Impact of Using Excellence Management Models in the Customer Satisfaction of Brazilian Electricity Distributors - 10 Years of Studies

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Abstract. In this work we evaluate the impact of the use of the model of excellence in Brazilian management by electricity distribution companies and their impact on customer satisfaction. It was evaluated 10 years of use of the model in groups of companies with different levels of implementation of the model MEG (users, indifferent, engaged and winning) using a statistical approach, firstly using descriptive statistics and by last applying the nonparametric kruskal-Wallis test. It is evidenced the existence of differences between the identified groups revealing the correct decision using the described model. We could attest the positive effects evidenced by the use of reference models of the electric energy sector, on a large scale, during the period analyzed. The results here obtained can be used, at least as guidance, by similar organizations or other industries.

Keywords: Excellence models · Customer satisfaction · Energy distribution · MEG · IASC · Satisfaction survey · Nonparametric tests

1 Introduction

In the recent years, the Brazilian energy sector has been undergoing constant transformations, provoked by dynamic scenarios, a more restrictive regulatory environment and specific performed by industry associations like ABRADEE (Association of Electric Power Distribution Companies).

The challenges imposed on the distributers, due to availability, the progressive improvement in the quality of services rendered, competitive prices, efficiency and cost-effectiveness (Baltazar 2007), besides balancing the interests of several interested parties (Brito 2007), has been leading industry associations like ABRADEE, as well as regulatory agencies to propose actions that enable the companies to face these challenges.

© Springer Nature Switzerland AG 2020
O. Gervasi et al. (Eds.): ICCSA 2020, LNCS 12251, pp. 481–491, 2020.
https://doi.org/10.1007/978-3-030-58808-3_35

Among the actions implemented are the index of satisfaction evaluation of consumer (IASC) and the ABRADEE awards, promoted by Brazil's regulatory agency (ANEEL) and ABRADEE, respectively. In the case of the IASC prize, ANEEL annually conducts a satisfaction survey on services provided to residential consumers, which enables the IASC prize to cover the entire national territory. The ABRADEE prize, in turn, more specifically in the Management Quality category serves as an incentive to the adoption of the MEG (Excellence in Brazilian Management Model) provided by the distribution companies. In this category, participation in the PNQ (National Quality Prize) awards a grade that is subsequently used in the assessment of the ABRADEE Quality in Management Award.

As an effect of the actions mentioned above, at present the sector has participated significantly in the National Quality Prize (PNQ) and in similar awards, both regional and sectoral. For Boutler et al. (2013) and Corredor and Goñi (2010), the organizations that obtain these awards in recognition for their achievements are those that have the best results. Thus, the objective is consistent with the initial aim of the award: to encourage improvements that produce results.

Hence, we are able to evaluate, between the period of 2007 to 2016, if there are differences in performance of the IASC among the companies that regularly use the model, including the award winning companies and the indifferent ones.

The outline of this article is developed in four sections. In Sect. 2 is presented some background about models of excellence in management.Section 3 makes a brief summary about the methodology, the selection of variables is presented, is displayed a short summary about exploratory analysis of the data and it is performed the hypothesis tests. The results of statistical approach are presented. Finally in Sect. 4 some conclusions are drawn and some suggestions are pointed.

2 The MEG Model

According to the National Quality Foundation (FNQ 2016), the MEG is a world-class system of business management or a model for excellence in management. For Puay et al. (1998) and Miguel et al. (2004), these models represent efforts devoted by countries to improve their international reputation in the world market.

In the Brazilian context, the MEG model deserves special attention, seeing that it has become one of the most significant guidelines directed at competitiveness in the country (Cardoso et al. 2012). Furthermore, its importance corroborates ABRADEE's endeavor to promote actions that bring about the best results for the electric energy distribution companies and their interested parts, such as the ABRADEE Award.

The universality of the model and the possibilities of use by any type of organization (Calvo-Mora et al. 2015), as well as the slight differences in scope (Bucelli and Costa Neto 2013) also offer possibilities for the exchange of practices across industries, maximizing the benefits from its use.

