# CRITICAL SUCCESS FACTORS AND QUALITY SERVICE IN VEHICLE INSPECTION BODIES

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## ABSTRACT

The scope of this research is to determine the **Critical Success Factors** – CSF for the launching of a Vehicle Inspection Body accredited by Inmetro – OIA; evaluation of the **Perceived Service Quality** – PSQ by the s of the inspection services offered by an OIA;, and then verification, through regression analysis and the minimum square method, of the eventual relation between those two previous issues.

The confirmation of a positive relation between CSF and PSQ, which did not occur, would indicate that a proper implementation of the CSF by the OIA could imply a better perception of the service quality, promoting a virtuous cycle that would contribute to increase credibility and diminish  necessity of controlling for the Vehicle Inspection Body Accreditation Program.

## THE  CONTEXT

DENATRAN (National Transit Department) and INMETRO (National Institute of Metrology) created a national program of vehicle inspection bodies accreditation, due to the necessity of diminishing the amount of unsafe vehicles in Brazil.  The accreditation of an inspection body indicates to the society that it has technical competence to execute inspections, in conformity with the applicable technical standards and regulations.

The OIA (Accredited Vehicle Inspection Body) issues Vehicle Safety Certificates (CSV) after inspection and approval of modified, home made or recovered vehicles.  Only

with a CSV in hand it is possible to obtain in the DETRANS (Transit Departments) the documentation for vehicles that must be inspected.

## THE PROBLEM

Accreditation programs, applied to mandatory services, require double efforts concerning their **credibility.** The accreditator is not present at the daily activities of the accredited inspection bodies, and cannot guarantee that their performance will always be the same as demonstrated when assessed.

Once the CSV is a mandatory document, sometimes the only goal of the client of an OIA is to regularize his/her vehicle documentation. Maybe, he or she is not interested (*or does not want)* an inspection of quality, for it could be too expensive to fix a failure detected. On the other hand, superficial inspections can be offered by the OIA for lower prices.

In this scenario, OIA that are technically competent can be tempted to approve unsafe vehicles, with prejudice to the credibility of the vehicle inspection accreditation program, that could become merely an innocuous governmental tax.

## THE GOAL

The eventual finding of a positive relation between CSF and PSQ, can point to a virtuous cycle for the vehicle inspection field. "The OIA that invest in the Critical Success Factors get more Perceived Service Quality from their clients, whom, on the other hand, are learning to privilege and claim for more quality". In short, the intention is to assess the potentiality of the relation between CSF and PSQ to provide, as a complement to controlling, credibility for the vehicle inspection accreditation program.

# THEORETICAL REFERENTIAL

## CFS, Industry Life Cycle and Porter Prognoses

According to Rockart (1979), the Critical Success Factors support the implementation of the organizational goals, chiefly in areas where a good performance is necessary to fulfill those goals, thus assuring a successful **competitive performance**.

Managers, at different levels of the organization, must have the appropriate information that enable them to determine if the actions are being conducted with efficiency, in each area considered as critical for the success of the firm. Considering those issues, Rockart developed empiric method based on interviews, presented in the article entitled: ''Chief Executives Define Their Own Data Needs'', Harvard Business Review (Rockart e Bullen, 1979).

