

## Quality and Productivity Initiatives: Experiences by Companies of South of Brazil

Ademar Galelli (UCS)<sup>1</sup>

Paulo Fernando Pinto Barcellos (UCS)<sup>1</sup>

Margareth Rodrigues de Carvalho Borella (UCS)<sup>1</sup>

<sup>1</sup>University of Caxias do Sul – PPGA – Brazil.

### Abstract

*Strongly influenced by the globalization of the economy, competition for the dispute of a share of the market is forcing companies to meet increasingly greater requirements such as management systems setting-up and other initiatives to improve quality and productivity. A research made with firms in the region of Serra Gaucha (Brazil) points out to how companies are reacting to this phenomenon as well as the diversified results that were obtained with the implementation of various systems, programs, tools or methods. The preferred initiatives are the more common ones and those which have been already implemented by other firms, while the more complex and advanced initiatives are restricted to a few companies. The resulting success from the implementation of some initiative in a firm tends to happen again in others firms, and the same is true for failures as well.*

**Key words:** Quality management; quality tools; PGQP (Gaúcho Program on Quality and Productivity); Serra Gaucha

### Introduction

Market globalization is imposing constant challenges to companies. Among these challenges, producing with quality is a *sine qua non* condition to compete for customers who are increasingly demanding in face of competitors that want a bigger market share and the conquest of new segments. Some years ago, quality certifications according to international standards were object of proud within organizations as if prizes were for the performance aimed by their managers in a frenetic seeks for competitiveness in attractive markets. Quality was, then, understood as a destiny point in a journey that started more in emotion than in reason. Companies, especially those that were motivated by the foreign market, were compelled to have a quality certification to access the desired markets. What was once a final target, now it is a starting point, independently from the organization's size and the market in which it operates. Now, it is unimaginable trying to compete without quality. This picture got more complex with communications in real time supported by satellite transmissions. The decisive contribution of Internet and its consequent influences in the management style within organizations, in customers' and consumers' behavior, and in human communication habits has totally changed the competition way, shortening distances and approaching markets, companies, and people. It has changed what was seen as distant, inaccessible, and improbable into something irreversibly close, challenging, and real.

In the case of Brazil, as an emergent nation, the complexity of this theme comes not only from structural characteristics tied to it for a long time – with regional discrepancies much stressed in a land of continental size – but also from conjuncture contingencies stressed by the permanent urgency for solutions required to the economic growth and social development of the country.

Measures which appear as adequate in a context are inadvisable in another one due to an absolute lack of minimal conditions to their setting up. It is precisely in this contrastive scenery that the effort of improving quality challenges the nation's intelligence to look for needed solutions that appear to be more than adequate and effectively prove to be efficient and sustainable. Thus, in 1990, it is created the *Programa Brasileiro da Qualidade e Produtividade* (PBQP – Brazilian Program on Quality and Productivity), within the so-called *Ministério da Indústria e Comércio* (Commerce and Industry Ministry).

It is the first macro-economic initiative to set up a movement in the country for the consciousness of the importance of quality. The repercussion of this fact in Rio Grande do Sul (southernmost state of Brazil) creates, in 1992, the *Programa Gaúcho da Qualidade e Produtividade* (PGQP – Gaucho Program on Quality and Productivity). “With the objective of stimulating, articulating, and promoting actions aiming at making products and services of local organizations competitive through quality and productivity improvement” (FNQ, 2006, p. I), it is the first initiative at a state-level in the whole country. Since then, the movement has gotten muscle, conquered many adepts and assumed the dimension that was imposed to the main instigator of improving the management of organizations within the Rio Grande do Sul state via their products and services quality.

