not appear to be large, and to prove this statement, it was applied to Manova. Specifically, at Manova, the Bartlett test was used(HAIR, J. F. J. *et al.*, 2009; HAIR, J. F. *et al.*, 2009). Then, for each of the ten dimensions, the null hypothesis of the dimensions having the same relative importance was tested. This was done for each of the variables in the ten dimensions represented by vectors corresponding to the adequacy of the service (MA), the expectations of the customers (MD) and the perceived service (ND). And, as mentioned earlier, these ten dimensions emerged from the grouping of twenty-two questions according to the proposal of Parasuraman et al. (1985).

To check whether the null hypothesis would be accepted or not, Manova was used in the Statistica 12.0 software. The program provided the *p*-values0.4872,

0.0845 and 0.1066 for the matrices MA, MD and NP, respectively. The greatest variation occurred in the MD matrix, where the *p*-valuewas 0.0845. If the *p*-valueswere lower than the cut-off value of 0.05, it would be necessary to identify which components would be significantly different from the null hypothesis vector. Regarding the test statistics, as is well known, the Bartlett test with $n = 22$ and the Fischer test with $p = 1$ and $k = 10$ were applied. Thus, for all vectors, the theoretical value was greater than the statistic, which proves the non-rejection of the null hypothesis that all means are equal(HAIR, J. F. J. *et al.*, 2009). Arranging the data of the vector of customer expectations in relation to the twenty-two questions, grouped in the ten dimensions already foreseen, the previous result is confirmed, in other words, H_0 is not rejected at a significance level of 5% because the theoretical value 32.7 is greater than the value of the 8.6830 statistic. This result occurred in the arrangement of the data for the adequacy of services and perceived services vectors.

3.3 Factorial analysis of Servqual's gap

So far, Servqual's model has not been called into question, it has been considered as correct. Then, using the Statistica 12.0 software, Cronbach's alpha coefficient was

extracted to verify the consistency of the questions and it was concluded that the dimensions proposed by Zeithaml et al. (1996)are adequate to the data, in other words, the values obtained for Cronbach's alpha show great internal consistency, indicating a high homogeneity and equivalence of responses to all items(HAIR, J. F. J. *et al.*, 2009). For the minimum, desired and perceived levels, the coefficients indicate indices in the amount of 0.9629, 0.9702 and 0.9450, respectively. Also, the total item-score correlation indexes obtained are acceptable, in other words, for the minimum, desired and perceived levels, the indices showed 0.5466, 0.6003 and 0.4437, respectively, satisfying the minimum criterion of 0.2000 considered for that instrument. This means that the levels have a good level of discrimination, which allows the presence of homogeneity between the items that make up the instrument to be confirmed. Furthermore, if any variable indicates little functional equivalence between the response of that item and the response obtained in the total scale, it can be eliminated by observing the lowest values for the total item-score correlation index.

