# AN OVERVIEW OF SOFTWARE PROCESS QUALITY INSTRUMENTS ADOPTION AT BRAZIL

## *Preliminary Results of a Survey*

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Abstract: This paper presents results from a quantitative research that was conducted among 260 participants of a software quality event in Brazil. This research aims the understanding the occurrence of several IT problems in the analyzed organizations and the impact of the quality instruments adoption on those problems. The main contribution is the identification of the respondent's perception about the relationship of the quality instruments adoption and their impact on several IT problems throughout statistical analysis of the data.

## 1 INTRODUCTION

This paper presents the preliminary results of a quantitative research conducted in Brazil in order to explore and understand the relationship among some quality instruments, the organizations and the usual Information Technology (IT) problems. It was carried out statistical analisys in the collected data aiming to understand the impact of quality instruments adoption in the usual IT problems.

This paper is organized in five sections. This introduction is the section 1 and it is followed by the literature review in the section 2. The section 3 presents the research method. The section 4 presents the data analysis and the section 5 presents our conclusions.

## 2 LITERATURE

The ITIL has been pointed out by both academy and industry as a good way to manage IT services (ITSMF, 2003). The ISO 9000 standards were created to deal with quality management (ISO 2000). The PNQ (a Portuguese acronym to National Quality Prize) was developed and it is maintained by the Brazilian National Quality Foundation (FNQ 2004). CMMI was created to help organizations on their process area capability and maturity assessments, and on establishing and implementing the improvements prioritization (SEI, 2004). IT Governance Institute has designed and created the COBIT (Control Objectives for Information and related Technology) (IT Governance Institute, 2005).

## 3 RESEARCH METHOD

This work has an exploratory nature, proper to be applied when the goal is evaluate a theme or an investigation problem not widely studied or that has no previous study (SAMPIERI, COLLADO, LUCIO, 1991 and YIN, 2001). The research strategy adopted was a survey.

The data was collected by applying a form that was filled out by the respondents whom have attended a software and IT services quality event in 2006. 240 out of 260 participants had answered the questions. 34 out of 240 forms were not considered as they had a lot of non answered questions.



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Table 1: Relative frequency of IT problems and quantity of answers.

| Question | Totally Disagree (%) | Disagree (%) | Agree (%) | Totally Agree (%) | Answers |
|---|---|---|---|---|---|
| Q1.1 - Lack of formal decision making process | 17.3 | 43.1 | 31.0 | 8.6 | 197 |
| Q1.2 - Lack of clear alignment among IT actions and strategic goals of the organization | 17.0 | 42.0 | 31.5 | 9.5 | 200 |
| Q1.3 - Lack of quantitative knowledge about performance | 6.4 | 29.7 | 40.6 | 23.3 | 202 |
| Q1.4 - Quality and performance of suppliers below the expectations | 5.4 | 30.1 | 52.2 | 12.4 | 186 |
| Q1.5 - Frequent IT project delays | 6.0 | 25.9 | 47.8 | 20.4 | 201 |
| Q1.6 - Poor quality of our IT products | 11.4 | 51.7 | 28.4 | 8.5 | 201 |
| Q1.7 - High cost of IT area | 2.1 | 36.3 | 51.6 | 10.0 | 190 |
| Q1.8 - IT area isn't treated as service provider internally | 16.2 | 39.1 | 36.0 | 8.6 | 197 |
| Q1.9 - Low availability of IT systems and applications | 18.2 | 57.6 | 21.2 | 3.0 | 198 |
| Q1.10 - Lack of customer focus | 15.3 | 47.0 | 29.7 | 7.9 | 202 |
| Q1.11 - High turnover of IT professionals | 10.1 | 42.4 | 32.8 | 14.6 | 198 |
| Q1.12 – Not motivated teams and professionals or not aligned with strategic goals | 9.4 | 42.9 | 36.5 | 11.3 | 203 |
| Q1.13 - Lack of companies and professionals with integrated comprehension of problems and solutions | 4.6 | 31.0 | 53.8 | 10.7 | 197 |

# 4 DATA ANALYSIS

The first question analyzed is about the IT problems faced by the organizations. A list of 13 usual IT problems was proposed and the respondents were asked to choose one option in the following scale: Totally disagree, disagree, agree and totally agree.

The Table 1 presents the relative frequency of answers about the IT problems faced by the organizations. In this table the IT problems were numbered from Q1.1 to Q1.13. This same numbering schema will be used in the Table 3, but the statement of the IT problem won't be repeated.

The second question aims to measure relationship between the organizations and a list of quality instruments. The respondents were asked to indicate the current step in adoption of each quality instruments.

The Table 2 presents the frequencies and the quantity of answers by each quality instrument.