Knowledge-exchange can also take place in relation to results obtained and/or practices adopted in similar awards, such as the Deming Prize (Japan), the Malcolm Baldrige National Quality Award (USA) and the European Quality Award (Europe), all

of which are among the most eminent awards according to considered by Kholl and Tan (1952), Tan (2002) and Puay et al. (1998).

For this study, it is relevant to emphasize that the versions of the MEG model employed between 2007 and 2016 were composed of two evaluation groups, namely processes and results. Both were aligned by way of fundamentals of excellence.

The criteria related to processes are established through the analysis of detailed information on how the organizations implement their management processes without pre-defined methodologies. Information concerning Leadership, Strategies and Plans, Clients, Social Responsibility, Information and Knowledge, People and Business Processes are requested from each organization. In turn, the results item calls for results that demonstrate the implementation of practices, the attainment of strategic results and the fulfillment of requirements set out by interested parties in a period of at least 3 years, besides benchmarking studies that show evidence of leadership (FNQ 2018). As a result, the evaluated organization receives a written remark about their strong points and areas for improvement, which can be used to improve management, as well as a score ranging from 0 to 1000 points, awarded according to pre-established criteria. The benefits of its use, however, are still controversial, and must be further analyzed individually for each sector or performance attribute. For Doelema et al. (2014), success in the implementation of this model is not assured, despite the dissemination of its use. For Boutler et al. (2013) and Corredor and Goñi (2010), organizations that adopt reference models demonstrate superior results.

In the context of this study, Puay et al. (1998) points out that the users of excellence models not only improve their quality, but also enhance other performance attributes, including client satisfaction, which is represented in the electric energy sector in the form of the IASC. Thus, the relation between GS (Global Score) and the IASC, and the difference in IASC performance among different groups of companies involved (users vs. indifferent, award winning vs. engaged) will be our object of study.

2.1 Measuring the Level of Satisfaction

The evaluation of customers' satisfaction level can be verified in relation to a product or a process. It can be defined as the result of a consumption experience, or as the consumer's response to balancing their expectations concerning a product or service, and the result obtained (Engel et al. 1993).

Used as a comparative tool with external benchmarks, and for gauging the quality of services rendered by the concessionaires of public services of electric energy, for problem-solving and for improving regulation, ANEEL conducts surveys based on studies of methods published by Marchetti and Prado (2001, 2004). Since 2000, ANEEL promotes the IASC prize, which recognizes the organizations that obtained the highest scores in the IASC customer satisfaction survey (ANEEL 2017).

At present, all distribution companies must undertake the survey and are held accountable to its results, which are made available for public consultation on the agency's website. The survey thus serves as a mechanism of popular pressure, among others, employed by the regulatory agency to encourage the improvement of services provided.

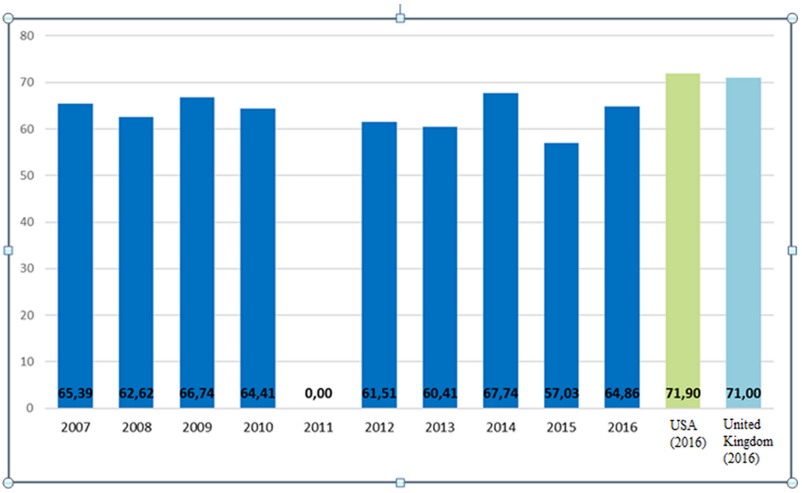

Fig. 1. Evolution of IASC Brazil (2007 to 2016). Evaluation of the quality of public services in Brazil (2016) and comparison with USA (2016) and United Kingdom (2016).

