TOURQUAL scale: Psychometric properties and internal structure validation

Abstract

Purpose: This study focuses on assessing the psychometric properties necessary to validate the internal structure of the TOURQUAL scale.

Design/methodology/approach: A quantitative research study was conducted in collaboration with the Brazilian Network of Tourism Observatories, comprising 927 respondents surveyed between October 2021 and May 2022. The data analysis involved the application of descriptive statistics and exploratory factor analysis, in alignment with the principles outlined in the Standards for Educational and Psychological Testing 2014 to validate the scale.

Findings: The findings of this study validate the TOURQUAL scale as a robust tool for assessing the perceived quality of tourist services, with results demonstrating one-dimensionality and replicability.

Originality: This study is the first to assess the psychometric properties for validating the internal structure of the TOURQUAL scale.

Keywords: TOURQUAL, service quality, tourist attraction, scale validation, Brazil

Introduction

The concept of service quality emerged as a response to scepticism regarding perceived quality in the mid-1980s (Grönroos, 1984; Oliver, 1980; Parasuraman, Zeithaml, and Berry, 1985). Consequently, Grönroos (1984, 1992) built upon Oliver's (1980) disconfirmation paradigm, marking the first academic effort to address service quality. This framework laid the foundation for Parasuraman *et al.* (1985, 1988) to develop a comprehensive service quality (SERVQUAL) model that has gained widespread acceptance in both academia and the corporate world (Kwenye and Freimund, 2016). The SERVQUAL scale, stemming from the disconfirmation paradigm, results from a comparison between customer expectations and actual service performance (Kwenye and Freimund, 2016). It comprises 22 items that measure the following five key dimensions: (i) tangibility, (ii) reliability, (iii) responsiveness, (iv) assurance, and (v) empathy. Although recognised as one of the earliest scales for assessing service quality, SERVQUAL has faced criticism for evaluating service quality and customer satisfaction after consumption, focusing on the gap between expectations and actual performance. In contrast to the disconfirmation logic, Cronin Jr. and Taylor (1992, 1994) argued that quality assessment should be based on the customer's attitude towards the quality dimensions and should not include other variables in measuring perceived quality. Consequently, they introduced the service performance (SERVPERF) model.

The SERVPERF model departs from Oliver's (1980) disconfirmation paradigm by excluding the expectation element and focusing solely on performance. It assesses customers' perceptions of service quality within the same five SERVQUAL dimensions. Cronin Jr. and Taylor's critique (1992) led to the creation of numerous models in various service sectors. These models often adapted SERVQUAL to different settings and introduced new methodological approaches to measuring service quality. Notably, in the field of tourism and hospitality, several scales have been developed to gauge perceived service quality (Koc and Ayyildiz, 2021). These models include the seminal SERVQUAL (Parasuraman *et al.*, 1988) and more specialised models tailored to specific sectors within tourism. Examples include CASQUAL for casinos (Bradley and Wang, 2022), DINESERV for restaurants (Stevens *et al.*,

1995), ECOSERV for ecotourists' service expectations (Khan, 2003), HOLSAT for holiday satisfaction (Tribe and Snaith, 1998), HOLSERV (Mei *et al.*, 1999), HOTELQUAL (Delgado *et al.*, 1999), LODGSERV (Knutson *et al.*, 1990), LQI (Getty and Getty, 2003), RESORTQUAL (Alcalde-Giraudo *et al.*, 2021), HWebSQ (Nguyen, Nguyen, and Pervan, 2020) and the Web Quality Index for assessing service quality in the hotel sector and its websites (Fernández-Cavia *et al*., 2014). Other models include HISTOQUAL for historic castles (Frochot and Hughes, 2000) and RURALQUAL for rural establishments (Alcalde-Giraudo *et al.*, 2021).

These scales provide valuable insights into the key criteria for service quality. They are adaptations of the SERVQUAL scale, often developed through interviews or questionnaires. However, some studies, such as He *et al.* (2018), have argued that both SERVQUAL and SERVPERF lack temporal resolution, a criticism that extends to many of these scales due to their similar logic. In response to the need for assessment tools with attributes influencing actual and potential behavioural intentions, Mondo and Fiates (2017) proposed a novel tool, TOURQUAL, designed to evaluate the perceived quality of services at tourist attractions. This study focuses on TOURQUAL, which has been empirically applied in various studies involving qualitative and quantitative analyses of tourist attractions and destinations (Mondo and Fiates, 2016, 2017; Mondo, Marques, and Gândara, 2020), events (Mondo *et al.*, 2020), accommodations (Andade Leal and Maracajá, 2021), museums (Chacón, 2022), bars and restaurants (Mondo *et al*., 2022), and historical sites (Mondo, Hallmann, and Burg, 2018).

The significance of service quality as a predictor of satisfaction, image formation, loyalty, and business development has been underscored in research. Studies have shown that customer-relations management has a substantial impact on service quality, customer satisfaction, and loyalty (Kwenye and Freimund, 2016). Consequently, examining the correlation between service quality, satisfaction, and value is essential for more efficient approaches (Dedeoğlu, 2019). Working with attributes has proven to be one of the most effective forms of management (Leutwiler-Lee *et al.*, 2023; Kim, Badu-Baiden, and King, 2023).

Furthermore, Sánchez-Rebull *et al.* (2018) aimed to provide empirical insights into customer satisfaction antecedents and consequences. Their study concluded that theoretical models and empirical applications are contingent on the specific sector under analysis. However, the most commonly identified determinants are service quality (as an antecedent) and loyalty (as a consequence), encompassing recommendations and revisits, respectively. Thus, the literature consistently highlights that perceived quality is an antecedent of satisfaction and behavioural intentions, irrespective of being mediated by satisfaction (Chen and Jiang, 2019).

