

KEY VARIABLES TO ENHANCE THE QUALITY OF INTERNET SERVICE IN A REGION OF THE INTERIOR OF THE AMAZON: AN EXPLORATORY ANALYSIS USING MODELING OF STRUCTURAL EQUATIONS

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ABSTRACT

Competitiveness driven by technological, economic, social, and environmental factors has changed how customers purchase products and services. This research aimed to analyze variables to enhance the quality of the internet service in a region of the interior of the Amazon, considering the users' perceptions. To this end, the survey was adopted as a research strategy, and the structural equation modeling method was used to validate the proposed conceptual model. To validate the model, a literature search was carried out, variables of the quality of internet services were selected, and a survey was carried out with users in a region in the interior of the Amazon, totaling 204 respondents. The averages of the variables indicated that the variables "navigation (speed and stability)," "service agility (repair)," and "user support (maintenance)" were the most important perceived in the opinion of internet service users in the region analyzed. On the other hand, those of less importance in the perception of the user were the variables "price of the service," "warranty time" and "flexibility of the service (package options available)." As for the validated conceptual model, the importance of three relevant constructs was verified: sale, attendance and usability. From a theoretical point of view, the results achieved here can contribute to the expansion of debates in the area of quality in services, and from a practical point of view, the results contribute to the definition and elaboration of the strategic planning of managers involved in the area. Few studies discuss the quality of internet services in a specific region considered lacking in technological infrastructure, such as the interior of the Brazilian Amazon.

Keywords: Internet services; quality management; quality in services; technological services; PLS-SEM.

INTRODUCTION

Competitiveness driven by technological, economic, social, and environmental factors has changed how customers purchase products and services (Ponsignon *et al.*, 2019) processes and people and improve performance. This represents a tremendous and risky challenge for most organisations. Against this background, this article sets out to explore and understand how the quality management (QM. Chen *et al.* (2020) explain that such changes, in part, are the result of the widespread adoption of new modes of consumption, among others, due to the autonomy of instant access to information.

Three significant events have marked humanity and globally influenced how consumers seek and evaluate telecommunication services (Izogo, 2018; De Muylder *et al.*, 2018). The first was the creation of the internet in 1969 in the United States, which revolutionized the means of communication; the second was the emergence of new technologies, Information and Communication Technology (ICTs), from the mass production of highly technological products; and the third was the phenomenon of continuous digitization, which has intensified the constant access to information and the instant sharing of diversified content (Blagojević and Šćekić, 2021; Grandinetti *et al.*, 2020; Mary *et al.*, 2021).

According to Chen *et al.* (2020), due to frequent technology advances, consumers are increasingly demanding from telecommunications companies the high quality with which products and services are provided, forcing organizations in this sector to constantly adapt. However, Mas-Machuca (2021) knowledge management (KM emphasizes that these requirements are positive and can be converted into elements for the development of strategies and the consequent evolution of the business.

In the context of high competitiveness, it becomes important to adopt management methods to increase the performance of products and services. In this sense, quality management is crucial for achieving objectives, improvement, and customer satisfaction (Grandinetti *et al.*, 2020; Kalia *et al.*, 2021; Kao and Lin, 2016; Schiavo *et al.*, 2018). The evaluation of quality in services allows the organization to observe, from the perceptions of customers, which gaps affect their business, enabling the achievement of improvement and the consequent satisfaction of consumers (Abdallah, 2021; Ampaw *et al.*, 2020; Xue *et al.*, 2019; Zhou *et al.*, 2019).

Quality management, specifically in the telecommunications sector, has been the focus of many studies in several developed countries, such as Germany, the United States, China, and South Korea, as it demonstrates effec-

tiveness in the performance of services in regions with little infrastructure (Zouari and Abdelhedi, 2021).

In the Brazilian context, few studies on the quality of the telecommunications sector consider users' views in a specific region. What exists is research using quality concepts and tools in the analysis of tangible and intangible factors of a context unique and particular to an organization (Oliveira *et al.*, 2013; Oliveira and Laurindo, 2015; Quintella and Vilela, 2007; Theis *et al.*, 2022). Jung and López-Bazo (2020) and Valetin, Machado, and Mountian (2020) their nature, the economic context and the propensity of the government to intervene in the economy influence the process of formulating public policies to deal with the crises' consequences. For this purpose, we compare the emergency policies established by the federal government executive and legislative branches, when studying the evolution of the telecommunications sector in Brazil, concluded that not all regions follow the process of technological development, as is the case of the Amazon region, where some resources such as infrastructure (transport and internet) are still scarce, which compromises the quality of such services in the region.