According to Rockart and Bullen (1981), the CSF concept is used mainly to help at the planning of Information Systems, as shown at the Figure 1, below:
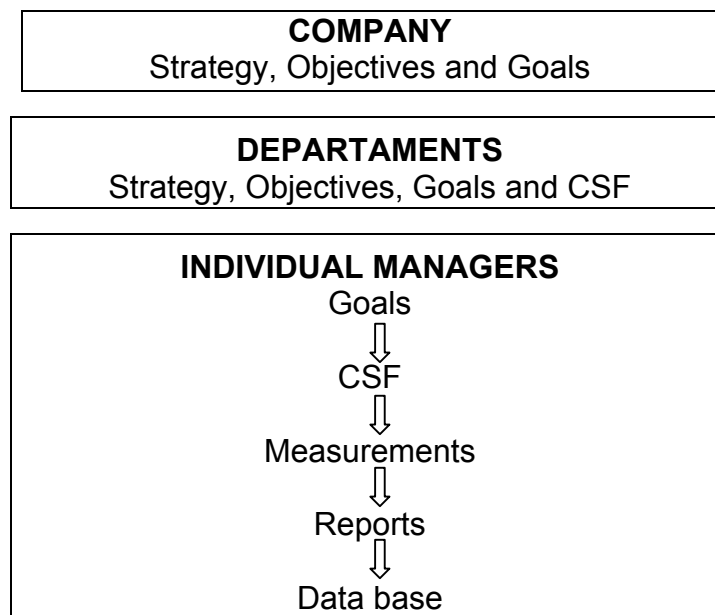
```
+-----------------------------------------------+
|                  COMPANY                      |
|        Strategy, Objectives and Goals         |
+-----------------------------------------------+

+-----------------------------------------------+
|               DEPARTAMENTS                    |
|     Strategy, Objectives, Goals and CSF       |
+-----------------------------------------------+

+-----------------------------------------------+
|            INDIVIDUAL MANAGERS                |
|                   Goals                       |
|                    ⇩                          |
|                    CSF                        |
|                    ⇩                          |
|                Measurements                   |
|                    ⇩                          |
|                  Reports                      |
|                    ⇩                          |
|                 Data base                     |
+-----------------------------------------------+
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**Figure 1:  CSF usage process for information finding**

Source: Bullen e Rockart (1981)

## Industry Life Cycle

When Michael Porter (1986) applies the classical concept of product life cycle to the industry, he suggests that it occurs to the latter with the same four basic stages of life cycle, following the patterns of the S curve: launching, growing, maturity and decline, as illustrated in Figure 2 below:
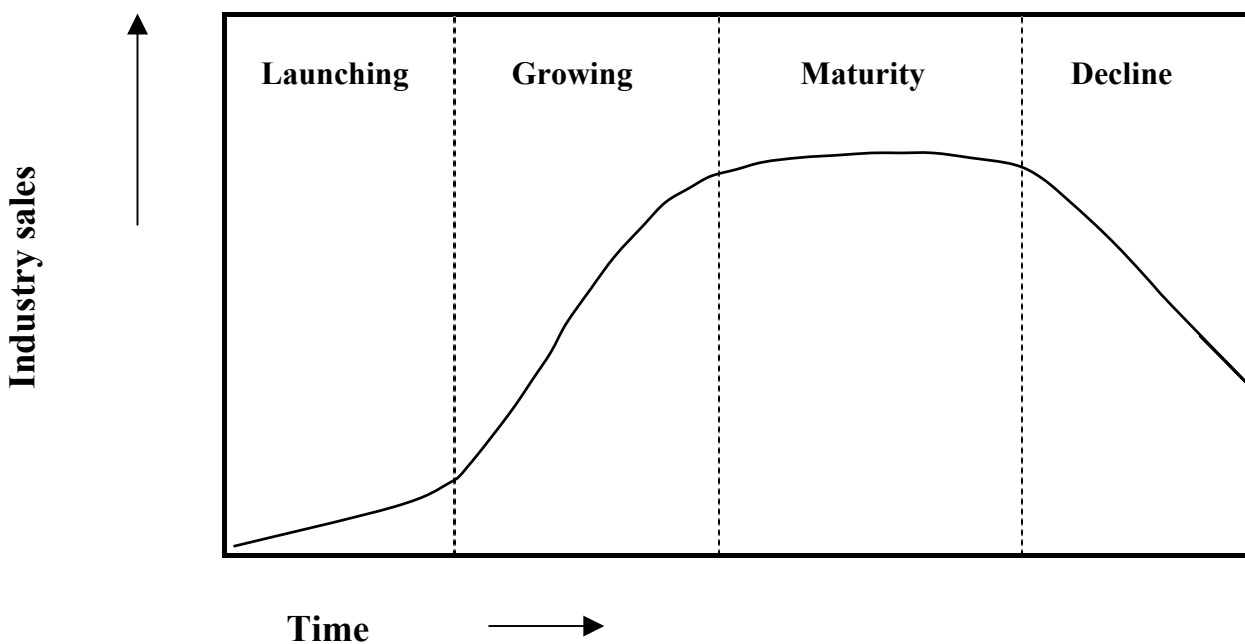


**Figure 2 – Industry Life Cycle Stages**
Source: Porter, 1986.

- *Launching Stage*: difficulty to overcome clients´ inertia,
- *Growing Stage*: clients begin to look forward to the product or service once it is successful at the testing in the introductory stage,
- *Maturity Stage*: growth slows down, leveling at the basic potential of the group of significative clients, and
- *Decline Stage:* which comes with the competition of new products or services.

## Porter Prognoses applied to Industry Life Cycle

Based on his model of the five market interacting strengths, and on strategic determinants, interactions and implications of the principal evolution processes of the competitive structures for different industries, Porter (1996) developed, for the four life cycle stages, prognoses for the evolution of an industry, considering ten different aspects.

The Porter Aspects and respective prognoses related to the launching stage of an industry life cycle are described in table 1:

| Porter Aspects | Prognosis for the launching Stage of the life cycle |
|---|---|
| Buyers and Buyers´ behavior | - High income buyer<br>- Buyers´ inertia<br>- Buyers must be convinced to test the product/service |
| Products/services and Changes in products/services | - Lower quality<br>- Product/service design is a key-factor for development<br>- Many product/service variations, without patterns<br>- Frequent design changes<br>- Basic designs for the product/service |
| Marketing | - Very high publicity/sales<br>- Better price strategies<br>- High marketing costs |
| Manufacture and Distribution | - High costs with specialized personnel<br>- High production costs<br>- Specialized channels |
| R&D | - Mutable production techniques |
| Overseas Trading | - Some export |
| Global Strategy | - Better period to increase market share<br>- R&D e engineering are basic functions |
| Competition | - Few companies |
| Risk | - High risk |
| Margin and Profit | - High prices and margins<br>- Low profits<br>- Limited price flexibility for individual sales |

**Table 1: Porter Aspects and Prognosis for launching stage of an industry**

Source: Author´s adaptation from Porter (1986)

# Perceived Service Quality – PSQ and the SERVQUAL Model

Services differ from products under three fundamental aspects: they are *intangible, inseparable* and *heterogeneous*, making service quality more difficult to be assessed.  The criteria for judgement, not only the results (as for products), are defined by the clients and may be complex and difficult to be captured precisely.

Parasuraman et al. initially identified ten *service quality dimensions,* and *four key-factors of client expectation*, which compose the clients´ perception of service quality, as shown in the figure 3 below:
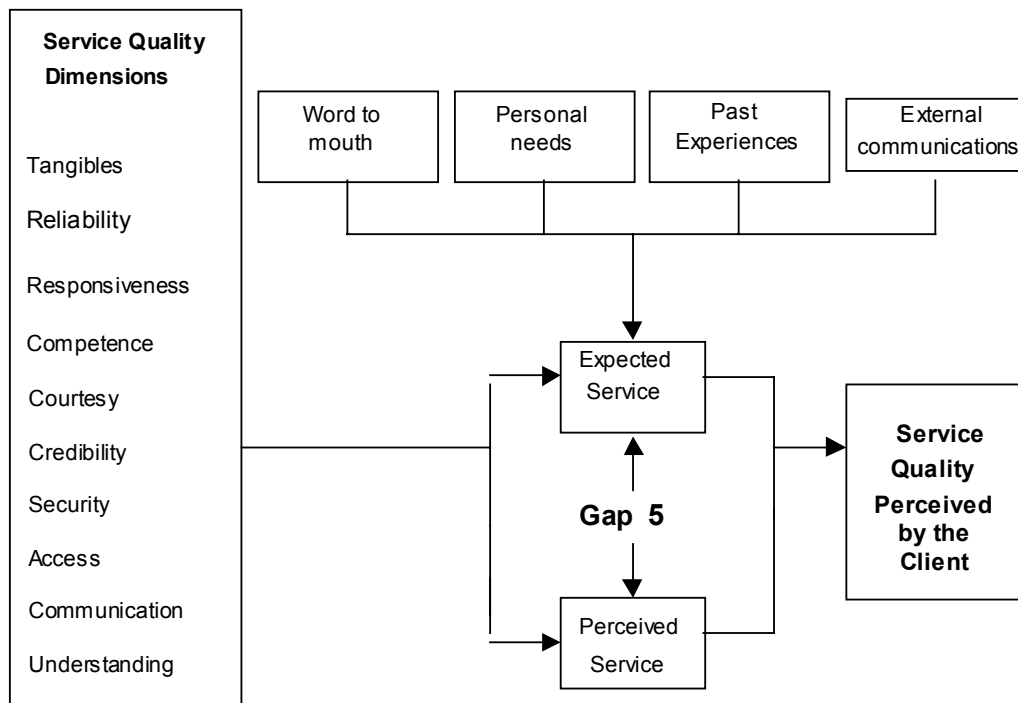


**Figure 3:  Service Quality perceived by the client .**
Source: Zeithaml, V. A.; Parasuraman, A.; Berry L. L.  Delivering Quality Service.
New York,  The Free Press, 1990