The *Serra Gaucha* region, in particular the Caxias do Sul pole, constitutes expressive concentration of companies of several industries, where the most important ones are those from the metal-mechanical, furniture, knitwear products, and winegrowing sectors. Given the importance they represent for the regional economy, it is compulsory to investigate how these organizations face the current quality movement, headed by PGQP. For this purpose, the present study was proposed by the University of Caxias do Sul (UCS) to local business entities. Among the approached entities are: CIC (Chamber of Industry, Commerce and Services of Caxias do Sul), Sindilojas (Union of the Retail Commerce of Caxias do Sul), SIMECS (Union of the Metallurgic, Metal-mechanical and Electric Industries of Caxias do Sul), SIMPLAS (Union of Plastic Material Industries of the Gaucho Northeast), CIC-BG (Centre of Industry, Commerce and Services of Bento Gonçalves), Commercial Centre of Flores da Cunha, Association of Commerce, Industry and Services of São Marcos, Sindmóveis (Union of Construction and Furniture Industries of Bento Gonçalves), IBRAVIN (Wine Brazilian Institute) and ACIV (Commercial and Industrial Association of Veranópolis). Some institutions have widely understood the relevance of the project, spontaneously offering themselves to collaborate.

### ***A Short History of Quality in the Region of Serra Gaucha***

Quality, in Brazil, started to be a prime theme only in the beginning of the 1990's, when the federal government started the Brazilian Program on Quality and Productivity “with the objective of improving productivity, reliability, and quality levels in industry” (PGQP, 2007). In Rio Grande do Sul, in 1992, the local government started, structuring the PGQP attempting to changes that were happening in world and national sceneries. This initiative was totally accepted by local businesspeople. As pointed out by the quality portal, “the partnership between the public sector and the private initiative allowed to spread out the philosophy and principles of quality in a democratic way, and offered the opportunity to a series of initiatives, focused on the improvement of products and services of local companies, to be promoted” (PGQP, 2007).

In Caxias do Sul, one of *Serra Gaucha* main poles, CIC, also attempting to actions that were starting all over the country for more competitiveness of national companies through quality, places itself favorably and assumes the leadership of the movement in town and in the region.

Thus, on May 30<sup>th</sup>, 1994, CIC, inspired by what was happening in other main cities in Brazil, has launched the Project Quality Caxias under its coordination. This project had the participation of Sebrae/RS, Senai, Senac, UCS, Serrana Association of Human Resources and Gaucha Association for Quality.

Targets established and consolidated by the CIC Quality Commission to divulge and set up a new quality culture not only among associates but also at other segments of the society have distinguished CIC, with UCS support, to assume the coordination of the regional committee of PGQP in a solemn ceremony held on March 16<sup>th</sup>, 1995. With this act, PGQP considerably enlarges and starts to include all industries from the Northeast region of the state. In the following years, under CIC guidance, PGQP got stronger through several adhesions and made significant room at industries from the most diverse segments in *Serra Gaucha*. By the century turn, the number of adhesions to the program is significant. According to Souza (2003), in 2002, there were 496 companies enrolled in the program. In this same year, however, this number of adhesions was not translated into quality practice. From the 496 enrolled companies, only 63 organizations (12.7%) were effectively participating of the offered courses as well as of the self-evaluation system coordinated by the *Serra Gaucha* Quality Committee, and thus practicing quality according to the PGQP guidelines.

### ***The Research***

Before approaching the procedure used in the research project, it is important to remind that “there is not a unique, standard, correct method to do a research” (Churchill 1987, p. 71). For Simon (1969), we must not wait until the adequate approach is found because there are many ways to deal with a problem – someones good, others no – but probably various good approaches, inexistent the perfect project. This research project used an approach that, because of cost, time and available resources, was preferred to other considered alternatives.