Considering the context presented, this article aims to analyze variables to enhance the quality of the internet service in a region of the interior of the Amazon through the validation of constructs considering users' perception. For this, the structural equation modeling method was used.

The study is organized in addition to the introduction into five more sections. The following section is composed of the theoretical framework, which presents, in a reasoned manner, theoretical aspects considered relevant for the research development. After this section, the methodological procedures consisting of its main stages are presented. Then, the results are found, along with possible associated debates. Finally, the conclusion of the research is followed by a list of references.

THEORETICAL BACKGROUND

Quach *et al.* (2016) and Ponsignon *et al.* (2019) consider quality management an important factor in developing strategies to improve productivity in products and services. Zouari and Abdelhedi (2021) define quality management as a field of study that encompasses agile and practical requirements that guide and improve existing processes, aiming to ensure consistency and efficiency in results.

De Mulder *et al.* (2018) explain service quality as a cognitive assessment that functions as an indicator of

the performance of the service delivered in comparison with customer expectations. According to Tassabehji *et al.* (2019), service quality increases the company's loyalty and profitability. Perceived service quality should include service processes and results, as they reflect the company's ability to meet customer needs and maintain its competitive advantage (Prentice, 2014).

In the telecommunications sector, the quality of connection, navigation, and user support are considered relevant attributes for customer loyalty. Dimensions of service quality such as automated search, communication between customers, acquisition of information, content, mass customization, and ease of use have direct impacts on competitiveness in telecommunications services (Abd-Elrahman *et al.*, 2020; Pina *et al.*, 2014; Raza *et al.*, 2020). The quality of the internet service perceived by the customer in both aggregated and specific dimensions significantly affects consumer satisfaction since it is understood that customers can only assess whether a particular service is good or bad after using it (Deutrom *et al.*, 2021; Dolinšek and Lutar-Skerbinjek, 2018; Kasiri *et al.*, 2017; Suárez *et al.*, 2016; Xue *et al.*, 2019; Zarei *et al.*, 2019).

The quality of telecommunications service is judged according to customers' perceptions that the quality of the network connection supply is considered strong and stable (Lai *et al.*, 2009), the information and support teams are trained to be receptive to the service channels provided by the companies (Javaid *et al.*, 2021), and if it guarantees the security and privacy of the contractor (Quach *et al.*, 2016).

In addition, when customers encounter problems with their Internet service, they often turn to technical and support staff for help and support, so they are constantly under pressure to perform their jobs reliably and compliantly to meet their productivity goals and provide excellent customer service (Rod and Ashill, 2013). Considering the context of Internet services, the quality of the signals sent must be the same as when they were contracted and any interruption of the connection can result in user dissatisfaction and a poor perception of the quality of the service (Chen *et al.*, 2020; Zhang *et al.*, 2015; Zhou *et al.*, 2019).

The literature presents research on the quality of user satisfaction with internet services. For example, the study carried out by Bartikowski *et al.* (2018) found that the quality of the signal provided influences the economic growth of the population and their respective day-to-day activities, which pointed out that the telecommunications service provided by companies in poor neighborhoods in New York should improve the quality of the signal provided.

In China, Zhang *et al.* (2015) evaluated the quality of internet service provided by electronic devices and realized that providers are more concerned with recovering post-loss customer service than adapting it to consumer demands. In Germany, Gerpott (2018) it explores two relative speed characteristics of broadband connections (customer quality experiences in terms of delivered transmission speeds (1 analyzed the customers' level of satisfaction with telecommunications services and identified that the main dissatisfaction with the services offered is the reduced network speed and the limited number of downloads.

Mary *et al.* (2021) Filipinos may find it hard to choose who's the unrivaled as there are also abundant factors to say a telecommunication company is the finest. This study's foremost objective is to conduct a comparative analysis within the topmost selling ISPs in the Philippines by the means of customer satisfaction. These ISPs ranked as the top four (4 compared student's satisfaction with ISP services in different regions of the Philippines. The study showed that there were not many differences between the companies involved in the research and that both meet users' needs and are always willing to focus more and more on disseminating the quality of their services. The authors concluded that in the Philippines, internet service providers affect the effectiveness of education in the country, especially in the context of the COVID-19 pandemic, in which many educational centers around the world had their teaching adapted to the remote scenario.