The **SERVQUAL** model helps to understand and measure Service Quality. It is a *gap model*, which enable us to assess the extension of the gaps between expectation and perception, concerning service quality.  The model works with five gaps, where four internal gaps are related to service provider and generate **gap 5,** which is the gap between expected service quality and perceived service quality, under clients´ point of view.

The final version of the SERVQUAL consists in **22 statements** - each presented as pairs of questions posed to the client regarding expectation and perception, respectively. For instance, one pair of questions can be: "Employees will be neat?" and "Employees were neat?". The statements, comprehending five quality dimensions consolidated from the ten initial quality dimensions, are listed in table 2 below:

| Quality Dimensions | Statements to be put in pairs of questions |
|---|---|
| Tangibles | • Have updated, modern-looking equipment<br>• Have physical facilities visually appealing<br>• Employees are neat appearing<br>• Materials associated with the service (pamphlets, etc.), visually appealing |
| Reliability | • When the company promises to do something by a certain time, it will do so<br>• When a client has a problem the company shows a genuine interest in solving it<br>• The company performs the service correctly the first time<br>• The company provides its services at the time promised<br>• The company insists o error-free records |
| Responsiveness | • Employees tell the clients exactly when the services will be performed<br>• Employees give prompt services to their clients<br>• Employees are always willing to help clients<br>• Employees are never too busy to attend clients´ requests |
| Security | • Employees´ behavior instill confidence in clients<br>• Clients feel safe in their transactions with the company<br>• Employees are consistently courteous with clients<br>• Employees have knowledge to answer to clients' questions |
| Empathy | • The company gives individual attention to clients<br>• The company has operating hours convenient to all clients<br>• The employees give personal attention to clients<br>• The company has the clients' best interests at heart<br>• The employees understand the specific needs of their clients |

**Table 2: Statements to assess Service Quality from the five consolidated quality dimensions**
Source: Zeithaml, V. A.; Parasuraman, A.; Berry L. L. Delivering Quality Service. New York, The Free Press, 1990

**Using the SERVQUAL**

The two questions, for each quality statement, are presented to the respondent in two questionnaires, one to measure expectation and another to measure perception. For each question the respondent scores points from 7 (I totally agree) to 1 (I totally disagree).

A gap 5 SERVQUAL value is then measurable, through the subtraction of the points scored to each two questions, by each respondent:

**SERVQUAL value = points scored for perception − points scored for expectation**

For instance, if N clients answer to a SERVQUAL questionnaire, the average SERVQUAL value, *to each one of the five dimensions*, is calculated as follows:

1) For each client, add the SERVQUAL values obtained for the quality declarations of one dimension and divide the sum by the number of declarations of the dimension.

2) Add the values obtained in step 1 for all the N clients, and divide the total by N.

After this procedure, a *general average* of the Service Quality can be calculated by adding the SERVQUAL values obtained for each one of the five dimensions, and dividing the sum by five. This general average is not *weighed*, because it does not take in consideration the relative importance that clients attribute to each dimension. A *weighed* average can be obtained granting different weights for the dimensions.

## METHODOLOGY, PREMISES AND DEVELOPMENT OF THE STUDY

The **Hypothetical-deductive** method has been adopted for the CSF determination because it is compatible with a) the available resources, b) the nature of the theoretical referential, and c) the availability of empiric elements for the hypotheses validation testing, configuring the following dynamics:

- Detection of knowledge gaps for the solution of a problem,
- Elaboration of hypotheses for testing the prediction of events occurrence,
- The testing consist in critical discussion and confrontation of the hypotheses against facts and

- The testing allow a temporary confirmation of the corroborated hypotheses, until new problems and conjectures will lead to new hypotheses and new testing (Lakatos and Marconi, 2000).

## The premises adopted

*1   The Critical Success Factors are a valid scientific tool to the strategic planning of an industry.*