Table 2: Quality instrument adoption.

| Quality instrument | Won't be implemented (%) | Planning (%) | Implementing (%) | Answers |
|---|---|---|---|---|
| PNQ | 61.4 | 25.1 | 13.5 | 171 |
| ISO9001 | 36.6 | 19.3 | 44.1 | 161 |
| COBIT | 47.6 | 37.3 | 15.1 | 166 |
| eSCM People | 70.3 | 27.7 | 1.9 | 155 |
| CMM | 52.1 | 35.6 | 12.3 | 163 |
| ITIL | 23.2 | 48.2 | 28.6 | 168 |
| CMMI | 6.5 | 32.4 | 61.2 | 170 |
| OPM3 | 55.7 | 38.6 | 5.7 | 158 |
| Six Sigma | 41.5 | 39.6 | 18.9 | 164 |

These results show that the CMMI is the most adopted quality instrument in these organizations, followed by ISO9001 and ITIL. It also shows that the majority of the organizations have no plan to adopt eSCM, PNQ or OPM3.

The analysis of IT problems faced by the organization and the degree of adoption of quality instruments leads to the analysis of the association between these two variables. The hypothesis is the possibility of a negative association between quality instruments adoption and the IT problems, i.e. the adoption of some quality instrument reducing the frequency of some IT problem. Therefore, and due to the nominal nature of the variables, we tested the hypothesis using a chi-squared statistical test.

A chi-squared test is a statistical tool to verify the association between two nominal variables. It can be used to calc two values. The first one, the p-value, provides the statistical significance of the test and allows us rejecting the null hypothesis of no association between the analyzed variables. The second one, the contingency coefficient C, is a number between 0 and 1 that express the degree of association between the two analyzed variables.

The Table 3 presents several statistically significant associations. Since we are looking for negative associations, then we need analyze the contingency tables to verify if the adoption of each quality instrument is increasing or decreasing the frequency of the IT problems. Only five associations are analyzed in this paper due to their highest contingency coefficient C and statistical significance.

The Table 4 presents the contingency table between PNQ adoption and the question 1.13. This

Table 3: Contingency coefficient C among quality instruments and IT problems.

| IT problems | PNQ | ISO9001 | COBIT | eSCM | People CMM | ITIL | CMMI | OPM3 | Six Sigma |
|---|---|---|---|---|---|---|---|---|---|
| Q1.1 | 0.037 | 0.119 | 0.067 | 0.163 | 0.092 | 0.247** | 0.056 | 0.132 | 0.099 |
| Q1.2 | 0.104 | 0.156 | 0.112 | 0.151 | 0.030 | 0.249** | 0.102 | 0.089 | 0.116 |
| Q1.3 | 0.186* | 0.258** | 0.158 | 0.173 | 0.166 | 0.097 | 0.035 | 0.094 | 0.204* |
| Q1.4 | 0.033 | 0.075 | 0.120 | 0.107 | 0.141 | 0.212* | 0.090 | 0.077 | 0.070 |
| Q1.5 | 0.076 | 0.108 | 0.085 | 0.142 | 0.246** | 0.109 | 0.150 | 0.107 | 0.047 |
| Q1.6 | 0.202* | 0.155 | 0.071 | 0.094 | 0.097 | 0.083 | 0.171 | 0.102 | 0.156 |
| Q1.7 | 0.209* | 0.219* | 0.065 | 0.122 | 0.167 | 0.048 | 0.046 | 0.121 | 0.193 |
| Q1.8 | 0.215* | 0.043 | 0.069 | 0.128 | 0.062 | 0.087 | 0.080 | 0.067 | 0.196* |
| Q1.9 | 0.033 | 0.131 | 0.124 | 0.113 | 0.112 | 0.180 | 0.047 | 0.139 | 0.127 |
| Q1.10 | 0.190* | 0.061 | 0.051 | 0.101 | 0.078 | 0.111 | 0.127 | 0.050 | 0.115 |
| Q1.11 | 0.108 | 0.153 | 0.074 | 0.180 | 0.104 | 0.079 | 0.113 | 0.172 | 0.196* |
| Q1.12 | 0.080 | 0.147 | 0.132 | 0.054 | 0.151 | 0.071 | 0.022 | 0.080 | 0.118 |
| Q1.13 | 0.288*** | 0.207* | 0.038 | 0.031 | 0.131 | 0.067 | 0.142 | 0.104 | 0.148 |

statistically significant at: * 5% level, ** 1% level and *** 0.1% level

association has p-value of $5.40 \times 10^{-4}$, allowing us to reject the null hypothesis of no association between the variables. However, we can see that neither the frequency of respondents that agree with this IT problem change significantly in the group of those are implementing PNQ nor the frequency of respondents that disagree change significantly in the group of those are implementing PNQ. Then, we cannot affirm that there is an association between the adoption of PNQ and the decrease of this IT problem.