Considering this context and analyzing the literature, it was possible to identify variables related to quality in the provision of internet services, and they were considered in the realization of this research with internet users in the interior of the Brazilian Amazon region, aiming to identify the perception of such users regarding the quality of the service and, consequently, generate basic information for strategic decision-making by service providers in that region. **Chart 1** presents a summary of the identified variables and the references that show the importance of each one.

Analyzing the variables presented in **Chart 1**, the importance of considering the speed, stability, customer service, security, privacy, and flexibility of the service is highlighted. Chung *et al.* (2016), Dhasarathan *et al.* (2020), Gerpott (2018) it explores two relative speed characteristics of broadband connections (customer quality experiences in terms of delivered transmission speeds (1, and Saravanan (2020) consider the speed of the internet connection as a relevant variable for loyalty and increased satisfaction because the greater the guarantee of the speed at which data is provided, the greater the trust and satisfaction of users.

Variables	Code	References
Navigation (Speed and Stability)	V-1	(Chung et al., 2016; Dhasarathan et al., 2020; Gerpott, 2018; Saravanan, 2020).
Customer service	V-2	(Gerpott, 2018; Quach et al., 2016).
Security and privacy	V-3	(Kuo et al., 2017; Thaichon and Quach, 2015) value, trust and commitment.
Service flexibility (package)	V-4	(Biczók et al., 2010; Brunetti et al., 2020) network neutrality, and Quality of Experience (QoE).
Service price	V-5	(Biczók et al., 2010; Erevelles et al., 2003; Vlachos, 2016) network neutrality, and Quality of Experience (QoE).
User support (maintenance)	V-6	(Erevelles et al., 2003; Rains and Tsetsi, 2017; Traore et al., 2019; Vaz et al., 2013).
Warranty time	V-7	(Kuo et al., 2009; Rains and Tsetsi, 2017) perceived value, customer satisfaction, and post-purchase intention. Structural equation modeling and multiple regression analysis were used to analyze the data collected from college and graduate students of 15 major universities in Taiwan. The main findings are as follows: (1.
Agility in service	V-8	(Erevelles et al., 2003; Rains and Tsetsi, 2017).

Chart 1. Quality variables

Source: The authors (2023)

Quach et al. (2016) believe that, in addition to the speed provided to the user, service is an important factor in competitiveness. In technology services, especially on the internet, the receptivity and clarification of information should always be appreciated, as customers evaluate the way they are treated as well as the response capacity of the team to the service. Gerpott (2018) states that good service ensures that the customer feels secure in the service offered, increasing their trust and credibility with the provider and the consequent referral to other users.

Thaichon and Quach (2015) consider a significant aspect of the quality of service, in addition to speed and service: the security and privacy with which the internet provider company guarantees the confidentiality of its customers information as they build a relationship of trust and benevolence with the provider (Brunetti et al., 2020). For Kuo et al. (2017), it is an important relationship to maintain the contractor's long-term permanence and increase service satisfaction.

In this context, flexibility is also seen as a quality characteristic since the greater offer of internet service plans means that the company offers its services to different audiences and is adapting to different contexts, especially in the economy, which directly reflects on the social reality and availability of access to services for users (Biczók et al., 2010; Brunetti et al., 2020).

According to Vlachos (2016), service value is the main link between behavioral intent and the exchange between what the customer receives and what the customer offers. Biczók et al. (2010) network neutrality, and Quality

of Experience (QoE) investigate the impact of customer loyalty on price competition between internet providers and point out that the most important factors in choosing this service are related to price and perceived value in increasing customer satisfaction. In addition, Erevelles et al. (2003) believe that price also refers to what consumers pay for access to services, which includes upfront and ongoing costs.

From the point of view of variables related to technical support, Traore et al. (2019) particularly in the management of the maintenance process of the component parts of trains. Service Oriented Architecture (SOA and Vaz et al. (2013) argue that maintenance services are designed to maintain or restore properties related to systems, equipment, and components, which can provide the status of a specific service. In that same logic, Erevelles et al. (2003) define the user support variable as an extension of the ISP's service in ensuring configuration and solving specific network problems.

According to Rains and Tsetsi (2017), the warranty period of the service offered by the internet provider must ensure that features such as speed and signal quality are maintained as per the contract and that the service provider organization must always focus on preventing failures or related problems in the connection of the signal; otherwise, the customer will be dissatisfied and give up the desired service (Kuo et al., 2009) perceived value, customer satisfaction, and post-purchase intention. Structural equation modeling and multiple regression analysis were used to analyze the data collected from college and

graduate students of 15 major universities in Taiwan. The main findings are as follows: (1.