2.2 Satisfaction of Brazilian Customers with Respect to Electric Power Delivery Services

For Oliver (1981, 1997), satisfaction can be understood as the evaluation of the (user's) surprise inherent in a consumption experience. It is, hence, a relevant managerial tool for organizations that seek to improve the provision of their services.

For Marchetti and Prado (2004), in the case of public services such as the supply of electric energy, this type of evaluation has the role of enhancing the process of monitoring the results of the distribution companies, as well as correcting public policies and directing sectoral efforts towards satisfying the needs of consumers. In this way, having been designed for the energy distribution sector, the IASC represents an index of great social and managerial relevance.

The national results (see Fig. 1), however, do not show substantial improvement (in recent years). Weighed up against the comparative benchmarks, they indicate the existence of ample scope for attaining higher levels of improvement.

Compared to other public services (see Fig. 2), the measurement of satisfaction with the electric energy supply rates is the best among the services evaluated. The results presented Fig. 2 are in contrast with the need for improvement so that they can be classified as positive in the same evaluation (50%) (CNI 2016).

Hence, it is evident that the even though there have been advances in the improvement of indicators, sustained efforts are still required to reach a minimum threshold of satisfaction compatible with the standards demanded by the Brazilian population.

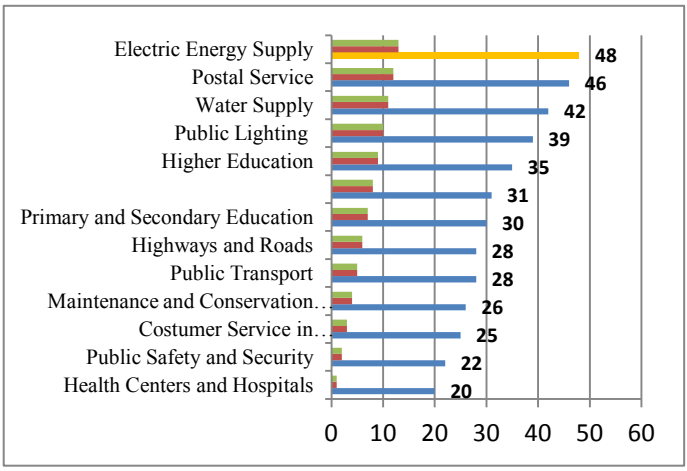

Fig. 2. Evaluation of the quality of public services in Brazil (2016) in contrast with the need for improvement so that they can be classified as positive.

3 Methodology

3.1 Sample and Population

The sample is composed by 31 organizations containing public data made available through sustainability reports, imparting a necessary level of maturity for the process of collating the information, which enables it to be made publicly available while ensuring an adequate degree of transparency. Together, the chosen organizations correspond to 96.1% of the total number of consumers and 95% of the electric energy distributed nationally.

The period of analysis comprehends the years between 2007 and 2016, where the initial year of the series is related with the fact that the PNQ had started to be used as criteria for awarding the ABRADEE Management Quality Prize, in a correlated way.

3.2 Variables Investigated and Data Collection Procedure

For the study in question, the GS and IASC variables were investigated. The GS variable derives from the score obtained by companies in the PNQ, which can vary between 0 to 1000 points, indicating the level of maturity of their management practices. This variable's collection process reflects the judgment of a multidisciplinary board with training and experience for evaluations of models of excellence. In addition, the data used to classify the organizations according to their participation was provided by the FNQ, where the award winners were made public through press releases and announcements to the market and posted on the entity's website.

The IASC scheme, in its turn, is annually organized by ANEEL using a standard methodology (Marchetti and Prado 2001, 2004). Its values can vary from 0 to 100% and are made available for public consultation on the entity's website from the first year

an application for the award was submitted. The set of data provided is the very same used for the IASC award (ANEEL 2016).