*2   The Porter aspects and prognoses can be considered as potential CSF, compatible with the SWOT methodology used by Rockart for CSF determination.*

*3   The SERVQUAL method, developed by Zeithaml, Parasuraman and Berry (1990), is valid to assess the  Service Quality perceived by the clients of a company.*

## The Development of the Study

### Identification of Potential CSF and definition of hypotheses

In this study, the identification of potential CSF for the launching of an OIA, did not consider the Porter Aspects:  *buyers´ behavior, changes in products/services, R&D, risk, overseas trade and global strategy*, for their low compatibility with a mandatory, regulated and domestic service.

| Porter Aspects | Porter Prognostics | Potential CSF at the launching of an OIA |
|---|---|---|
| Competition | Few companies | • No other OIA in  the area |
| Margins and Profits | Low profits | • Charge lower prices |
| Distribution and Manufacturing | High content of labor | • Training and qualification of technical personnel |
| | | • Training and qualification of the personnel interacting with the client |
| Marketing | High marketing costs | • Spacious, comfortable and appealing facilities |

**Table 3: Potential CSF for an OIA based on Porter aspects and prognoses**

Source: elaborated by the author

Considering the potential CSF identified in table 3, the five hypotheses listed below were defined, to be tested aiming at the determination of the CSF.

**- H1**: None or few competitors in the area is a CSF at the launching of an OIA.

**- H4**: Practice of lower prices than the competition is a CSF at the launching of an OIA.

**- H2**: Quick and precise inspections is a CSF for the launching of an OIA.

**- H3**: Courteous, communicative and sincere attendance is a CSF at the launching of an OIA.

**- H5**: Spacious, comfortable and appealing facilities is a CSF at the launching of an OIA.

Observation: the above order of the hypotheses has been altered in relation to the previous order of the five potential CSF identified (Table 3), due to the order adopted for the questionnaire. This was done to avoid tendency in the answers that could be caused by concatenation of ideas within adjacent questions.

## The population, the questionnaire and the CSF data compilation

The data survey for CSF determination was done considering a population stratified in two populations:

- Third part population, composed by Cgcre/Inmetro accreditation technicians, lead auditors and technical auditors, who are independent of the inspection service.
- First part population, composed by OIA owners, technical managers and inspectors, who provide the inspection service.

Structure of the questionnaire for CSF determination:
- Item 1: a group of ten questions for CSF determination, through a 2 by 2 combination of the five potential CSF.
- Item 2: one question to check whether the respondent would disregard one of the five potential CSF proposed in the questionnaire.
- Item 3: one question to check whether the respondent would include other(s) CSF in the questionnaire.

- Item 4: One question, exclusive for the first part population, concerning the order of a decreasing priority attribution for the five potential CSF, at the OIA where the respondent works.
  - For the third part population, data of 18 questionnaires were compiled.
  - For the first part population, data of 41 questionnaires were compiled.
  - Although the stratification in two populations can provide interesting information, the data of the whole 59 questionnaires available (a sample of the union of first and third part populations) was used for the CSF determination.

**The Statistical treatment of data compiled for the CSF**

The t-Student distribution was chosen to make the statistical analysis, considering its adequacy to the size of the first part sample (n=18, < 30), and also to the third part sample and the union sample (n=41 and n=59), once the t-Student distribution tends to normality for n > 30 samples (Anderson, 2002).

Using the statistic tool  Minitab (version 13),  measurements for central tendency (mean) and dispersion (standard deviation) were calculated for  data compiled from the 59 questionnaires, for the potential CSF I, II, III, IV and V, and then determined the respective trust intervals,  using the t-Student distribution, with 5% of uncertainty.

| CSF | N | Mean | SD | TI (95%) |
|-----|-----|-------|-------|-------------------|
| III | 59 | 28,64 | 11,37 | (25,68 to 31,61) |
| II | 59 | 23,39 | 10,92 | (20,54 to 26,24) |
| V | 59 | 22,03 | 11,86 | (18,94 to 25,12) |
| I | 59 | 15,42 | 13,56 | (11,89 to 18,96) |
| IV | 59 | 10,51 | 12,92 | (7,14  to 13,88) |