Furthermore, Kuo et al. (2017) suggest that an important factor for increasing the quality of the internet service is related to the agility of the service, as they believe that the responsiveness of the service corresponds to the customer's needs, which reflects not only on the technical aspects of the provider but also on its effectiveness in user response time.

Given the concepts and contexts presented, it is possible to perceive the importance of providing internet services for the economic development of a particular region, especially when considering regions with limitations in technological infrastructure, such as the region of the interior of the Brazilian Amazon considered in this study.

METHODOLOGICAL PROCEDURES

This section first presents the classification of the research and then the step-by-step with steps developed for the execution of this study.

Research classification

Initially, it is worth noting that the research strategies used were a literature review and a survey of users of internet services in a region in the interior of the Brazilian Amazon. The literature review provided the necessary basis to understand the context considered in this study and the elaboration of a research hypothesis, as presented at the end of Section 2. Through the survey, it was possible to understand users' perceptions of health services and internet services offered in the region regarding the quality of the services provided. The approach used was mixed, meaning that the qualitative and quantitative aspects of the research were considered (Gray, 2017). The variables' identification and analysis related to quality in the provision of services are characterized as a qualitative approach. On the other hand, a scale from 1 to 10 to quantify, in users' opinion, the quality of internet provision services through statistical techniques also characterizes the research as quantitative. As for the nature of the research, it is classified as applied research. Considering the objective, it can be classified as exploratory since, through the results achieved, it seeks to promote

the expansion of debates in the area. It is understood that there is still much to be discussed about the context of quality management in services, considering internet service providers. Finally, the instrument for data collection was an online form (a questionnaire), and data analysis was performed using the structural equation modeling technique.

Research Steps

The following steps were developed to carry out the research: a) literature review; b) elaboration of the conceptual framework to be validated; c) data collection through a survey of internet users in the interior of the Brazilian Amazon region; d) analysis of means and validation of the proposed model through structural equation modeling; and e) generation of debates on the results in light of the literature and establishment of conclusions. Each step mentioned will be detailed below.

For the development of the literature review, a search was carried out on the following scientific bases: Science Direct, Taylor Francis, Scopus, and Emerald Insight. Aiming at thoroughly understanding the concepts and scenarios of studies related to quality management in services, and specifically in the provision of internet service, the following search terms were used: "Quality Management," "Quality in Internet Services," "Internet," "Telecommunication Services," and also combined as "Quality AND Internet" and "Services AND Users." The identified articles were downloaded, and their contents were analyzed in detail. Their summary is presented in Section 2. After understanding the concepts of quality management in services and identifying variables in the literature considered in this context, the eight variables considered in this study were defined (**Chart 1**) based on their importance as reported in the literature.

Step two refers to the elaboration of the conceptual framework. The structural model was formed by four constructs aiming to validate them through the analysis of the quality variables that make up each one of them. The constructs were named Quality, Sale, Attendance, and Usability. Quality is composed of a set of eight variables: sale with three, attendance with three, and usability with two, respectively, which together belong to quality management in internet services. The structured conceptual framework is presented in **Figure 1**.

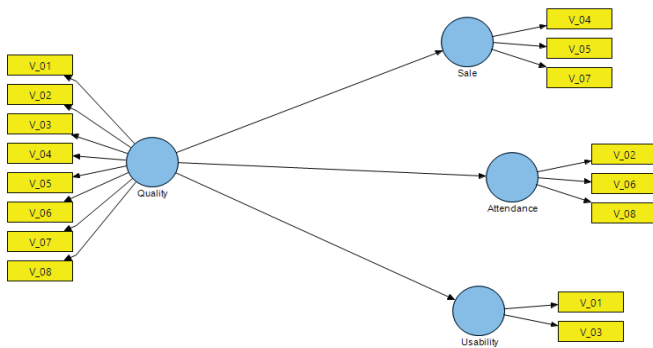


Figure 1. Proposed conceptual framework

Source: Authors (2023)