### ***The Method***

The study was developed in four steps: (1) preliminary phase of meetings to sensitize business-class entities to secure their support to the initiative; (2) development of the questionnaire to be applied to companies, discussed with the project supportive entities; (3) quantitative data collection; and (4) collected data processing, results analysis, interpretation, and elaboration of conclusions. The initial step of the project was formed by meetings at *Serra Gaucha* class entities head offices. At the opportunity, it was discussed the general objective of the study as well as the research questions that would interest the entity itself and its associates. The relevance of the topics to be inserted in the questionnaire was discussed, and it was assured each institution that a copy of the project report would be delivered to them when of its conclusion. On the other hand, it was asked the class entity for its list of associates with address, telephone number and e-mail address to allow a further contact by the researchers.

SIMECS and CIC were selected to carry out meetings in their head offices, in March 2005. These entities were chosen because they are both from the metal-mechanical pole, which characterizes the sector concentration in the region, and because both have the greatest number of associate companies. Other entities were contacted by telephone. Meetings lasted for about 90 to 120 minutes when entities interest in discovering and understanding the connection of PGQP quality initiatives and quality improvement by companies was revealed.

### The Questionnaire

The development of the questionnaire was based upon the meetings discussions. Once the instrument was built by the researchers, it was discussed with the *Serra Gaucha* Quality Committee (CQSG), the Regional Committee of PGQP, headquartered at CIC, and finally consolidated in two blocks. The first block (Block A) refers to demographic data of the interviewed company, while the second one (Block B) refers to the respondent’s perception about PGQP. In this block there are 20 topics that, supposedly, may be influenced by the implementation of the PGQP approach. Respondent’s answer is through a Likert scale from 1 (I totally disagree) to 5 (I totally agree) according to what is presented in Appendix 2. After pre-testing and its resulting adjustments, the questionnaire was considered adequate for utilization. A letter was prepared (Appendix 1) to be sent to each associate with the questionnaire to make clear the research project is official, in behalf of the respective entity and of UCS.

### Sample and Data Collecting

The third step of this study has started when of the conclusion of the two first steps with the collection of quantitative data. After the pre-test and small adjustments the questionnaire was considered adequate to be used, and it was sent to about 900 companies in the region through the class entities involved via Internet. This stage started in June and ended up in December 2005 when the last answered questionnaires were received (159 in total). Despite the telephone contact from the researchers to the interviewed people about the importance of answering back the questionnaire, the average index of return was of 18%. Data collection limitations may be synthesized in two points: (1) most associate companies to the entities involved in the project are micro and small companies, and do not have an electronic address; and (2) the interviewed companies selection was made by the class entities under the criteria of the organization size.

### Data Analysis

The proceedings for the statistical analysis included descriptive statistics (frequencies, measures of central tendency and dispersion measures), linear correlation, and table crossing.

### Demographic Data

Table 1 presents the main activity of the companies, which reveals a great number of industrial companies (81.8%) in the sample, what is representative of the study population.

**Table 1: Distribution of companies according to their activity**

Activity	Frequency	%	Valid %	Accumulate %
Industry	130	81.8	83.9	83.9
Commerce	5	3.1	3.2	87.1
Service	20	12.6	12.9	100.0
<b>Total answered</b>	<b>155</b>	<b>97.5</b>	<b>100.0</b>	
Not answered	4	2.5		
<b>Total</b>	<b>159</b>	<b>100</b>		

Table 2 shows the distribution of companies into the nine main sectors. Table 2 shows the distribution of companies into the nine main sectors. The most of them are included in the metal-mechanic sector (47%), followed by the furniture sector (14.6%) and all the others are distributed in smaller percentages among the other sectors or are not identified.