It was also verified if the five dimensions proposed by Zeithaml et al. (1996)are similar to the ten that were determined for this study. However, it is important to mention that the factor analysis was performed in the measure of superiority of the service (MSS), considering that this is the main difference for the company to check its quality in relation to its services provided. Applying factor analysis, extraction of the main components took place using a specified proportion of the variance ($\square= 0.6$), and the explained variance of all components was considered to be greater than 60%. In addition, a maximum number of factors equal to five was also set and after Varimax Rotation, there were factorial loads(HAIR, J. F. J. *et al.*, 2009; HAIR, J. F. *et al.*, 2009). Looking at Figure 6, the proportion of variance explained by the first factor, which is 51.8%, by the second factor, which is 5.9%, by the third factor of 4.6%, by the fourth factor of 3.7% and the fifth factor of 3.1%, totaling an explanation of the variance of 69.1%. Thus, the F1 factor presents the largest factorial loads for variables 11 to 15, which are those defined to evaluate the dimensions conceived as customization and privacy. The F2 factor has greater factorial loads in variables 5 to 7, which intend to evaluate the receptiveness and ease of understanding dimensions, but disregards variable 8, which would be a component of the latter dimension. The F3 factor presents the factorial load in variables 1 to 3, created to evaluate the access and efficiency dimensions, but also disregards variable 4, which in the applied questionnaire was part of the efficiency dimension. The F4 factor, in turn, has factorial loads in variables 21 and 22, responsible for the security dimension. Finally, the F5 factor presents a factorial load in only one variable, variable 16, which is partly responsible for the wait time for service dimension.
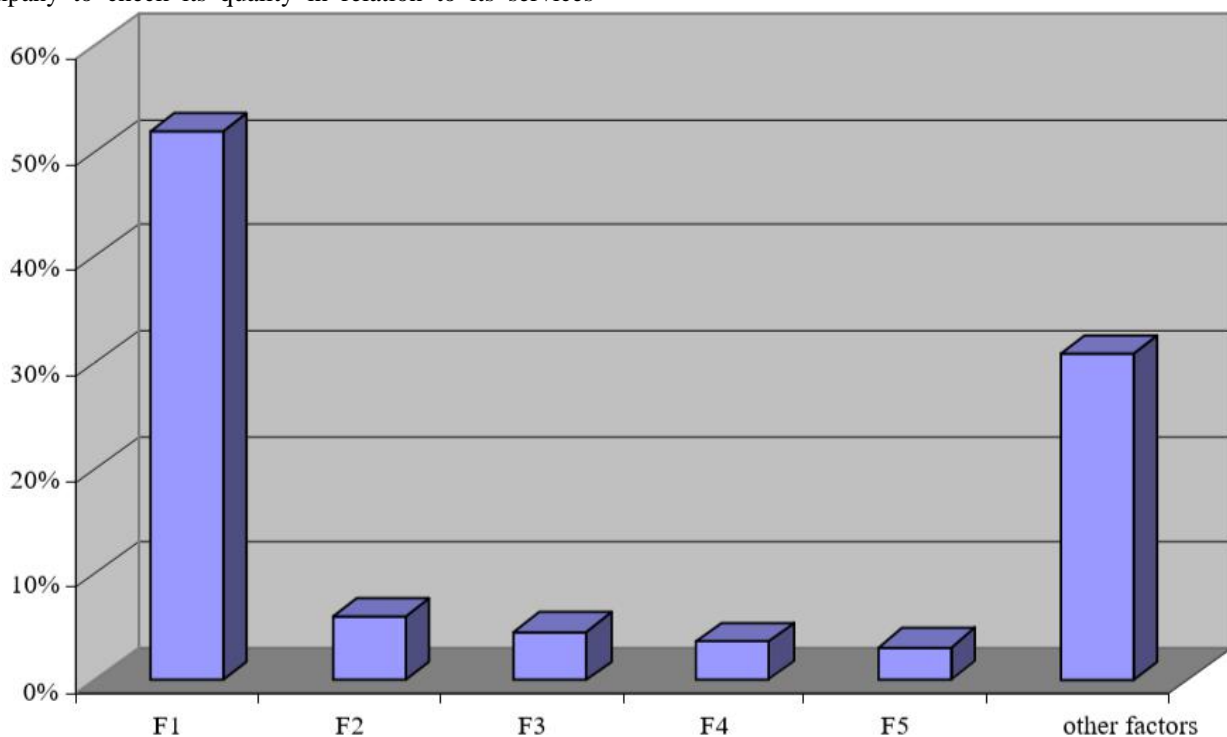

Fig.6: Factors extracted by Varimax Rotation

Source: Prepared by the authors (2020).

In addition to observing the factorial loads, it is important to mention that the commonality of the variables was considered good, since they are greater than 0.6(HAIR, J. F. J. *et al.*, 2009). This occurred in virtually all variables. With the results of the factor analysis by the principal component method, five latent variables (factors) are identified, representing the dimensions of perceived quality, since the F5 factor represents a single variable and, in this case, it is directly defined by variable 16. The F1 factor brings together variables 11 to 15, merging the dimensions of customization and privacy, which were initially established and which are now called Trust in the company. The second F2 factor groups the variables 5 to 7, established to evaluate the receptiveness and ease of understanding dimensions, now called flexibility in providing services. The F3 factor aggregates variables 1 to 3, initially created to represent the dimensions of access and efficiency and are now called ease of self-service. The F4 factor aggregates variables 21 and 22, representing the security dimension and which will continue to be called the *security*dimension. And finally, the F5 factor is defined by variable 16, partly representing the wait time for service dimension, which is now called *speed*. Some variables that were part of the pre-established dimensions were eliminated, as is the case of variable 4, representing the simplicity of service via the agency and which was part of the efficiency dimension. Likewise, variable 8, which represented the opportunity for the agency to easily adapt to customer requirements and included in the ease of understanding dimension, was also eliminated. The criterion for these exclusions was the low commonality between the variables.