Then, the development of the survey with the users of the internet service offered by companies that operate in the interior of the Brazilian Amazon was carried out. An online questionnaire composed of nine questions was sent via email, and each respondent was asked to assign a grade to each of the listed questions (quality variables), considering in their opinion how important each one is for enhancing the quality of the internet service. A grade from 1 to 10 was assigned to each variable, where at the extremes, grade 1 indicates that “the variable is not important for promoting an internet with quality,” and grade 10 indicates “this variable is essential for promoting a quality internet.” Intermediate grades could be freely assigned. To define the minimum size of the valid sample, the G*Power software was used with the following parameters: F test for the test family; linear multiple regression, fixed model, and R2 deviation from zero for the statistical test; a test power of 80%; 5% for the probability of error; and an effect size of 15% (Hair *et al.*, 2014). The details and results of the sample size calculation are presented in Section 4, and the questionnaire used can be seen in Appendix A. It is noteworthy that before conducting the survey, this study was approved by a Research Ethics Committee under the number from the CAAE register: 56961422.4.0000.5174.

Then, with the data obtained from the survey, they were treated to validate the proposed conceptual model. For this, the Structural Equation Modeling (SEM) technique was used via Partial Least Squares (PLS), performing a second-order confirmatory factor analysis method using the SmartPLS 2.0 software following the guidelines proposed by Silva *et al.* (2019). Hair *et al.* (2014) say that “PLS regression is a regression-based approach that explores the linear relationships between multiple independent variables and single or multiple dependent variables.” Initially, in SEM, the correct allocation of parameters in thematic constructs is analyzed, and later, the causal relationships between these constructs are analyzed (Xue *et al.*, 2018) but its development is being hindered by

lack of innovation. To improve this, stakeholders are endeavoring to develop more innovative methods by inter-organizational collaboration. Despite its extensive use by other industries such as manufacturing, little is known of how to successfully apply collaborative innovation to ICT. This paper develops a method for studying the effects of a variety of aspects of existing collaborative relationships for ICT innovation using a combination of social network analysis (SNA). Anholon *et al.* (2018) state that second-order Confirmatory Factor Analysis is a specific technique for modeling structural equations that allows confirming the grouping of variables seeking validation, analyzing them in a broad and reflective way, and giving rise to the other latent variables that are sought to be evaluated. The presentation of the results of this study is detailed in Section 4. The validation steps of the proposed conceptual model are presented, considering the guidelines by Hair *et al.* (2014) and Ringle *et al.* (2014). Finally, discussions about the results were elaborated in light of the literature and the establishment of conclusions.

RESULTS AND ASSOCIATED DEBATES

This section presents the results obtained and the debates associated with the literature.

Sample characterization

Considering the statistical factors mentioned in the methodological section, the test was performed to obtain a valid sample size for the research, and a value of at least 55 respondents was obtained. Therefore, the research was carried out with users of internet services offered by providers located in the Baixo Tocantins region, in the interior of the Amazon, who applied through an online form (Google Forms).

The form was made available through social networks and sent to the electronic addresses of higher education institutions in the region. In total, they were sent to 303 users, obtaining a response rate of 67%, totaling 204 respondents. However, filtering was performed, and seven of the 204 responses obtained were excluded because they did not belong to the study context region. As a result, a total of 197 respondents were obtained. Of these 197, 58% are users belonging to the municipality of Cametá, 21% from Mocajuba, 13% from Baião, 4% from Limoeiro do Ajuru, 3% from Oeiras do Pará, 1% from Abaetetuba, 1% from Thailand, and 1% from Igarapé-Miri.

In addition to the sample quantity, the time of use of users with the provider’s service was also characterized, with the perception of 77% between 1 and 24 months of

use, 15% equivalent between 24 and 48 months, 5% from 48 to 72 months, 2% from 72 to 96 months, and 2% of users between 96 and 120 months. At this stage, it was important to know the time users use the service because the more experience they have with the service offered, the greater their perception will be, and in this research, the focus is to identify what the user in the interior of Amazon considers relevant for quality internet service.

Descriptive analysis of the means of each variable

In view of the possession of the data, initially, a descriptive analysis was carried out through the averages attributed by the respondents to each variable. It is worth noting that the variables measured here correspond to the theoretical framework raised in the light of the literature and correspond to the proposed model, namely: Navigation (speed and instability) (V_01), Customer Service (V_02), Security and Privacy (V_03), Service Flexibility (package options available) (V_04), Service Price (V_05), User Support (maintenance) V_06, Warranty Time (V_07), and Service Agility (Repair) V_08. **Figure 2** presents the averages found with the application of the survey.