Despite its widespread acceptance and use by academic researchers and public and private managers in the tourism and hospitality sectors, the construct validation of the TOURQUAL scale remains unimplemented. Such validation is essential to enable the scale's use as an instrument for evaluating the perceived service quality of tourist attractions and to ensure statistical comparability between studies, thereby enhancing the protocol's managerial utility.

Although several models and statistical analyses have used TOURQUAL, it is worth noting that we did not encounter any studies that applied exploratory factor analysis in the initial assessment of attractions. However, some studies have used factor analysis in the context of attribute adaptations for tourist bars (Mondo *et al.*, 2023) and events (Mondo *et al*., 2020). Additionally, it is crucial to explore whether the model exhibits a one-dimensional structure or has multiple dimensions, as discussed by Spreng and Singh (1993) about SERVQUAL, and the subsequent theoretical and practical implications. Thus, our study question is as follows: *What psychometric properties validate the internal structure of TOURQUAL?* with a specific focus on evaluating service quality in tourist attractions.

Following the guidelines of the Standards for Educational and Psychological Testing (American Educational Research Association, American Psychological Association, and National Council on Measurement in Education, 2014), content validity was established in a previous phase (Mondo and Fiates, 2017). This study now concentrates on the validation stage related to the internal structure, which assesses the extent to which the relationships among test items and components align with the construct upon which the proposed test score interpretations are based (American Educational Research Association *et al.*, 2014, p. 16).

To achieve this, a national survey was conducted as part of a scale validation study involving the Brazilian Network of Tourism Observatories and engaging over four thousand tourists visiting 223 tourist attractions across Brazil. The collected data were subjected to the necessary statistical tests to validate the TOURQUAL scale in accordance with established standards.

Literature Review

Service quality

Grönroos (1984) developed one of the earliest models for measuring service quality, considering perceived service quality as a function of expected service and perceived service, weighing technical quality, functional quality, and company image. Subsequently, Parasuraman *et al.* (1985) developed the SERVQUAL scale based on Oliver's (1980) disconfirmation paradigm, which was refined in 1988, 1991, and 1994a, aiming to assess customer satisfaction after the consumption experience, considering the difference between customer expectations and perceptions of service performance. They applied the scale with a five-dimensional structure (tangibility, responsiveness, empathy, assurance, and reliability), encompassing 22 items across four service categories: product repair and maintenance, long-distance telephone service, retail banking, stock brokerage, and credit card operations. However, the existing literature has highlighted gaps in the five dimensions of SERVQUAL, as they are not universally applicable and show a high degree of intercorrelation (Buttle, 1996). These dimensions vary depending on the context (Bouman and van der Wiele, 1992). Carman (1990) concurred that this scale cannot be generic and should be modified according to specific services.

Fick and Ritchie (1991) confirmed the five-dimensional structure for airlines, hotels, restaurants, and ski services but also identified deficiencies. Therefore, they introduced the pivotal-core-peripheral (P-C-P) model to assess the quality of any service sector. Philip and Hazlett (1997) stated that the P-C-P model is applicable to all service sectors. Moreover, the hospitality industry is treated as a whole and does not consider various hotel segments. For instance, although Saleh and Ryan (1992) identified a five-dimensional structure in the hotel industry, the dimensions were different: sociability, tangibility, safety, avoiding sarcasm, and empathy. Oberoi and Hales (1990) further found that service-quality perception in conference hotels in the UK was bidimensional, comprising tangible and intangible aspects. Subsequently, Webster and Hung (1994) adapted SERVQUAL for the hotel industry and confirmed an octodimensional structure: tangibles, reliability, communication, responsiveness, safety, understanding, and convenience. Akan (1995) tested the scale in four- and five-star hotels in Turkey and recognised six dimensions: personality and competitiveness, communication and transactions, tangibles, knowing and understanding the customer, price and speed of service, problem solving, and hotel booking price. Among them, the courtesy and competence of the hotel staff were encompassed. Ekinci *et al.* (1998) tested SERVQUAL in two Turkish beach resorts and determined a bidimensional structure—tangibles and intangibles—for the resort environment. In a business hotel in Turkey, Akbaba (2006) found that business travellers had the highest expectations regarding convenience, followed by safety, tangibles, adequacy in service delivery, and understanding and care.

Spreng and Singh (1993) criticised the application of alphas to different scores and explained the lack of discrimination among various dimensions of the SERVQUAL scale. Applying a seven-point Likert scale is defective, as the inverted polarity of scale items can introduce respondent errors (Buttle, 1996; Babakus and Mangold, 1992), and there is little evidence concerning customers evaluating service quality in terms of performance–expectation gaps (Buttle, 1996). The fact that SERVQUAL focuses on the service delivery process rather than service outcomes has been highlighted. There is a difference between the service delivered and a single service (Buttle, 1996; Miguel and Salomi, 2004; Parasuraman *et al.*, 1985), between expected and perceived service (Miguel and Salomi, 2004), and in communicated service (Miguel and Salomi, 2004).

Therefore, Knutson *et al.* (1990) developed a new 26-item scale, LODGSERV, adapted from SERVQUAL, to measure customer expectations in the hotel industry using five dimensions: reliability, assurance, responsiveness, tangibles, and empathy. Patton *et al.* (1994) translated LODGSERV into Japanese and Chinese and applied the scale in Japan, Taiwan, Hong Kong, Australia, and the UK. In addition, Stevens *et al*. (1995) developed a new scale adapted from SERVQUAL, DINESERV, to measure service quality in restaurants, considering dimensions such as reliability, tangibility, safety, responsiveness, and empathy. However, their attributes overlooked several elements of the consumer restaurant experience (Marković *et al.*, 2010), such as food quality and physical environment safety, particularly in light of the global emergence of COVID-19 precautions (Benaglia *et al.*, 2023).