**Table 2: Distribution of companies among sectors of the economic activity**

Sector	Frequency	%	Valid %	Accumulate %
Metal-Mechanic	71	44.7	47.0	47.0
Electro-Electronic	6	3.8	4.0	51.0
Automotive	9	5.7	6.0	57.0
Plastic	8	5.0	5.3	62.3
Winegrowing	9	5.7	6.0	68.2
Textile	2	1.3	1.3	69.5
Furniture	22	13.8	14.6	84.1
Chemical	1	.6	.7	84.8
Informatics	2	1.3	1.3	86.1
Other	21	13.2	13.9	100.0
<b>Total answered</b>	<b>151</b>	<b>95.0</b>	<b>100.0</b>	
Not answered	8	5.0		
<b>Total</b>	<b>159</b>	<b>100</b>		

When crossing the variables Activity and Sector, it is observed that, from the 70 companies of the metal-mechanic sector that have answered to both questions, 65 of them (92.9%) are industries, and the other 5 (7.1%) classify themselves as service companies. As for the 22 companies of the furniture sector, it is observed that 21 (95.5%) have industrial activity, and only one (4.5%) is in services. Thus, most companies (91 out of 159, or 57.2%) are industries from both metal-mechanic and furniture sectors, what represents the characteristic profile of the region that is part of this research.

### **Competition and Partnership**

Two aspects, competition and cooperation, also were investigated. Their importance is related to the fact that in modern business environment economy globalization is forcing companies to face a stronger competition and adopting as business strategy the cooperation with other companies, including with competitors, which is known as “coopetition” as proposed by Brandenburger and Nalebuff (1996). It is tried here the relationship between these two variables and the initiatives in the area of quality and productiveness. The research results for these two questions are in Tables 3 and 4.

**Table 3 : Degree of competitive action that the company suffers**

Alternatives of answers for competition	Frequency	%	Valid %	Accumulate %
1 – Unique in the market	1	.63	.63	.63
2 – Little competition	4	2.52	2.53	3.16
3 – Reasonable competition	47	29.56	29.75	32.91
4 – A lot of competition	68	42.77	43.04	75.95
5 – Wide national and international competition	38	23.90	24.05	100.00
<b>Total answered</b>	<b>158</b>	<b>99.37</b>	<b>100.00</b>	
Not answered	1	.63		
<b>Total</b>	<b>159</b>	<b>100.00</b>		

For data in Table 3, the average of answers is 3.87 and the standard deviation is equal to .83. It is observed only 5 companies (3.16% from the ones that have answered to this question) suffer little or no competition, while the other ones (96.84%) say they suffer reasonable to strong competition. As mentioned before, competition among companies, reinforced by the phenomenon of economy globalization, exposes companies in Serra Gaucha to the effects of competition in a perceptive way.

For data in Table 4, considering the scale of answers varied from 1 to 5, the average of answers is 2.68 and the standard deviation is equal to 1.01. It is observed 70 companies (44.30% from those that have answered to the question) practice little or no cooperation with other companies, while the other 88 (55.70%) say they practice at least a reasonable cooperation, including 6 companies (3.80%) that make it in a wide way and involve this even in competition. It shows that, despite a certain number of companies is exploring the benefits of cooperation to other companies, there is a considerable space to improve this aspect.

**Table 4: Degree the company practices cooperation**

<b>Alternatives of answers for partnership</b>	<b>Frequen cy</b>	<b>%</b>	<b>Valid %</b>	<b>Accumulate %</b>
1 – Does not practice	19	11.95	12.03	12.03
2 – Practices little	51	32.08	32.28	44.30
3 – Practices reasonably	56	35.22	35.44	79.75
4 – Practices a lot	26	16.35	16.46	96.20
5 – Widely practices, even with competitors	6	3.77	3.80	100.00
<b>Total answered</b>	<b>158</b>	<b>99.37</b>	<b>100.00</b>	
Not answered	1	.63		
<b>Total</b>	<b>159</b>	<b>100.00</b>		

When studying these two variables (competition and cooperation), the most probable hypothesis would be that the more companies suffer the action of competition the more they would tend to effective cooperate to get stronger and more competitive. It is not observed, however, in the studied sample, for the coefficient of Pearson’s linear correlation, determined by the answers of 157 companies, is .075 with a statistics significance of .351.