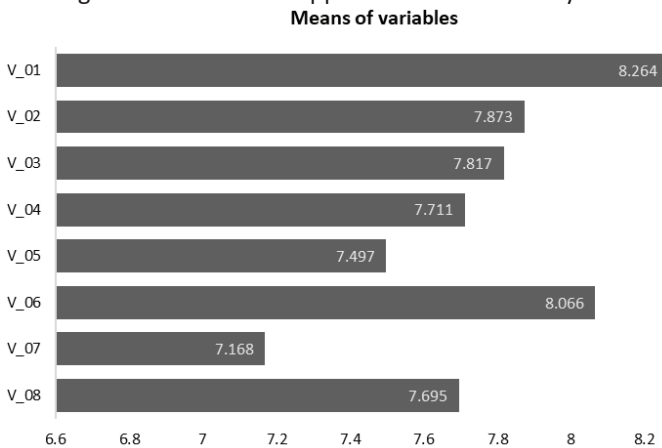


Figure 2. Averages of the variables analyzed
 Source: The authors (2023)

The analysis and associated debates regarding the averages achieved are presented in subsection 4.4.

Validation of the proposed conceptual framework

After the analysis of the averages and in order to provide increased robustness to the treatment of the data to reach the proposed objectives, the validation of the proposed conceptual framework was carried out, where the SmartPLS 2.0 software was used through the use of the PLS Algorithm, according to **Figure 3**.

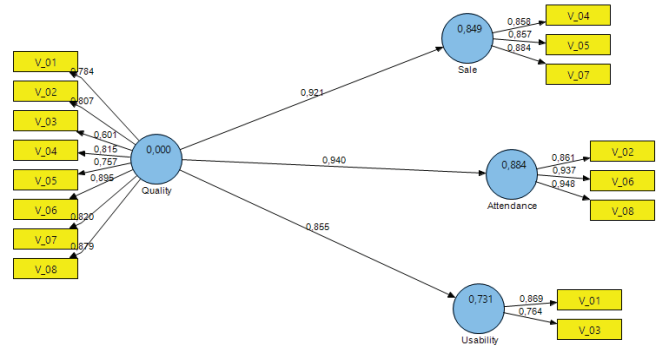


Figure 3. Statistical validation of the conceptual framework
 Source: Authors (2023)

For the model, the quality criterion parameters were Average Variation Extracted, Composite Reliability, and Cronbach's Alpha. The parameter results can be viewed in **Table 1**.

It is noticed that all the constructs obtained the AVE value within the recommended standard (AVE > 0.50). This means "the model converges to a satisfactory result" (Ringle *et al.*, 2014); that is, the variables are well correlated (positively) with their respective constructs.

For Composite Reliability (acceptable CC > 0.70 and < 0.90, but for exploratory research, according to Hair *et al.* (2014), it is acceptable CC > 0.60 and < 0.90), the values were above the recommended (CC > 0.60) according to **Table 1**. Analyzing Cronbach's Alpha (AC > 60 and 70), the constructs had a value according to recommendations (AC > 0.60) (Hair *et al.*, 2014).

Then, the cross-load analysis was performed to verify the best allocation of each variable. As shown in **Table 2**, the variables have higher factor loadings in their own constructs. This proves that the variables are well allocated in their constructs.

Table 1. Quality criteria of the analyzed model

Constructs	AVE	Composite Reliability	R Square	Cronbach's Alpha
Attendance	0.840000	0.940198	0.883674	0.903871
Quality	0.638865	0.933300	-	0.916962
Sale	0.750600	0.900269	0.848576	0.833867
Usability	0.670021	0.801755	0.731143	0.513986

Source: Authors (2023)

Table 2. Cross load analysis

Variables	Attendance	Sale	Usability
V_01	0.765550	0.576721	0.869408
V_01	0.765550	0.576721	0.869408
V_02	0.861339	0.655942	0.640266
V_02	0.861339	0.655942	0.640266
V_03	0.401640	0.589011	0.764312
V_03	0.401640	0.589011	0.764312
V_04	0.699330	0.857642	0.641182
V_04	0.699330	0.857642	0.641182
V_05	0.609179	0.856965	0.569418
V_05	0.609179	0.856965	0.569418
V_06	0.937279	0.757387	0.696978
V_06	0.937279	0.757387	0.696978
V_07	0.697087	0.884230	0.622997
V_07	0.697087	0.884230	0.622997
V_08	0.948475	0.709388	0.689422
V_08	0.948475	0.709388	0.689422

Source: Authors (2023)

Evaluating Pearson's Determination Coefficients (R²), the value of R² (Table 3) was 88% (service), 84% (sales), and 73% (usability), that is, greater than 26% than Cohen (1988) suggests as a large effect. This indicator is related to the quality of the adjusted model.