**Table 4:  Potential CSF percentage values of mean, standard deviation and trust intervals for data sampled on the 59 first and third part questionnaires.**

Source: elaborated by the author

**The criteria for CSF determination**

The criteria adopted to corroborate the hypotheses formulated in this study -- that is, *to reject the respective null hypotheses (H0), with 95% of certainty* -- was to consider as effectively critical those CSF that obtained more than 20% of the options in the questionnaires. This criteria is based on the understanding that if all of the 05 hypotheses were equally probable, it should be obtained the same 20% of options for all CSF if the whole population were sampled. Therefore, the CSF that obtained more than 20% of the options, is above the "average critical level" of the 05 potential CSF proposed in the questionnaires.

**Hypotheses testing for CSF determination**

Applying the above established criteria to the trust intervals calculated by the Minitab (table 4), it is possible to assure, with 95% of certainty, that **for the hypotheses**:

- **H1**, being H0: "None or few competitors in the area <u>is not</u> a CSF at the launching of an OIA", **H0 cannot be rejected, for this potential CSF obtained no more than <u>18,96%</u> of the options in the questionnaires**.

- **H2,** being H0: "Quick and precise inspections <u>is not</u> a CSF at the launching of an OIA", **H0 can be rejected, for this potential CSF obtained at least <u>20,54%</u> of the options in the questionnaires.**

- **H3**, being H0: "A courteous, communicative and sincere attendance <u>is not</u> a CSF at the launching of an OIA", **H0 can be rejected, for this CSF obtained at least <u>25,68%</u> of the options at the questionnaires.**

- **H4**, being H0: "Practice of lower prices than the competition <u>is not</u> a CSF at the launching of an OIA", **H0 can not be rejected, for this CSF obtained no more than <u>13,88%</u> of the options in the questionnaires.**

- **H5**, being H0: "Spacious, comfortable and appealing facilities <u>is not</u> a CSF at the launching of an OIA", **H0 cannot be rejected, for this CSF did not obtain at least 20%** (18,94% was the lower limit of the trust interval) **of the options in the questionnaires.**

**Therefore, the hypotheses testing corroborated the hypotheses:**

- **H2**: **Quick and precise inspections**
- **H3: Courteous, communicative and sincere attendance**

And refuted the hypotheses:

- H1: None or few competitors in the area
- H4: Practice of lower prices than the competition
- H5: Spacious, comfortable and appealing facilities

## Evaluating the SERVQUAL gap 5 for Perceived Service Quality

Based on the statements elaborated by Parasuraman et al. for the five consolidated quality dimensions (see table 2), 22 pairs of questions were formulated to evaluate the clients perception of the inspection service quality.

Although Parasuraman et al. propose to use two questionnaires, one to measure the expectation before the service and another to measure the perception after it, only one questionnaire was applied in this study, just after the end of the inspection. The intention was to minimize the effort and time spent with distribution, orientation and filling of the questionnaires, and also to avoid inconsistency between the pairs of answers of respondents that, when filling the second questionnaire, could no more remember their previous answering criteria.

## Elaboration and distribution of the PSQ questionnaire

The questionnaire was structured in three columns:

- The first column lists the 22 declarations, for the 5 quality dimensions,
- the second one consists in scales graduated from 1 to 7, where the respondent points out, <u>before the inspection</u>, the grade for his/her quality service <u>expectation,</u> as to each one of the 22 declarations, the third one consists in the same scales, where the respondent points out, <u>after the inspection</u>, the grade for his/her quality service <u>perception, as to</u> each one of the 22 declarations.

The questionnaires were sent to the 40 OIA by e-mail (filling instructions attached), to be distributed to the respondents just after the end of the inspections.  In case of non-approval of the inspected vehicle, the OIA employee gave the questionnaire to the respondent only after the re-inspection.

**The SERVQUAL values obtained for gap 5**

Only 16 OIA returned filled in questionnaires, and 3 out of those sent insufficient number (less than 8) of questionnaires with consistent data.  Therefore, the CSF x PSQ relation could be evaluated only for 13 OIA.

In table 5 there are listed, in decreasing order, the SERVQUAL values calculated on the data compiled from the questionnaires answered by respondents of the 13 OIA.