***Initiatives in the Area of Quality and Productivity***

It is necessary to observe questions in block B (B01 to B37), listed in appendix A, are answered in a scale from 1 to 5, referring to the perception of the answerers about the results they could get in implementing the several initiatives (systems, tools, methodologies or programs). To the answerer it was offered the possibility of informing 0 (zero) in case the company does not have interest in implementing the initiative at the moment, and the option 9 (nine) in case the company aims to implement such initiative in the future. Considering that, for questions B01 to B37, the number of non-answerers, among the 159 companies that were part of the research, has varied between 6 and 8, the analysis of the results could be done in nominal values of answers, and the percentage analysis would not be necessary. Table 5 has descriptive statistics of the 37 questions, and the most important one for this analysis is the arithmetic average of answers considering the scale from 1 to 5 (therefore, it was not considered the answers 0 and 9 to calculate the average).

It is possible to observe the averages vary from 2.50 (B26 - QFD) to 3.67 (B05 - ISO 18000), and it indicates that, in average, companies that have implemented the initiative noticed results which are close to expected. Dispersion measures (standard deviation and amplitude), however, show there is a considerable variability among answers, and it indicates at least some companies are frustrated (they notice results are below and even much below the expected), while others notice results higher or much higher than expected.

**Table 5: Descriptive statistics for the 37 initiatives in the area of quality and productivity**

Initiative					Answers from 1 to 5				
	n (answ.)	Not answ.	0	9	n	Min.	Max.	Arith. Average	Standard deviation
B01	153	6	38	44	71	1	5	3.23	.64
B02	153	6	126	19	8	3	3	3.00	.00
B03	153	6	116	32	5	3	4	3.60	.55
B04	153	6	80	63	10	3	4	3.40	.52
B05	153	6	121	29	3	3	4	3.67	.58
B06	153	6	110	38	5	3	4	3.60	.55
B07	153	6	76	28	49	1	4	2.92	.64
B08	153	6	52	20	81	2	4	3.12	.53
B09	153	6	87	17	49	1	4	3.08	.67
B10	153	6	100	18	35	2	4	3.03	.51
B11	152	7	111	21	20	1	4	3.00	.65
B12	153	6	59	17	77	1	5	3.25	.73
B13	153	6	80	18	55	2	5	3.16	.69
B14	153	6	67	35	51	1	5	3.02	.84
B15	153	6	59	26	68	1	5	3.21	.66
B16	153	6	44	37	72	2	5	3.26	.84
B17	153	6	70	45	38	1	5	3.16	.68
B18	153	6	108	25	20	2	5	3.55	.83
B19	153	6	42	27	84	2	5	3.33	.70
B20	152	7	83	46	23	2	5	3.43	.79
B21	152	7	123	20	9	2	5	3.33	1.00
B22	153	6	63	43	47	1	4	3.09	.62
B23	153	6	108	39	6	3	3	3.00	.00
B24	151	8	61	46	44	1	5	3.39	.95
B25	153	6	73	43	37	1	5	3.00	.88
B26	152	7	120	30	2	2	3	2.50	.71
B27	152	7	130	20	2	3	3	3.00	.00
B28	152	7	114	30	8	3	3	3.00	.00
B29	153	6	107	41	5	2	5	3.20	1.10
B30	153	6	91	30	32	2	5	3.22	.71
B31	153	6	66	56	31	1	5	3.13	.81
B32	152	7	101	31	20	1	5	3.00	.79
B33	152	7	114	27	11	2	5	3.09	.83
B34	152	7	128	16	8	2	5	3.00	.93
B35	151	8	128	16	7	2	4	2.86	.69
B36	152	7	127	13	12	2	5	3.42	.79
B37	153	6	105	27	21	1	4	2.76	.70
<b>Average</b>	<b>152.62</b>	<b>6.38</b>	<b>91.57</b>	<b>30.62</b>	<b>30.43</b>	<b>1.84</b>	<b>4.41</b>	<b>3.16</b>	<b>.65</b>