Cronin Jr. and Taylor (1992, 1994) developed SERVPERF based on customer perceptions of service in four industries: banking, pest control, dry cleaning, and fast food. They discarded Oliver's (1980) disconfirmation paradigm by eliminating expectations and using only performance (Buttle, 1996), considering customer perception of service quality. They distinguished service quality from satisfaction, with quality conceptualised as a customer attitude (Miguel and Salomi, 2004). SERVPERF was adapted for festivals (FESTPERF) by Tkaczynski and Stokes (2010) and for rural retail use by Saravanan and Kannan (2012). In another study, Lee *et al*. (2000) tested both SERVQUAL and SERVPERF to analyse the influence of two service quality dimensions, tangibles and responsiveness, on service type in an entertainment park, a fitness centre, and an investment consultancy. Their study found limitations in the models, although SERVPERF was more suitable than SERVQUAL. The causal relationship between customer satisfaction, service quality, and purchase intention has not been fully elucidated (Miguel and Salomi, 2004).

Incorporating the concept of experience into the framework of service quality, it is essential to recognise that tourist satisfaction extends beyond the traditional metrics of service delivery. Pine and Gilmore (1998) highlighted the significance of experiences in shaping consumer satisfaction, in which memorable and engaging experiences become a crucial part of service quality. Furthermore, as suggested by Volo (2009), the experiential dimension of tourism specifically addresses the emotional and subjective aspects of the tourist experience. This is complemented by the work of Walls *et al*. (2011), who argued that the emotional responses elicited by these experiences play a vital role in determining overall service quality. Thus, integrating the concept of experience acknowledges the complex, multifaceted nature of service quality in tourism.

Appendix 1 summarises the measurement scales found in the literature that focus on tourist services (except for the first three, which are seminal).

Methods

Data collection methods, instrumentation, and pilot testing

This is a cross-sectional, observational, and descriptive study (Aggarwal and Ranganathan, 2019; Ranganathan and Aggarwal, 2019; Sampieri *et al.*, 2013). The research resulted from a

collaboration between the Brazilian Network of Tourism Observatories (RBOT) and the creators of the TOURQUAL protocol with the objective of carrying out a national survey on the assessment of the quality of Brazilian tourist services and attractions. In total, 301 attractions were registered to participate in the research, of which 223 were considered suitable for inclusion, according to tourism observatories managers.

Each tourism observatory was responsible for contacting the attractions to present and explain the survey and ask them to approach tourists to respond to it. QuestionPro.com software was used to prepare the online questionnaires. We provided 27 questionnaires, one for each Brazilian state and another for the Federal District, listing the participating attractions.

The online questionnaire items were adapted from the original study by Mondo and Fiates (2017). Of the original 26 items, one item relating to trust and another relating to accessibility for people with disabilities were omitted. The decision to remove the trust attribute was based on the understanding that trust is a consequence of the perception of quality, and not a separate element in its evaluation. Thus, the attribute merged aspects associated with the perception of quality (such as satisfaction) without distinguishing them as separate constructs, causing conceptual confusion and reducing managerial applicability. As for the accessibility item, it was excluded due to its limited applicability and the tendency to induce response bias when extremely positive evaluations were provided, even when there was no accessibility to the evaluated attraction. This issue has also been observed in previous studies using TOURQUAL (Mondo *et al.*, 2016, 2018).

Upon removing the two attributes mentioned, two additional items were introduced. The first pertained to the perception of sustainability actions in the attraction, and the second involved a breakdown of the technical knowledge attribute, which was used to evaluate the tour guide and other service or attraction staff. Numerous managers at the surveyed locations requested these modifications and underwent deliberation and approval by specialist professionals from the 14 tourism observatories who actively contributed to the research. This is particularly relevant in the context of sustainability initiatives due to the abundance of natural attractions within the scope of our study and the necessity of disseminating technical knowledge related to tour guidance among all employees involved in attraction management.

The items were assessed using a 5-point Likert-type scale (1 = *Terrible*, 2 = *Bad*, 3 = *Average*, 4 = *Good*, 5 = *Excellent*). In addition to the TOURQUAL scale items, the questionnaire included demographic variables—the respondent's state of origin, residence status (resident/non-resident), sex, marital status, income, and age. A pre-test was conducted with 20 respondents to identify any inconsistencies in understanding the questions. Based on their feedback, the questionnaire was modified. The questionnaires were divided by state to better tailor them to the respondents and to disseminate regional results conveniently to the partner observatories. Data collection took place from November 2021 to May 2022.

Sample

The sample for this study comprised tourists who had visited tourist attractions in Brazil. Data were processed by excluding cases with missing information in any of the variables of the TOURQUAL scale, as certain variables could not be evaluated in all attractions (e.g., some attractions had no guide service or did not offer bathrooms). Consequently, 2,323 responses with missing data were omitted, resulting in 2,122 of the initial 4,445 responses that were evaluated across all attributes. Subsequently, data were screened for the presence of outliers. Using the Mahalanobis D^2 measure divided by the number of variables (26) to account for degrees of freedom (Hair *et al.*, 2009), 385 potential outliers were identified. Cook's distance, which assesses the collective impact of an observation on the overall fit in multiple regression models (Kutner *et al.*, 2005), identified 327 of the 385 respondents as having a strong influence on overall fit. As a result, these 327 cases were excluded, resulting in a final sample of 1,795

respondents. This final sample was then randomly divided to facilitate further analysis, resulting in a study sample consisting of 927 respondents.