| OIA | SERVQUAL values (perception grade – expectation grade) | | | | | |
|---|---|---|---|---|---|---|
| | Security | Empathy | Reliability | Responsiveness | Tangibles | **Total** |
| **12** (n=13) | 1,04 | 1,51 | 1,09 | 1,12 | 0,81 | **5,57** |
| **03** (n=29) | 0,99 | 1,25 | 1,07 | 1,10 | 0,96 | **5,37** |
| **13** (n=12) | 1,17 | 0,55 | 0,97 | 0,56 | 0,87 | **4,12** |
| **02** (n=17) | 0,60 | 0,86 | 0,68 | 0,78 | 0,68 | **3,60** |
| **05** (n=16) | 0,30 | 0,38 | 0,54 | 0,66 | 0,84 | **2,72** |
| **06** (n=16) | 0,59 | 0,47 | 0,34 | 0,45 | 0,50 | **2,35** |
| **10** (n=17) | 0,54 | 0,28 | 0,57 | 0,41 | 0,25 | **2,05** |
| **09** (n=20) | 0,26 | 0,26 | 0,41 | 0,16 | 0,49 | **1,58** |
| **O1** (n=20) | 0,46 | 0,39 | 0,30 | 0,42 | -0,04 | **1,53** |
| **04** (n=14) | 0,34 | 0,20 | 0,18 | 0,25 | 0,23 | **1,20** |
| **11** (n=9) | 0,19 | 0,40 | 0,11 | 0,11 | 0,22 | **1,03** |
| **07** (n=8) | 0,06 | 0,06 | 0,06 | 0,03 | -0,31 | **-0,10** |
| **08** (n=8) | 0,22 | -0,35 | -0,27 | -0,28 | - 0,66 | **-1,34** |
| Total | 6,76 | 6,26 | 6,05 | 5,77 | 4,84 | 29,68 |

**Table 5:  SERVQUAL values calculated on the PSQ questionnaires data taken from 13 OIA**

Source: elaborated by the author

## Evaluating the CSF x PSQ relation

Table 4 shows the following decreasing order for the absolute CSF average values:

CSF **III** (2,87) > CSF **II** (2,34) > CSF **V** (2,20) > CSF **I** (15,4) > CSF **IV** (10,5)

In order to evaluate the relation CSF x PSQ, it was defined the variable "Priority Rightness Value" (**PRV**), consisting in: the product of the CSF average value, by a "priority rightness factor", that can assume the values < 1 ; 0,75 ; 0,5 ; 0,25 ; 0,0 > depending on the rightness of the priority level practiced by the OIA for each CSF, compared to CSF decreasing ordering **III, II, V, I, IV**.

Table 6 below shows, for each one of the 13 OIA, the **PRV** calculation steps, and the respective SERVQUAL value (**SV**).

| OIA | CSF priority levels practiced at the OIA launching | | | | | Priority Rightness Value (PRV) for the CSF practiced at the launching of the OIA, considering the average CSF values for the first and third part population | | | | | | | | | | | Total SERVQUAL value (SV) for the OIA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | III | II | V | I | IV | III | II | V | I | IV | III | II | V | I | IV | VAP |  |
| | | | | | | 5 | 4 | 3 | 2 | 1 | 2,87 | 2,34 | 2,20 | 1,54 | 1,05 | total |  |
| 12 | 5 | 4 | 3 | 4 | 1 | 1.0 | 1.0 | 1.0 | 0.5 | 1.0 | 2.87 | 2.34 | 2.20 | 0.77 | 1.05 | **9.23** | **5.57** |
| 3 | 3 | 5 | 4 | 1 | 2 | 0,5 | 0,75 | 0,75 | 0,75 | 0,75 | 1,43 | 1,76 | 1,65 | 1,16 | 0,79 | **6,79** | **5,37** |
| 13 | 4 | 2 | 5 | 3 | 1 | 0,75 | 0,5 | 0,5 | 0,75 | 1,0 | 2,15 | 1,17 | 1,10 | 1,16 | 1,05 | **6,63** | **4,12** |
| 2 | 3 | 4 | 5 | 2 | 1 | 0,5 | 1,0 | 0,5 | 1,0 | 1,0 | 1,44 | 2,34 | 1,10 | 1,54 | 1,05 | **7,48** | **3,60** |
| 5 | 1 | 3 | 2 | 5 | 4 | 0 | 0,75 | 0,75 | 0,25 | 0,25 | 0 | 1,76 | 1,65 | 0,39 | 0,26 | **4,06** | **2,72** |
| 6 | 5 | 4 | 3 | 1 | 2 | 1,0 | 1,0 | 1,0 | 0,75 | 0,75 | 2,87 | 2,34 | 2,20 | 1,16 | 0,79 | **9,36** | **2,35** |
| 10 | 3 | 2 | 5 | 1 | 4 | 0,5 | 0,5 | 0,5 | 0,75 | 0,25 | 1,44 | 1,17 | 1,10 | 1,16 | 0,42 | **5,29** | **2,05** |
| 9 | 4 | 5 | 3 | 2 | 1 | 0,75 | 0,75 | 1,0 | 1,0 | 1,0 | 2,15 | 1,76 | 2,20 | 1,54 | 1,05 | **8,70** | **1,58** |
| 1 | 3 | 2 | 4 | 5 | 1 | 0,5 | 0,5 | 0,75 | 0,25 | 1,0 | 1,44 | 1,17 | 1,65 | 0,39 | 1,05 | **5,70** | **1,53** |
| 4 | 4 | 3 | 5 | 2 | 1 | 0,75 | 0,75 | 0,5 | 1,0 | 1,0 | 2,15 | 1,76 | 1,10 | 1,54 | 1,05 | **7,60** | **1,20** |
| 11 | 4 | 3 | 2 | 5 | 1 | 0,75 | 0,75 | 0,75 | 0,25 | 1,0 | 2,15 | 1,76 | 1,65 | 0,39 | 1,05 | **7,00** | **1,03** |
| 7 | 1 | 3 | 1 | 4 | 5 | 0 | 0,75 | 0,5 | 0,5 | 0 | 0 | 1,76 | 1,10 | 0,77 | 0 | **3,63** | **- 0,10** |
| 8 | 2 | 4 | 3 | 2 | 4 | 0,25 | 1,0 | 1,0 | 1,0 | 0,25 | 0,72 | 2,34 | 2,20 | 1,54 | 0,26 | **7,06** | **- 1,34** |

**Table 6: The CSF Priority Rightness Values at the OIA launching and the respective SERVQUAL values**

Source: elaborated by the author

Once measured the priority rightness value for the CSF at the launching of each one of the OIA, it is possible to make a direct comparison of these values with the respective SERVQUAL values obtained by the OIA. It is then, possible to evaluate a possible relation between the CSF at an OIA launching, and Service Quality.

The columns on figure 1 represent, to each one of the 13 OIA, their values for PRV and SV taken from table 6, in decreasing order.
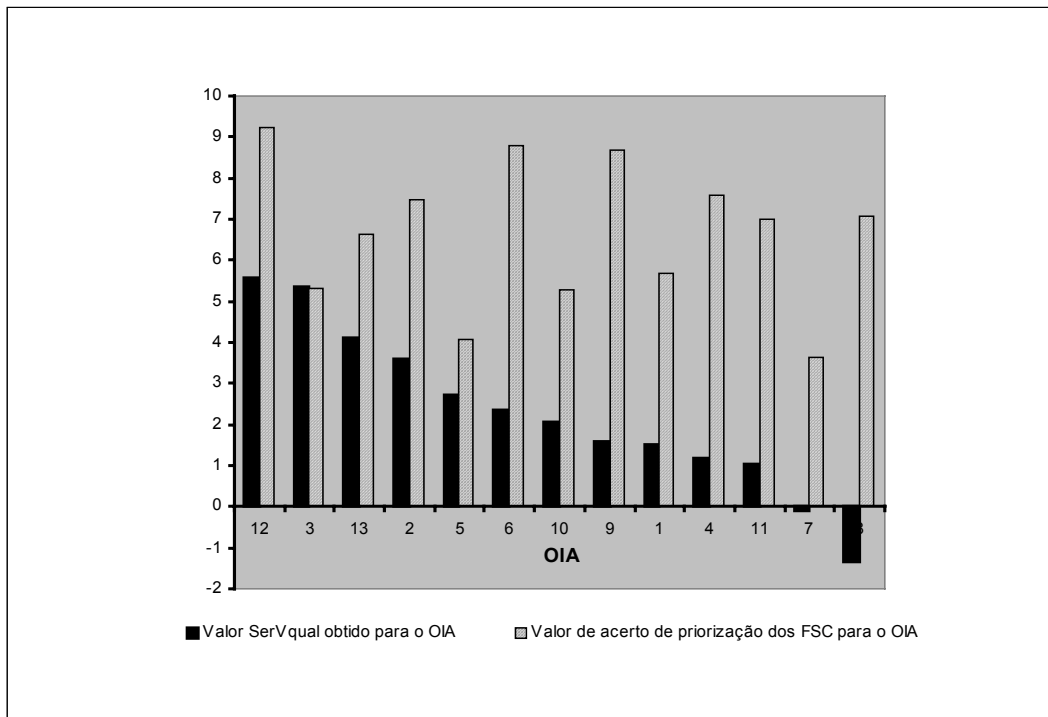


**Figure 1: PRV and SV values obtained for the OIA**

Source: elaborated by the author

In order to show a visual and direct representation of the relation between the CSF and PSQ, the graphic in figure 2 associates PRV (x-axis) and SV (y-axis).  It can be observed the great dispersion of the distribution.