3.3 Strategies for the Data Analysis

The information was organized and tabulated in such a way as to be analyzed and distilled. In all cases, the organizations have sufficient data for the intended analysis to be carried out.

The organizations were divided into two groups: (1) users; and (2) indifferent. Subsequently, the engaged organizations were subdivided into: (3) prize winners and (4) engaged.

We thus considered:

(1) users - that is, the organizations that have over 3 participations or attained 30% of recognition level in the period of analysis, which characterizes regular participation;

(2) indifferent - that is, those organizations that participated up to 3 times or 30% of the number of times during the analyzed period, sequentially or not;

(3) prize winners - that is, the user organizations that obtained greater recognition in the period of analysis;

(4) engaged – that is, the user organizations that did not receive awards.

Once the groups were formed, we analyzed the variables, initially through descriptive statistics using pure variables, and then through the same analyses of the grouped data. As for the choice of tests, the assumption of normality necessary for some types of analysis was gauged using the Anderson-Darling test (Pino 2014).

The tests used indicated, at a five percent level of significance, that the IASC variable does not present a normal distribution. The option selected for dealing with non-normality, as suggested by Pino (2014), was the use of non-parametric tests. Among the potential tests that could be used, the Kruskal-Wallis (KW) test was applied, seeing as it is suitable for this purpose (Kruskal and Wallis 1952). The KW test is a non parametric test that uses ranks to compare if several independent samples have their origin from the same distribution (one way analysis of variance by ranks). The parametric similar approach of KW Test is the ANOVA (parametric one way analysis of variance).

3.4 Treatment of Data

Once the graphic analyses deriving from descriptive statistics were performed, the database content was analyzed individually, with special attention to the missing data and to the atypical data (outliers) and corrected as necessary.

With reference to the GS, the missing data deriving from the quarantine periods was complemented by the results of the last participation in the PNQ. When the organization ceased to participate, we understood that the practice was interrupted and the gaps were maintained.

As for the IASC, the data from 2011 were not validated by ANEEL, which did not the disseminate indexes obtained (Carrasco 2018). Hence we opted for repeating the values of 2010 for the period of 2011. No correction of the atypical data (outliers) was necessary.

Data Analysis

Descriptive Statistics

The first analysis, deriving from descriptive statistics, allows us to understand the IASC behavior in the various groups of companies (users, indifferent, award winning and engaged). The descriptive statistics can be found in Table 1.

Table 1. Descriptive statistics

Companies	Minimum	Mean	Median	Maximum
Users	48.1	64.3	64.4	79.0
Awarded	51.7	66.5	67.8	79.0
Engaged	48.1	63.1	63.0	77.9
Indifferents	35.5	55.8	56.3	71.8

Best results

Worst results

When evaluating the measures of position, it can be observed that the best IASC results can be found in the group of award winning companies, whereas the worst relate to the indifferent ones.

On the basis of the results, as referred, it was of interest to test the existence of differences in performance of IASC amongst the companies that use regularly the model MEG, including the award winning companies and the indifferent ones. In both cases the null hypothesis, H_0, was conceived as assuming the equality between the groups and the alternative hypothesis, H_1, their difference. These hypotheses, which have been substantiated in the main analysis, are described in Table 2.

Table 2. Proposed hypotheses during the study

HA_0: Users organizations deliver the same level of performance in IASC as indifferent organizations	HA_1: Users organizations deliver a higher level of performance in IASC than indifferent organizations
HB_0: Award winning organizations deliver the same lev of performance in IASC as engaged organizations	HB_1: Award winning organizations deliver a higher level of performance in IASC than engaged organizations

The dispersion graph (see Fig. 3) also corroborates this analysis. Even though the correlation between the indexes is low, it can be noted that the award winning organizations are concentrated in the upper half of the graphs, and the indifferent companies in the lower quadrants.