In terms of the overall profile of the survey participants, the majority were female, comprising 53.3% of the sample. The average age of the respondents was 36.26 years. Regarding marital status, a significant proportion were single (48.5%). In terms of educational attainment, a substantial number held undergraduate degrees (42.7%). Furthermore, most participants were tourists (non-residents) (59%) (Table 1).

** Table 1 near here **

Data analysis

Exploratory factor analysis (EFA) was conducted to assess the factorial structure of the attributes within the TOURQUAL scale. This analysis was performed using a polychoric matrix and the robust diagonally weighted least squares extraction method, which is suitable for ordinal data (Asparouhov and Muthen, 2010). The significant result of Mardia's test ($p < 0.05$) (Mardia, 1970) indicated multivariate non-normality of the data. The determination of the number of factors to retain was based on the parallel analysis technique with random permutation of the observed data (Timmerman and Lorenzo-Seva, 2011). The chosen rotation method was the robust Promin (Lorenzo-Seva and Ferrando, 2019). To assess the one-dimensionality of the data, three indices were used: unidimensional congruence (UniCo), explained common variance (ECV), and mean of item residual absolute loadings (MIREAL). UniCo and ECV values exceeding 0.95 and MIREAL values below 0.300 suggest unidimensional data (Ferrando and Lorenzo-Seva, 2018). These procedures were conducted using Factor software, version 10.10.03.

The adequacy of the model was evaluated using the chi-square/degrees-of-freedom ratio (χ^2/df), and the following fit indices: root mean square error of approximation (RMSEA), root mean square of residuals (RMSR), comparative fit index (CFI), and Tucker-Lewis index (TLI) (Brown, 2006). A χ^2/df ratio of less than or equal to 3.0 was considered adequate. RMSEA values less than 0.08, with a confidence interval not exceeding 0.10; RMSR values less than 0.06; and CFI and TLI values exceeding 0.90 (preferably above 0.95) were considered adequate (Brown, 2006).

Factor stability was assessed using the H-index, which gauges how effectively a set of items represents a common factor (Ferrando and Lorenzo-Seva, 2018). The H values ranged from 0 to 1, with high values ($H > 0.80$), indicating that the latent variable is well-defined and likely to be stable in other studies; low H values suggest that the latent variable is ill-defined and likely unstable (Ferrando and Lorenzo-Seva, 2018).

The quality and effectiveness of the factorial estimates were assessed using four attributes: factor determinacy index (FDI), expected *a posteriori* marginal reliability (EAP), sensitivity ratio (SR), and expected percentage of true differences (EPTD). The recommended cut-off criteria for those measures are: FDI > 0.90, EAP > 0.80, SR > 2, and EPTD > 90% (Ferrando and Lorenzo-Seva, 2018), indicating the quality of the factorial estimates.

To refine the assessment of items, the item response theory (IRT) framework was required. By combining IRT and EFA, a more complete and nuanced assessment of measurement instruments is yielded (Bean and Bowen, 2021). While EFA helps uncover the latent item's structure, IRT provides fine-tuning and optimization of individual items. IRT focuses on individual item characteristics, particularly item discrimination (*a*-parameter) and item difficulty (*b*-parameter). Discrimination indicates how effectively an item distinguishes between individuals with varying levels of the latent trait being measured (Reckase, 2009), while difficulty reveals the trait level at which a respondent has a 0.5 probability of endorsing a particular response category (Bond, Yan, and Heene, 2021). IRT was implemented using Reckase's parameterization (1985), as provided by the Factor package.

Following the completion of all assessments, we have presented and discussed the results in the next section, suggesting the use of TOURQUAL as a measurement scale for diagnosing the perceived quality of tourist services.

Results

This section is divided into two sub-sections. The first includes a brief presentation of the sample characteristics, and the second presents the scale validation tests.

Scale validation tests

Bartlett's sphericity test (χ^2 = 10551.6, degrees of freedom = 325, $p < 0.001$) and the Kaiser-Meyer-Olkin test (0.977) indicate the interpretability of the item correlation matrix. The parallel analysis suggests a single factor for the data, a result supported by the indices assessing the one-dimensionality of the data (Table 2).

** Table 2 near here **

The fit indices demonstrate excellent adequacy of the one-dimensional model ($\chi^2 = 823.607$; df = 299; $p < 0.001$; χ^2/df = 2.754; RMSEA = 0.044; 95% CI [0.0314; 0.0492]; RMSR = 0.0532; 95% CI [0.043; 0.059]; CFI = 0.994; 95% CI [0.993; 0.997]; TLI = 0.994; 95% CI [0.992; 0.997]). The attributes exhibited high factor loadings (0.611–0.908). The reliability indices exceeded 0.95, indicating excellent internal consistency of the attributes. Replicability H indices (H > 0.80) (Ferrando and Lorenzo-Seva, 2018) suggest that the factor identified is stable and likely to be replicable in future studies. The quality and effectiveness of the factor estimates were also confirmed (Table 3).

** Table 3 near here **

The IRT results are shown in Table 4. Discrimination parameters (*a*) reveal that items can distinguish individuals with different levels of the latent trait (perceived quality); four items stand out as the most discriminating: 18_Cleaning (*a* = 2,161), 16_Internal signage (*a* = 1,887), 14_Infrastructure (*a* = 1,885), and 6_Comfort (*a* = 1,798). Regarding item difficulty (*b*), the thresholds show no unexpected response pattern, that is, the higher the scale response category, the greater the level of latent trait needed to endorse it. This implies that the greater the perception of service quality, the higher the evaluation category chosen, as expected. The results suggest that the items appropriately capture the respondents' evaluations of the quality of the specific aspects of the attractions.