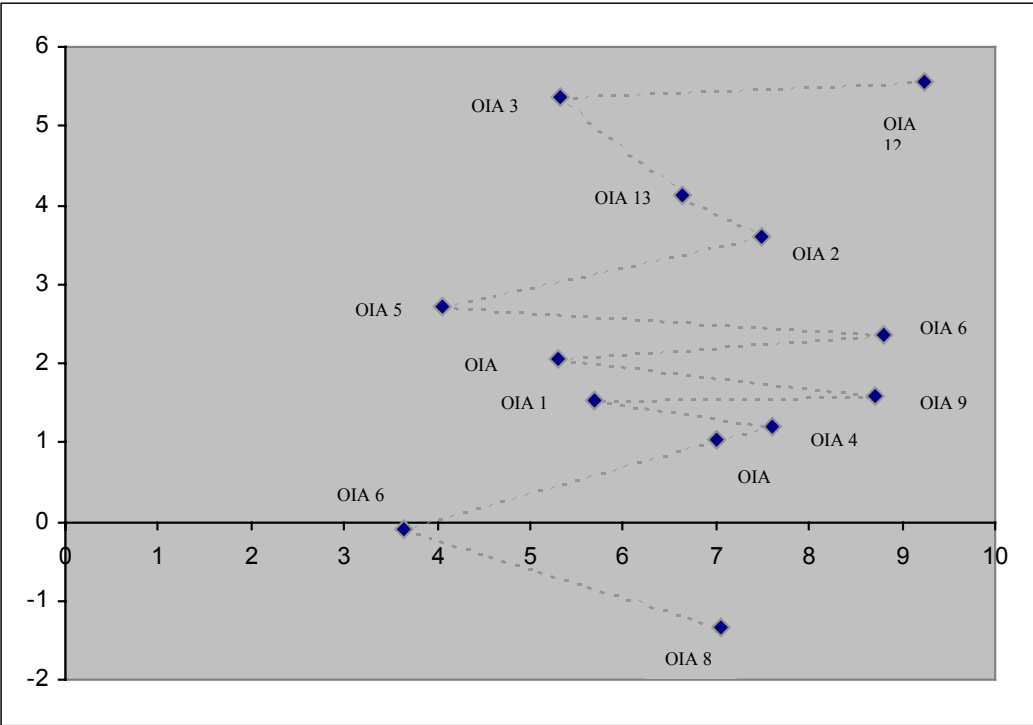


**Figure 2: VAP (x-axis) x VS (y-axis)**
Source: elaborated by the author

**Statistical analysis of the CSF x PSQ relation**

Using the Minitab, for a significance level of 5%, a regression analysis was made for the two variables PRV (independent variable) and SV (dependent variable).The following regression equation was obtained:

$$PRV = 0.21x \, SV + 0.87$$

To validate the equation, the Minitab performs two tests:

The first test assesses the significance of the correlation coefficients $\beta_0 = 0.87$ and $\beta_1 = 0.21$. $(Y = \beta_0 + \beta_1. X)$. This test considers the two hypotheses below:

H 0 : the correlation coefficient is equal to zero (i.e., there is no significance).

H 1 : the correlation coefficient is different than zero (i.e., there is an actual relation between the variables considered, for the significance level adopted).

To reject H0, and so corroborate H1, *p* value (calculated by the Minitab) would have to be lower than the 5% adopted as the significance level. As for $\beta_0$ e $\beta_1$ *p* values found were respectively 70.7% and 52.6, *0 cannot be rejected.* That is, *it cannot be assured that the coefficients are different than zero and that the regression equation is significant to explain the relation between the variables PRV and SV.*

In the second test, of variance analysis, the Minitab compares the variation due to the regression equation, with the random variation, considering two hypotheses:

H 0 : the variation due to the regression equation is not different from the random variation.

H1: there is a difference between the two variations (i.e., the regression equation is significant to explain the event, for a determined Alfa error).

Considering the 5% significance level (Alfa error) adopted, to reject H0 the *p* value would have to be < 5%. Once the *p* value calculated by the Minitab was 52,6%, *H0 cannot again be rejected*, that is, *the regression equation is not significant and the variable are not correlated.*

Lastly, there is the value for the Determination Coefficient R2 (R-sq) = 3.8%, also calculated in the Minitab regression analysis,. *This means that only 3.8% of the variation is explained by the regression equation, therefore 96.2% of the variation must be random.*

# CONCLUSIONS, COMMENTS AND SUGGESTIONS

## Regarding the Critical Success Factors determination

**Conclusion:**

As shown in the statistical analysis, hypotheses 2 and 3 were corroborated, which means that the potential CSF II ( *Quick and precise inspections)* and the CSF III (*Courteous, communicative and sincere attendance)* are Critical Success Factors at the launching of an OIA.

**Comments:**

A) Although, by the statistical parameters and criteria adopted in this study, only the CSF II and III had been considered effectively critical, the five potential CSF evaluated are significant, for all of them were identified based on the same theoretical referential. They represent, for the study of the CSF x PSQ relation in vehicle inspection, information as important as the H2 and H3 corroboration.

B) Ratifying the previous consideration, the potential CSF V (*Spacious, comfortable and appealing facilities)* obtained, in the questionnaires, an average of options very close to the CSF II, with an inferior limit of the trust interval only 1.06 percentage points under 20%. Besides, if only the first part population had been considered, *Spacious, comfortable and appealing facilities* would be a CSF, and the CSF II would not be.

C) The potential tendency to get politically correct answers from the questionnaires, mainly for the first part population, is a subjective and difficult component to be measured, but should not be underestimated. This potential tendency is understandable, considering that the study is undertaken by an employee of the institution that accredits the OIA, although the total independence of the study has been very clearly stated to the participants.

D) Endorsing the consideration above, the low percentage obtained by the CSF IV, *to practice lower prices than the competition*, is not quite compatible with the strong pressure by ANGIS (the vehicle inspection bodies' national association) to have the inspection prices fixed by Cgcre/Inmetro. They alleged that the OIA were practicing a "wild competition" and that the inspections´ quality was falling dramatically. Although Angis pressure could have a protectionist component, it is true that in areas with high concentration of OIA the inspection prices are much lower.