Table 4: Association between PNQ adoption and the lack of companies and professionals with integrated comprehension of problems and solutions (Q1.13).

| PNQ | Impl. | Planning | Won't implement | Total | |
|---|---|---|---|---|---|
| Q1.13 | (%) | (%) | (%) | (%) | Answers |
| Agree | 63.6 | 40.5 | 74.5 | 64.5 | 107 |
| Disagree | 36.4 | 59.5 | 25.5 | 35.5 | 59 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 166 |

Table 5: Association between ISO 9001 adoption and the lack of quantitative knowledge about performance (Q1.3).

| ISO9001 | Impl. | Planning | Won't implement | Total | |
|---|---|---|---|---|---|
| Q1.3 | (%) | (%) | (%) | (%) | Answers |
| Agree | 57.1 | 56.7 | 83.1 | 66.7 | 106 |
| Disagree | 42.9 | 43.3 | 16.9 | 33.3 | 53 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 159 |

The Table 5 presents the contingency table between ISO 9001 adoption and the question 1.3. This association has p-value of $3.46 \times 10^{-3}$, allowing us to reject the null hypothesis of no association between the variables.

We can see in the Table 5 a negative association between the adoption of ISO 9001 and the lack of quantitative knowledge about performance. The frequency of respondents that agree with this IT problem decreases from 66.7% to 57.1% in the group of those are implementing ISO 9001. On the other hand, the frequency of respondents that disagree with this IT problem rises from 33.3% to 42.9% in the group of those that are implementing ISO 9001. Then, we can affirm that, at least in the analyzed sample, the adoption of ISO 9001 tends to decrease the lack of quantitative knowledge about performance.

The Table 6 presents the contingency table between ITIL adoption and the question 1.2. This association has p-value of $4.42 \times 10^{-3}$, allowing us to reject the null hypothesis of no association between the variables.

Table 6: Association between ITIL adoption and the lack of clear alignment among IT actions and strategic goals of the organization (Q1.2).

| ITIL | Impl. | Planning | Won't implement | Total | |
|---|---|---|---|---|---|
| Q1.2 | (%) | (%) | (%) | (%) | Answers |
| Agree | 21.3 | 50.6 | 44.4 | 40.9 | 67 |
| Disagree | 78.7 | 49.4 | 55.6 | 59.1 | 97 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 164 |

In this case, there is also a negative association between ITIL adoption and the lack of clear alignment among IT actions and strategic goals of the organization (Q1.2). The frequency of

respondents that agree with this IT problem decreases from 40.9% to 21.3% in the group of those are implementing ITIL. On the other hand, the frequency of respondents that disagree with this IT problem rises from 59.1% to 78.7% in the group of those that are implementing ITIL. Then, we can affirm that, at least in the analyzed sample, the adoption of ITIL tends to decrease the lack of clear alignment among IT actions and strategic goals of the organization.

The Table 7 presents another association about ITIL. It shows the contingency table between ITIL adoption and the question 1.1, which is about the lack of formal decision making process. This association has p-value of $4.79x10^{-3}$, allowing us to reject the null hypothesis of no association between the variables.

Table 7: Association between ITIL adoption and the lack of formal decision making process (Q1.1).

| ITIL | Impl. | Planning | Won't implement | Total | |
|---|---|---|---|---|---|
| Q1.1 | (%) | (%) | (%) | (%) | Answers |
| Agree | 25.5 | 44.3 | 60.5 | 42.7 | 70 |
| Disagree | 74.5 | 55.7 | 39.5 | 57.3 | 94 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 164 |

In this case, there is also a negative association between ITIL adoption and the lack of formal decision making process (Q1.1). The frequency of respondents that agree with this IT problem decreases from 42.7% to 25.5% in the group of those are implementing ITIL. On the other hand, the frequency of respondents that disagree with this IT problem rises from 57.3% to 74.5% in the group of those that are implementing ITIL. Then, we can affirm that, at least in the analyzed sample, the adoption of ITIL tends to decrease the lack of formal decision making process.

The Table 8 presents the contingency table between People CMM adoption and the question 1.5. This association has p-value of $5.84x10^{-3}$, allowing us to reject the null hypothesis of no association between the variables.

Table 8: Association between People CMM adoption and frequent IT project delays (Q1.5).

| People CMM | Impl. | Planning | Won't implement | Total | |
|---|---|---|---|---|---|
| Q1.5 | (%) | (%) | (%) | (%) | Answers |
| Agree | 40.0 | 70.9 | 76.5 | 70.0 | 112 |
| Disagree | 60.0 | 29.1 | 23.5 | 30.0 | 48 |
| | 100.0 | 100.0 | 100.0 | 100.0 | 160 |

In this case, there is also a negative association between People CMM adoption and frequent IT project delays (Q1.5). The frequency of respondents that agree with this IT problem decreases from 70% to 40% in the group of those are implementing People CMM. On the other hand, the frequency of respondents that disagree with this IT problem rises from 30% to 60% in the group of those that are implementing People CMM. Then, we can affirm that, at least in the analyzed sample, the adoption of People CMM tends to decrease the frequency of IT project delays.

# 5 CONCLUSIONS

This paper presents results from a quantitative research that was conducted among 260 participants of a software quality event in Brazil. The main contribution is the identification of the respondent's vision about the relationship of the quality instruments adoption and the several IT problems.

The results obtained through this survey provided an overview of the impact of the analyzed IT problems in the organizations. Through the appliance of statistical tests, we also obtained understanding about the impact of the quality instruments in some IT problems.

As future work, other dimensions of the survey will be analyzed and a framework to quality instruments integration will be developed.

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