The identification of four key discriminators—comfort, infrastructure, internal signage, and, predominantly, cleanliness—in the assessment of tourism attractions highlights significant disparities in service quality. These elements are fundamental to the tourist experience, as underscored by Chen and Chen (2010), who emphasized the critical role of basic amenities in shaping visitor satisfaction.

The disparities in these areas suggest a prioritization for improvements. For instance, beach bars in less urbanised coastal areas might struggle with infrastructure and cleanliness due to their remote locations, as noted by Buckley (2012). In contrast, urban museums and parks often serve as benchmarks for high standards in these aspects due to their structured environments and consistent maintenance, as observed by Richards and Wilson (2004).

This differentiation in service quality underscores the need for tailored strategies. Attractions like beach bars might focus on enhancing basic amenities to elevate the visitor experience. Meanwhile, urban museums and parks could aim to maintain their high standards to continue serving as benchmarks.

Incorporating these nuances into the TOURQUAL scale can provide more targeted insights for service improvement across various types of attractions, reflecting the diverse needs and expectations of tourists in different settings. This approach aligns with the call for context-specific service quality measures in tourism research, as advocated by Parasuraman *et al.* (1988) and Zeithaml *et al.* (1990).

** Table 4 near here **

Accordingly, we outline the proposed operationalisation of the scale. The primary objective of using the scale is to assess tourists' perceived service quality at tourist attractions. Therefore, the recommended measurement scale uses a 5-point rating system, in which 1 = *Terrible*, 2 = *Bad*, 3 = *Average*, 4 = *Good*, and 5 = *Excellent*. Furthermore, it is advisable to include an initial question concerning overall satisfaction with the service, rated on a free scalar scale ranging from 1 to 5 or 1 to 10. This facilitates subsequent regression tests or structural models to examine the influence of TOURQUAL quality attributes on the formation of tourists' overall satisfaction. Additionally, the questionnaire should include demographic questions to characterise the sample, such as place of origin, age group, income bracket, sex, level of education, marital status, and travel companions (family, friends, or none). We recommend that the attributes be presented as follows (see Table 5).

** Table 5 near here **

Discussion and Conclusion

The assessment of service quality at tourist attractions is paramount for ensuring customer satisfaction and underscores the necessity of continuously evaluating services in the post-visit phase. This need led to the development of the TOURQUAL scale. The present study examined the validity of the TOURQUAL scale, originally developed by Mondo and Fiates (2017). Following the recommendations of the scale's creators, this study assessed its validity by testing it among tourists who visited various attractions in Brazil. The findings of this study confirm both the external validity and the reliability of the TOURQUAL scale.

These findings suggest that the construct is unidimensional. The latent variable resulting from EFA is consistent across all attributes, aligning with tourists' perceptions of service quality (Hair *et al*., 2018). In this sample, there were no discernible categories of perception within the realm of service quality. Despite variations in factor loadings, the differences between attributes are not significant enough to result in more than one factor. However, the most discriminative items from the IRT analysis suggest that respondents appraise differently the perceived quality mainly concerning physical evidence or the infrastructure of the attraction's facilities.

This one-dimensional finding is convergent with results by Hair *et al.* (2018), Tabachnick and Fidell (2013), Stevens (2012), Costello and Osborne (2005), and Fabrigar *et al.* (1999).

The implications of this one-dimensional result include interpretive simplicity, ease of use, and potential for unified measurements. A single factor simplifies the result interpretation, as the sole latent variable explains all observed variables (Reise *et al.*, 2000). It is more straightforward for subsequent modelling, such as regression or structural models. Additionally, it suggests that all original variables can be measured similarly or share a common underlying construct (Reise *et al*., 2000).

However, there are limitations to consider with a one-dimensional result, including potential loss of information, issues with conceptual validity, and limited generalisation. Reducing multiple variables to a single factor results in some loss of information, which can hinder the understanding of nuances and individual relationships between the original variables (Reise *et*

al., 2000). If the original variables were expected to reflect different aspects of a broader concept and EFA results in only one factor, there may be a disconnect between the theoretical conception and empirical findings (Reise *et al.*, 2000). Depending on the data and sample used, there may be limitations in generalising the results. If a single factor is highly specific to the sample, it may not represent the broader population (Hair *et al.*, 2018).

Therefore, the one-dimensionality discovered in this study stimulates new theoretical discussions regarding perceived service quality. Tourist perceptions, represented by more than 20 attributes within a single factor, demonstrate the robustness and comprehensiveness of the latent variable perceived service quality. It reflects the general perception of the studied sample and offers a foundation for further analysis in a broader population.

Acknowledging the limitations of our study due to its unidimensional results, it is important to contextualise the generalisation of our findings within the broader scope of global tourism contexts. As Weaver and Lawton (2017) highlight, while there may be one-dimensionality in certain aspects of service quality measurement, the core dimensions often have universal applicability. The TOURQUAL scale's effectiveness across various regions, in line with Choi and Chu's (2001) findings, suggests that despite these limitations, the scale can adapt and provide relevant insights into service quality in different cultural settings. This adaptability indicates that while mindful of the one-dimensionality concern, TOURQUAL can still serve as a robust tool for assessing service quality globally.