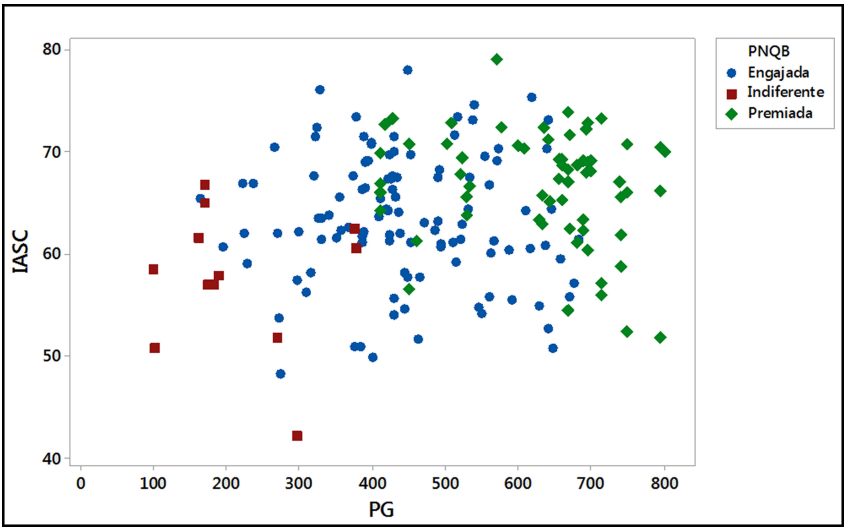

Fig. 3. Scatter analysis GS versus IASC.

The results of the dispersion graph reinforce the low correlation established in the Pearson correlation test (0.18803). It also occurs due to the fact that the IASC represents the satisfaction of consumers, therefore providing an external view of the organization, while the GS indicates internal improvements, as well as those related to the management of the indicators that will reflect the highest satisfaction indexes. On that account, they are complementary, even though they do not explain each other only by themselves.

Testing the Hypothesis

For each hypothesis being tested, we defined two alternatives. The null hypothesis (H_0) consists in admitting that there are no statistical differences among the samples presented. The alternative hypothesis (H_1) consists in a finding of differences. In the case in question, rejecting the null hypothesis (H_0), applying the test Kruskal-Wallis (Martins 2001), is equivalent to confirm the suppositions in this study.

In this way, by obtaining p-value results lower to 0.05 (see Table 3) we consider that there is statistical evidence for the hypotheses HA_1 and HB_1 (shown in Table 1) at a significance level of 5%.

Table 3. P-value results (Kruskal Wallis test).

Groups	$\propto$	n	IASC p-value
Engaged vs Awarded	5%	220	<0.001
Awarded + Engaged vs Indifferent	5%	307	<0.001

4 Conclusions

In this article, we have evaluated the performance difference in IASC of Brazilian electric energy distribution, in a period of ten years (2007 to 2016), vis-à-vis their performance level in the adoption of the MEG.

In our first evaluation, we demonstrated the performance difference between the user companies and the indifferent ones through validation of Hypothesis HA_1. This confirms studies such as that of Puay et al. (1998), where the best satisfaction results are found in companies using excellence models.

The validation of the second hypothesis, HB_1, leads us to confirm that the award winning organizations have better IASC results than the engaged organizations. Hence, these findings corroborate studies like those by Escrig and Menezes (2015), who point to an increase in the correlation between managerial maturity and results in the organizations using this model.

Both conclusions are aligned with the findings presented by Boutler et al. (2013) and Corredor and Goñi (2010), wherein such recognitions are obtained by companies that achieved more positive results, and not by the organizations whose results were not as good.

By adopting a combined and holistic approach, we also identified that the greater managerial maturity of companies, the better their results in the IASC index. Thus we can attest the positive effects evidenced by the use of reference models of the electric energy sector, on a large scale, during the period analyzed.

Acknowledgements. Marina A. P. Andrade acknowledges the financial support by Portuguese funds through the ISTAR -ISCTE, Instituto Universitário de Lisboa.

M. Filomena Teodoro acknowledges the financial support by Portuguese funds through the Center for Computational and Stochastic Mathematics (CEMAT), The Portuguese Foundation for Science and Technology (FCT), University of Lisbon, Portugal, project UID/Multi/04621/2019, and Center of Naval Research (CINAV), Naval Academy, Portuguese Navy, Portugal.

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