IV.   CONCLUSIONS

The growing modernization of society requires that there is, increasingly, an improvement in the quality of services provided by any organizational institution. And the satisfaction of customers' needs and expectations has been a constant in this search for quality, especially considering that the quality perceived by the customer must match or exceed their expectations (GHOBADIAN; SPELLER; JONES, 1994). In this context, and through the interdisciplinarity between service management, quality, customer satisfaction and technological innovation, this work sought to identify the services provided by energy company, define dimensions of the quality of these services and validate them through the application of a tool measurement. All of this to achieve the main objective, which was to measure the quality levels of the services provided by the company. From the results obtained, it can be concluded that the services provided by the company, in

general, are at average levels of perceived quality, in the first half of 2018, along with a sample of the population of the municipality. Furthermore, considering the opinion ofRamaswamy et al. (1996) that service quality measures must be *reliable*, since the measurement instrument or the measurement procedure must always assign the same value to something that is being measured, *valid*, as they have to measure what they really propose, *relevant*, because they have to provide useful information, which cannot be replaced by other measures that are already being used, and *consistent*, because they have to present a certain degree of balance in relation to the objectives of the system of measurements and consistency with the other measurements used, it can be said that Servqual's model, developed by Parasuraman et al. (1985), proved to be reliable, valid, relevant and consistent as a tool for measuring the quality of services provided for the company. Regarding the adaptations in Servqual's model carried out in this work, with the changes in the questions, directing them to the services provided by the company, it is concluded that they proved to be effective for the success in obtaining the opinion of customers who use this type of service.

It was also found that the services provided by the company are already part of the daily lives of customers, and that, in this type of service, the level of quality requirements is high, highlighting the dimensions related to wait time for service, customization, responsiveness and trust, which must be carefully worked on by the company. This fact shows that services must be provided according to the customer's time availability, since the service process takes place remotely and with extensive participation from the user.

In addition, it was evidenced that there is no restriction on the use of services regarding the level of education, sex or age of the customer. The quality observed (according to data analysis) obtained a low evaluation, mainly in the tolerance zones of the customization and wait time for service dimensions, all linked to customer service, which confirms the survey carried out by Noor and Nasirun(2015). According to him, the main problems detected by service providers are exactly those related to customer service, such as agility in solving problems and speed in service.

The trust dimension, which had the highest perceived quality index, was also the one that reached the lowest tolerance zone, between 4.5524 and 7.5505. As Lemon and Verhoef (2016) argues, this dimension is considered by customers to be the most important because they increasingly value trust in the services provided, which is also confirmed by the results of this survey, since

the dimensions linked to trust and ease of understanding were those that obtained the highest levels of need from the customers.

In addition to these factors, it is important to highlight the achievement of the results through factor analysis. The ten dimensions proposed in preparing the instrument were re-grouped into five, namely: *Trust in the company*, *Flexibility in providing service*, *Ease of self-service*, *Security* and *Speed*.

In general, it can be concluded that quality management of organizations is a promise to improve the quality of life, reconsidering work relations and social responsibility, especially when they aim at transforming people. Thus, the dimensions investigated in this work (access, efficiency, receptivity, ease of understanding, flexibility, customization, privacy, wait time for service, trust and security.) Proved to be valid for the purpose of measuring the quality of the services provided by the company. And even using factor analysis, the five new dimensions reaffirmed the results obtained through Servqual's Gap, that is, the services that obtained the highest scores, as is the case with the Accuracy of the service provided by electricians variable, were not part of the new dimensions, but not because it is a less important service. The fact that this variable and some others, which also obtained high scores, were excluded does not mean that they are not necessary to prepare a new question to evaluate the quality of the services provided.

Finally, it can be said that the services provided by the Paraná energy company must continue to be improved, especially with its customers, to expand and develop new businesses and provide customers with sources of satisfaction and reliability.

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