In addressing the one-dimensionality in our study, we emphasize the benefits of this approach, notably in simplifying the measurement and management of service quality indicators. Drawing on the work of DeVellis (2016) in scale development, we highlight how one-dimensionality facilitates clearer interpretation and application in managerial contexts. However, as noted by Hair *et al*. (2010) in their exploration of multivariate data analysis, this approach may lead to a loss of specific information that could be critical for certain aspects of tourism services. To mitigate this, our study outlines potential adaptations of TOURQUAL indicators to cater to the specificities of various tourism services, aligning with the flexible approach to service quality measurement advocated by Parasuraman *et al*. (1988) in their seminal work on service quality.

Another crucial aspect to address concerns the applicability and replicability of the TOURQUAL scale. Previous studies using the TOURQUAL scale have consistently found it easy to apply, with tourists readily comprehending the attribute content. However, the issue of replicability warrants further discussion, particularly due to the specificity of the tourist services in question. We contend that analyses and adaptations are necessary when applying the TOURQUAL scale in different contexts, such as museums, beaches, or parks. The scope of services varies significantly, which in turn alters the scope of consumption and, consequently, the perception of attributes. While the scale presented here is generally applicable to tourist attractions, we recommend that future studies adapt and test the scale to suit specific contexts. Services are dynamic, and it is the responsibility of researchers to monitor changes stemming from the setting of the study.

Furthermore, the replicability of service rating scales aiming to obtain consistent and reliable results in various contexts and over time is a crucial consideration in marketing research and service quality assessment. Parasuraman *et al.* (1985), the developers of the SERVQUAL scale, suggested that adaptations may be necessary for scale replications; Zeithaml *et al.* (2006) emphasized the need for adaptations due to sensitivity to the research context and temporal variations. Additionally, Sasser and Abert (1966) advocated for cultural adaptation in services, a perspective supported by Dabholkar (1996).

From a managerial perspective, the TOURQUAL scale has been successfully applied in various settings, demonstrating its effectiveness in yielding actionable insights related to service quality. However, it is important to recognise that services offered at different

attractions can vary significantly. For instance, one attraction may have a parking lot while another may not. Thus, when implementing the TOURQUAL scale, tourist attraction managers should be aware of the need to adapt the protocol to the unique circumstances of their service. Based on these findings, we propose the periodic collection of data from tourists using the TOURQUAL scale, perhaps every quarter, across diverse tourist attractions. This proactive approach serves the purpose of facilitating long-term performance analysis, enabling the development of improvement strategies, and allowing for an in-depth examination of individual attributes when required.

Furthermore, destination and tourist attraction managers can leverage these attributes as criteria for establishing excellence certifications or awards for tourist attraction performance. Such recognition creates a strong incentive for tourist attractions to continuously enhance their service quality, ultimately conveying to tourists a compelling image of a destination committed to delivering exceptional services. Additionally, a managerial implication involves using the attributes for qualitative assessment through methodologies such as incognito or 'hidden client' evaluations. In this approach, a reviewer engages with attractions as a regular customer and conducts a comprehensive analysis, delving into the performance of each attribute to gain deeper insights into the experience.

Effective management of service quality in tourist attractions has a significant impact on the competitiveness of urban and city tourism. Research by Ritchie and Crouch (2003) underscores the role of quality attractions in enhancing a city's appeal and contributing to its overall competitive advantage. Further, the utilization of standardized survey methods, as recommended by Dwyer and Kim (2003), allows for efficient data collection and sharing, enabling cities to engage in more intelligent management practices. This approach, supported by the insights of Buhalis and Amaranggana (2015), emphasizes the use of smart tourism technologies in managing urban tourist attractions, thereby fostering a more competitive and sustainable urban tourism environment.

One limitation of this research is that it was conducted among tourists who visited tourist attractions in Brazil. Therefore, validation in other countries is essential before considering it a universal scale. This would significantly contribute to the extensive body of cross-cultural research linked to TOURQUAL conducted to date. Second, the data for this study were collected during the post-visit stage of a visit using convenience sampling. Third, we acknowledge that minimising the variability of attractions in future research would better align the attributes with the reality of the studied service. Fourth, the study did not include questions to assess standard response behaviour, which is a suggestion for instrument review in future applications. Future studies using the TOURQUAL scale could develop a structural equation model in which the attributes form a latent variable, perceived quality, which, in turn, influences satisfaction and behavioural intentions, thereby enhancing the findings of the current study. Additionally, future studies should use item response theory to further explore the validity of the TOURQUAL scale. Finally, the adaptation of attributes for other types of tourist services, such as hotels, restaurants, and specific attractions (e.g., museums and parks) should be explored in future studies.

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Table 1. Profile of the respondents (Source: Authors own creation)

		f	%
Sex	Female	494	53.3
	Male	395	42.6
	Other	18	1.9
	Not informed	20	2.2
Marital status	Single	450	48.5
	Married	347	37.4
	Divorced/Separated	40	4.3
	Stable union	62	6.7
	Widower	14	1.5
	Other	8	0.9
	Not informed	6	0.6
Schooling	No formal education	3	0.3
	Elementary School	24	2.6
	High School	236	25.5
	Undergraduate	396	42,7
	Postgraduate studies	261	28.2
	Not informed	7	0.8
Residence	Resident of the region (resident)	378	40.8
	Tourist (non-resident)	547	59.0
	Not informed	2	0.2
Age*	Average	36.26	
	Median	34	
	Mode	25	
	Standard deviation	13.43	
	Not informed	14	

$n = 927$
*$n = 913$

Table 2. Parallel Analysis Results (Source: Authors own creation)

Factor	Percentage of explained variance of actual data	Mean percentage of explained variance of random data	Percentage of explained variance of random data (95% CI)
1	70.5029*	7.6698	8.4952
2	4.4151	7.2284	7.9246
3	3.4292	6.8745	7.5077
4	2.9664	6.5578	7.1147
5	2.3001	6.2726	6.7667
6	2.0341	5.9734	6.3968
7	1.6341	5.6938	6.0270
8	1.5672	5.4122	5.7636
9	1.5067	5.1230	5.4328