Table 3. Pearson Determination Coefficients

Constructs	R Square
Attendance	0.883674
Quality	-
Sale	0.848576
Usability	0.731143

Source: Authors (2023)

Analyzing Predictive Relevance (Q²-CV Red.), Stone-Geisser Indicator and Effect Size (f²-CV Com.), or Cohen Indicator. The effect size result can be seen in Table 4.

Table 4. Predictive relevance

Constructs	1-SSE/SSO
Attendance	0.744242
Quality	0.528631
Sale	0.630021
Usability	0.472837

Source: Authors (2023)

The Predictive Relevance shows how close the model is to what was expected of it (Ringle et al., 2014). All the values of Q² and CEV Red in the analyzed model are greater than zero. This shows that the model has Predictive Validity or Relevance.

The Effect Size shows how useful each construct is to the model. Values of 0.02, 0.15, and 0.35 indicate small, medium, and large predictive relevance, respectively (Ringle et al., 2014). The "Usability" construct presented f² (0.08), indicating little predictive relevance; the other constructs have a coefficient well above what is considered large predictive relevance. Table 5 illustrates the effect size for the analyzed constructs.

Table 5. Effect size between constructs

Constructs	1-SSE/SSO
Attendance	0.636416
Quality	0.528631
Sale	0.479265
Usability	0.089944

Source: Authors (2023)

For the values and significance of the Path Coefficients (Γ), Bootstrapping was run to evaluate the t-student values; the result is shown in Figure 4.

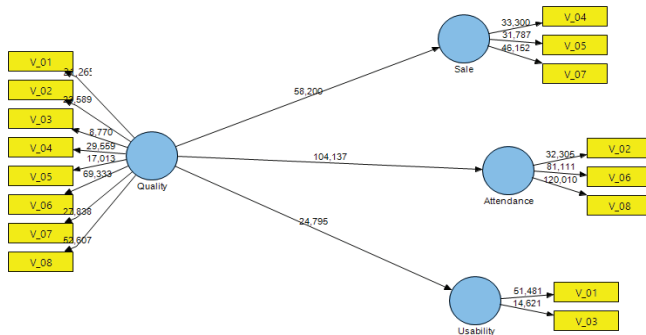


Figure 4. Bootstrapping Results

Source: Authors (2023)

After the steps above and considering the results obtained, it is possible to verify the model validity and conclude that companies that provide internet services should strategically consider customer perceptions and that through the analysis of validated constructs, they tend to provide a higher quality service to their users.

Associated debates

Based on the results of the averages of the variables, the following analyses were obtained: the variables “navigation (speed and stability),” “service agility (repair),” and “user support (maintenance)” were the ones that obtained the highest average in the opinion of internet service users in the interior region of the Amazon. The ones with the lowest averages in the perception of the user were the variables “price of the service,” “warranty time,” and “flexibility of the service (package options available).”

Related to the variables “navigation (speed and stability),” “service agility (repair),” and “user support (maintenance),” it is noted that it is a user need in which internet service providers in the analyzed region focus and give importance to a fast and stable data supply, be agile in the service of their services, mainly in the repair, as well as in the provision of support and maintenance services when there are interruptions in the supplied signal or any difficulty in access or instability of the internet. Jung and López-Bazo (2020) explain that this need is triggered by the constant changes and technological innovations that require the use of and access to quality internet to exercise and perform their daily functions and activities.

Franco (2021) comenta que, mesmo em regiões menos desenvolvidas tecnologicamente, como a Região Amazônica, especificamente no interior da região, a disparidade no acesso a recursos e serviços de qualidade é predominante, cada vez mais prevalente e percebida pelos usuários, pois vivemos em uma era de globalização

em que o desejo de acesso a essas tecnologias é comum. Além disso, o acesso a essa tecnologia, quando oferecida com qualidade, promove a busca pela realização de uma autêntica sociedade da informação e está cada vez mais comprometida com o compartilhamento de conhecimentos e questões relacionadas ao desenvolvimento econômico e à sustentabilidade (Franco, 2021; Hou e Cheng, 2017; Jung e López-Bazo, 2020).