**Suggestion:**

Out of the five potential CSF evaluated, CSF IV had the highest number of suggestions to be excluded from the questionnaire, while "*a good location, with easy access*" was the most suggested potential CSF to be included.. In case of a second survey, it would be interesting to substitute the CSF IV (that possibly interacted negatively with CSF I) for this most suggested CSF. This substitution would certainly influence the options percentage obtained for the others CSF, probably getting closer to reality.

## Regarding the Perceived Service Quality Evaluation

**Conclusion:**

Out of the five quality dimensions evaluated by SERVQUAL, the dimension *security* presented the highest quality gap, while *tangibles* presented the smallest. This result indicates a proper performance of the OIA, considering that the quality dimension which more positively surprised the clients is the one of highest importance to the credibility of the vehicle inspection bodies accreditation program.

**Comment:**

There were a high percentage of rejected questionnaires, which can be a sign of the clients´ unconcern regarding the quality of the vehicle inspection service. In other words, it can be an indication that a good part of the OIA clients is merely looking forward to accomplishing the obligation to obtain the CSV in order to regularize their vehicle documentation.

**Suggestion:**

In case of a second PSQ data survey, it would be interesting that the questionnaires were presented to the OIA clients by independent and properly trained personnel, as to maximize consistency and minimize tendency in the clients' answers.


## Regarding the evaluation of the CSF x PSQ relation

**Conclusion:**

Considering the premises and criteria adopted in this study, it was verified that for a significance level of 5%, **there is it not an effective relation between the CSF at the launching of an OIA and Quality Service**.

**Comments:**

A) This conclusion may seem odd or incoherent, considering that nowadays more and more enterprises depend upon focus on client and service quality to be successful. However, the accredited vehicle inspection is a peculiar and recent activity that besides being mandatory is also nondistinctive, for all the OIA provides the very same CSV that every client needs to regularize their vehicle documentation. Therefore, it is understandable that the success of an OIA does not depend upon service quality.

B) Good quality vehicle inspections can detect flaws that could jeopardize the patrimony and physical integrity of the citizens. On the other hand, the frequent occurrence of ineffectual inspections could compromise the credibility of the Vehicle Inspection Program, which would tend to represent just an innocuous burden for the vehicle proprietor.

C) The fact that CSF and Service Quality did not present a positive relation for vehicle inspection frustrates in part the goal of providing useful information to feed a virtuous cycle between those two issues. For this to happen, cycle existed, it would probably be necessary that the OIA client, and even their proprietors, were more aware of the benefits provided by the vehicle inspection. Such awareness would certainly minimize the necessity and the negative effect of a mandatory vehicle inspection.

**Suggestions:**

A) An important step to be taken would be a cost x benefit study for a divulgation and elucidation campaign on benefits inherent to an effective vehicle inspection, which might lead the client to privilege and look forward service quality. This could be the necessary impulse to establish a CSF x PSQ virtuous cycle and diminish the need of control, to assure that the vehicle inspection program meets the goal of providing security to vehicle proprietors and people around them.

B) Other surveys, with resources to evaluate the CSF x PSQ relation for different types of inspections and vehicles - modified motorcycles, modified vehicles, gas converted vehicles, taxi drivers, taxi fleets, transport companies, truck drivers, etc - would permit to focus various strata of the clientele. This could help to define format and targeting of a campaign like the one suggested above. It could also serve as a tool for the OIA owners, helping them to properly expend their resources, considering the difference concerning CSF and PSQ.

C) Finally, it is important to have in mind that without a significant relation between success of an OIA and service quality, the credibility and efficacy of vehicle inspection depends basically upon control. In this scenario, federal and state regulators are the ones responsible to implement a proper control system, in order to assure the effectiveness of the Vehicle Inspection Body Accreditation Program.

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