10	1.4620	4.8481	5.1620
11	1.2284	4.5646	4.8772
12	1.1159	4.2749	4.5886
13	0.9821	3.9984	4.2915
14	0.9188	3.7228	4.0501
15	0.8049	3.4419	3.7651
16	0.6841	3.1545	3.5166
17	0.6400	2.8760	3.2500
18	0.4937	2.5781	2.9502
19	0.4323	2.2973	2.7008
20	0.3801	2.0019	2.4285
21	0.2569	1.7037	2.1066
22	0.1428	1.4067	1.8224
23	0.0844	1.1023	1.5106
24	0.0112	0.7826	1.1899
25	0.0066	0.4407	0.7693
Unico		0.996; BCa Bootstrap 95% CI [0.994; 0.998]	
ECV		0.948; BCa Bootstrap 95% CI [0.935; 0.958]	
MIREAL		0.154; BCa Bootstrap 95% CI [0.139; 0.172]	

*Only one factor is suggested for retention as the % variance explained by this factor is greater than the random data.

Source: Research results, 2022.

Table 3. Factor loadings of the TOURQUAL attributes, reliability, factor replicability, quality and effectiveness of factor score estimates (Source: Authors own creation)

Item	Factor loadings	Confidence intervals of 95% of factor loadings (BCa)
1_Access	0.789	[0.399; 0.813]
2_Bathroom	0.836	[0.800; 0.861]
3_Queues	0.788	[0.578; 0.818]
4_Ease of purchase	0.783	[0.712; 0.822]
5_Schedule	0.824	[0.740; 0.859]
6_Comfort	0.874	[0.665; 0.897]
7_Learning	0.837	[0.792; 0.869]
8_Entertainment	0.806	[0.767; 0.849]
9_Aesthetics	0.805	[0.697; 0.840]
10_Escape from routine	0.834	[0.784; 0.863]
11_Security	0.813	[0.679; 0.846]
12_Prices	0.611	[0.554; 0.663]
13_Climate (weather conditions)	0.703	[0.629; 0.754]
14_Infrastructure	0.883	[0.807; 0.902]
15_External signage	0.803	[0.766; 0.837]
16_Internal signage	0.884	[0.854; 0.904]
17_Technology	0.793	[0.741; 0.820]
18_Cleaning	0.908	[0.886; 0.926]
19_Cargo capacity	0.846	[0.802; 0.876]

20_Variety of activities	0.805	[0.751; 0.840]
21_Sustainability actions	0.843	[0.807; 0.862]
22_Presentation	0.863	[0.742; 0.896]
23_Attention	0.855	[0.794; 0.889]
24_Attendance	0.863	[0.823; 0.902]
25_Technical knowledge of the guide	0.805	[0.695; 0.842]
26_Technical knowledge of providers	0.860	[0.770; 0.893]
Composite reliability (CR)		0.982
McDonald's Omega		0.982
Standardized Cronbach's alpha		0.981
H-latent		0.984; BCa Bootstrap 95% CI [0.981; 0.986]
H-observed		0.878; BCa Bootstrap 95% CI [0.848; 0.918]
Factor Determinacy Index (FDI)		0.992
EAP marginal reliability		0.984
Sensitivity Ratio (SR)		7.729
Expected percentage of true differences (EPTD)		98.2%

Table 4. Discrimination parameters and thresholds of the items (Source: Authors own creation)

Item	*a*	*b*			
		$Threshold_{1-2}$	$Threshold_{2-3}$	$Threshold_{3-4}$	$Threshold_{4-5}$
1_Access	1.283	−2.680	−2.205	−1.202	0.219
2_Bathroom	1.525	−2.559	−2.126	−1.332	−0.031
3_Queues	1.280	−3.022	−2.593	−1.785	−0.119
4_Ease of purchase	1.257	−3.042	−2.611	−1.971	−0.112
5_Schedule	1.456	−2.788	−2.565	−1.987	−0.150
6_Comfort	1.798*	−2.629	−2.186	−1.678	−0.273
7_Learning	1.531	−2.903	−2.589	−1.811	−0.229
8_Entertainment	1.363	−2.850	−2.724	−1.947	−0.245
9_Aesthetics	1.355	−3.264	−3.020	−2.440	−0.703
10_Escape from routine	1.509	−2.982	−2.804	−2.072	−0.415
11_Security	1.398	−3.134	−2.631	−1.775	−0.082
12_Prices	0.771	−3.155	−2.585	−1.343	0.571
13_Climate (weather conditions)	0.988	−3.736	−3.169	−1.728	0.083
14_Infrastructure	1.885*	−2.522	−1.983	−1.290	−0.161
15_External signage	1.348	−2.965	−2.166	−1.170	0.229
16_Internal signage	1.887*	−2.750	−1.997	−1.313	0.014
17_Technology	1.300	−1.793	−1.074	−0.444	0.390
18_Cleaning	**2.161***	−2.420	−2.052	−1.424	−0.205
19_Cargo capacity	1.585	−2.764	−2.470	−1.680	0.002
20_Variety of activities	1.358	−2.767	−2.394	−1.597	0.103
21_Sustainability actions	1.565	−1.841	−1.014	−0.615	0.137
22_Presentation	1.710	−2.708	−2.393	−1.898	−0.286
23_Attention	1.649	−2.906	−2.503	−1.966	−0.338
24_Attendance	1.708	−2.880	−2.582	−1.961	−0.306

25_Technical knowledge of the guide	1.359	−3.166	−2.691	−1.984	−0.279
26_Technical knowledge of providers	1.687	−2.629	−2.327	−1.783	−0.191

a: item discrimination; *b*: category difficulties; *Most discriminative items.