Thaichon and Quach (2015) argue that the speed and stability of the signal provided by internet providers increase customer loyalty, which is a crucial factor for business success because, by creating and maintaining customer loyalty, companies can obtain greater competitive advantages and survive in the market.

As for the less relevant variables “price of the service,” “warranty time,” and “flexibility of the service (package options available),” it was noted that users do not consider such variables factors of great importance, so that Internet service is offered with quality. Rains and Tsetsi (2017) comment that for internet providers, it is important to consider as a requirement for competitiveness in their market strategies a customer service to the internet consumer compatible with their social class that has options or packages of their services, as well as valuing the guarantee of the service on which it is provided.

Brunetti *et al.* (2020) corroborate the same thinking and claim that for the business’ success, the internet provider, and in the face of constant technological innovations and the growing demand of users, it is necessary to focus on strategies that go beyond meeting the needs of customers, but in a logic capable of surprising, that is, exceeding your expectations.

In relation to the validated model, one can verify the importance of the allocated constructs and their real significance in enhancing the quality of internet services offered by providers in the interior region of the Brazilian Amazon. The model points out that the constructs of sale, service, and usability, when strategically perceived by companies in the internet industry, make companies offer a level of service that meets the needs of their users.

Tassabehji *et al.* (2019) consider that sales strategies, when noticed by internet providers, are an important buffer for boosting service demand. Tripathi and Barua (2016) the demand for good internet service has grown. Clients expect a guarantee in the quality of service (QoS share the same reasoning and emphasize that when internet plan providers offer sales plans based on their customers’ needs, that is, in the form of offers of plans compatible with their reality, they exponentially increase the demand for services and the revenue margin of companies.

Fasiku, Awoleye, and Oyebisi (2020) strongly draw attention to the service provided by internet service providers, where they should focus on the agility of response between the service provider and the customer. For these authors, providers must increase their response capacity by individualizing the service to the maximum of their users, guaranteeing the constant qualification and training of the team so that they can respond when necessary, and ensuring that customers do not have to wait too long for assistance or to receive service (Fasiku *et al.*, 2020).

Finally, the usability construct is considered by Rintyarna *et al.* (2022) as a consumer loyalty strategy because when the internet provider is committed and offers exactly what the customer wants, always seeking to meet their desires, such as the stability of data provided when contracted, it provides a greater intrinsic perception for the user.

CONCLUSIONS

The present study sought to identify, based on the perception of users in a region in the interior of the Brazilian Amazon, key variables (found in the literature) for promoting the quality of internet services and, through the conceptual model proposed and statistically tested, it was possible to verify which variables are important so that managers and directors of internet service providers residing in the region can outline their strategies focusing on the needs of users and offering a quality service.

Considering the sample, it can be said that the proposed conceptual model was validated. Therefore, when internet service providers consider the perception of customers in a strategic way through the analysis of constructs, they tend to provide a higher-quality service to their users.

As a result of the averages of the quality variables considered in this study, it can be said that the variables “navigation (speed and stability),” “service agility (repair),” and “user support (maintenance)” are the most important, perceived in the opinion of internet service users in the interior region of the Amazon. The least significant variables in the user’s perception were “price of the service,” “warranty time,” and “flexibility of the service (package options available).” Of intermediate importance, in the opinion of users, the variable “customer service” appears.

In view of the analysis of the proposed conceptual model, it can be concluded that when analyzing quality variables present in the literature, it becomes relevant to consider them in a grouped way through constructs, where

it is possible to perceive that the results of this research indicate three important constructs to be considered: sales, service and usability.

The research presents both theoretical and practical contributions. From a theoretical point of view, the results achieved can serve as a basis for expanding debates on the quality of services. From a practical point of view, it can help area managers define strategies to improve their services based on the perceptions of their customers (users), thus contributing to improving the quality of Internet services in the interior region of the Amazon.

As a study limitation, it should be noted that the research was applied to users from a specific region in the interior of the Amazon, characterized by limited technological infrastructure, and the results achieved cannot be generalized to other regions where the sample is not carried out in the present, a fact that was mitigated by the exploratory nature of the research.

Therefore, and given what has been exposed for future studies, it is suggested to continue the research by testing other algorithms such as AHP (Analytic Hierarchy Process) or TOPSIS (Technique for Order Preference by Similarity to Ideal Solution) to rank the variables, to verify better which of these variables are important to increase quality, and to support strategies for internet service providers in a region considered to be of low technological development through the provision of quality service.

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