Table 5. Validated scale operability proposal (Source: Authors own creation)

Questions related to the scale
1. How do you evaluate the issue of access and parking at the attraction?
2. How do you rate the availability and cleanliness of the restrooms in the attraction?
3. How do you evaluate the issue of queues at the entrance and the general wait at the attraction?
4. How do you rate the ease of purchasing tickets (payment methods, online purchase) at the attraction?
5. How do you rate the opening hours of the attraction?
6. How do you rate your general perception of comfort in the attraction?
7. How do you evaluate your learning with technical, historical and cultural issues at the attraction?
8. How do you rate your level of fun and entertainment at the attraction?
9. How do you rate the aesthetics of the place (decoration, layout, beautiful or ugly)?
10. How do you evaluate your level of immersion at the attraction? (Did you escape your day by day?)
11. How do you evaluate the security within the attraction?
12. How do you evaluate the prices and the cost-effectiveness of the attraction?
13. How do you evaluate the climatic conditions at the attraction today?
14. How do you evaluate the infrastructure of the attraction, maintenance and disposition of equipment and furniture?
15. How do you evaluate the external signage to reach the attraction?
16. How do you rate the internal signage for moving around and orienting yourself within the attraction?
17. How do you evaluate the offer of technology in the attraction (internet, app or technological resources)?
18. How do you rate the overall cleanliness of the attraction?
19. How do you evaluate the issue of crowding and queueing at the attraction?
20. How do you evaluate the variety of activities offered in the attraction (in addition to the core activity they propose)?
21. How do you evaluate the sustainability actions implemented by the attraction?
22. Did you have contact with an employee of the attraction? If so, move on to the next attributes.
23. How do you evaluate the initial presentation of the service, informing what would be offered during the visit?
24. How do you rate the level of attention that the attraction's employees gave you?
25. How do you rate the overall service at the attraction?
26. How do you rate the technical knowledge of the tour guide who accompanied you?
27. How do you rate the technical knowledge of the attraction's employees?

Appendix 1. Summary of the measurement scales found in the literature that focus on tourist services (Source: Authors own creation)

Indexes, Scales and Models	Authors	Focus	Quality dimensions
Grönroos Model (1984)	Grönroos (1984)	Service industries	Technical quality; Functional quality; Company image
Kano model et al. (1984)	Kano et al. (1984)	Service industries	Attractive quality; Unidimensional; Specification of how it should be; Indifferent Quality; Reverse quality
SERVQUAL	Parasuraman et al. (1985)	Service industries: appliance repair and maintenance, long-distance telephone, retail banking and credit cards	Tangible; Reliability; Promptly; Warranty; Empathy
SEVPERF	Cronin Jr. and Taylor (1992, 1994)	Service industries: banking, pest control, dry cleaning and fast food	Tangible; Reliability; Promptly; Warranty; Empathy.
LODGSERV	Knutson et al. (1990)	Hotel industry	Tangible; Reliability; Responsiveness Warranty; Empathy.
DINESERV	Stevens et al. (1995)	Restaurants	Reliability; Tangibility; Safety; Responsiveness; Empathy.
HOLSAT	Tribe and Snaith (1998)	Holiday satisfaction: city and facilities; environment; restaurants, bars, shops and nightlife; transfer; heritage and culture and accommodation.	Attractions; Activities; Facilities; Accommodation; Accessibility
HOLSERV	Mei et al. (1999)	Hotel industry	Employees; Tangible; Reliability
HOTELQUAL	Becerra Grande et al. (1999)	Hotel industry	Reliability; Tangible elements; Staff characteristics; Complementary offer
HISTOQUAL	Frochot and Hughes (2001)	Historic castles; Cultural heritage	Service; Tangible; Communication Empathy; Consumables
ECOSERV	Khan (2003)	Ecotourism	Ecotangibility; Safety; Reliability; Responsiveness; empathy; Tangibility

RURALQUAL	Correia and Miranda (2007)	Rural establishments	Professionalism; Basic offer; Rural and regional environment; Complementary offer; Tangibility
RESORTQUAL	Valls-Figueroa et al. (2002)	Tourist destinations	Airport; Communication; Accessibility Hotel; Extra Hotels Chain; Environmental Quality; General Elements.
SYSTRA-SQ	Aldlaigan and Buttle (2002)	Banking	Quality of the service system; Quality of service; Behavioural; Machine service quality; Transactional accuracy of service.
Lodging quality index (LQI)	Getty and Getty (2003)	Hotel industry	Tangibility; Reliability; Responsiveness; Confidence; Communication.
Netqual –Website service quality	Bressolles (2006)	E-Tourism	Quality of information; ease of use; safety; site design; reliability.
E-travel service quality	Ho and Lee (2007)	E-travel	Quality of information; safety; functionality of the website; customer relationship; Responsiveness.
Web Quality Index (WQI)	Fernández-Cavia et al. (2014)	Official websites of tourist destinations	Home page; Languages; Quantity and quality of content; Interactivity; Social network; Mobile communication; Discourse analysis; Brand; Marketing; Information architecture; Web positioning; Usability; Accessibility
Hotel website service quality (hwebsq)	Nguyen et al. (2020)	Hotel industry	Functionality; Website design; Response time; Ease of use; Quality of information; Interactivity Safety.
CASQUAL.	Bradley and Wang (2022)	Casinos	Gaming Service; Restaurant Service;

			Hospitality Service; Cleaning.