When classifying the initiatives by the number of companies that have implemented them, it is observed B19 (quality audit) is the most implemented one (84 companies), followed by B08 (Flow chart), B12 (Data Collecting Form), B16 (5 S's) and B01 (ISO 9000), while B27 (Experiment project – Taguchi's method) is the least implemented one (two companies), followed by B26 (QFD), B05 (ISO 18000), B29 (Six Sigma) and B06 (SA 8000). It is observed among the 24 most implemented initiatives the amplitudes (difference between the higher and the lower answers) are high (3 or 4, except for B08 – flow chart – and B10 – histogram, with amplitude 2). Among the 13 least implemented ones, it is observed amplitudes between 0 and 1, except for B35 (Concurrent Engineering) with amplitude of 2 and B21 (re-engineering), B34 (design for manufacturability) and B29 (Six sigma methodology) with amplitude 3. With these results, it is possible to conjecture the higher is the number of companies that try to implement any initiative the more diverse are the conditions and adopted approaches, and they may lead to different results.

Still considering the five initiatives companies have mostly implemented, the coefficients of Pearson's linear correlation were calculated, and they are demonstrated in Table 6.

The positive and highly significant correlations among the most implemented initiatives (see Table 6) point out there is a tendency companies present similar perceptions related to the degree of implementing success. This may indicate a possibility that companies use similar approaches when investing time and resources to implement methodologies, being a lot careful to avoid negative factors lead to failure, and at the same time they reinforce positive aspects that lead to a good implementation.

**Table 6: Linear correlation coefficients among the 5 most implemented initiatives**

	<b>B01-ISO 9000</b>	<b>B08</b>	<b>B12</b>	<b>B16</b>
B08 – Flow chart	.464**			
B12 – Data collecting Form	.469**	0.638**		
B16 – 5 S's	.302*	.417**	.636**	
B19 – Quality Audit	.526**	.657**	.616**	.517**
* Sig. < .05; ** Sig. < .01 (n varies from 48 to 66)				

Related to the initiatives companies are not interested in implementing at the moment (answer 0), it is possible to highlight, in order, B27 (Experiment Project) with 130 manifestations, followed by B34 (Design for Manufacturability), B35 (Concurrent Engineering), B36 (Virtual Engineering) and B02 (QS 9000). These methodologies, in general, are used in organizations that have some history in being involved with the most advanced techniques. In case of the QS 9000, besides being a specific norm in cars industry, it tends to be replaced by ISO/TS 16949.

As for the initiatives companies intend to implement in the future (answer 9), there are, in first place, B04 (ISO 14000) with 63 manifestations, followed by B31 (TQM), B20 (Lean Manufacturing), B24 (Life Quality at work) and B17 (Quality costs). These methodologies are typical in the current moment, involving both technical and people and environment aspects.

***Competition and Cooperation versus Initiative in the Area of Quality and Productivity***

The analysis of the relationships between the variable *competition* and the initiatives in quality area shows there is only one positive correlation, with the initiative B22 – Process Statistic Control (Sig.=.004, n=47). It is observed that, with only this exception, the degree of perception about the results they could get from implementing the several initiatives in quality and productiveness area is not associated to the degree of exposure companies have related to competitors.



It would be possible to assume, then, competition, despite its amplitude, does not influence the results, and they probably come from other variables.

Similarly, the variable *cooperation* does not have a strong linear correlation index (Sig <.01) with some of the initiatives. It is again possible to suppose cooperation among companies, despite its degree, does not influence results in implementing initiatives in the area of quality and productiveness.

### **Conclusions**

The conclusions reported in this study mainly refer to the industrial companies from the metal-mechanic and furniture sectors, for they represent the greatest part of answered questionnaires.

A first conclusion is that, despite companies observe already a considerable degree of action of their competitors, they still do not use effectively the practice of cooperation with other companies, by means of partnerships or alliances. With associative, academic and governmental entities, companies could explore this collective alternative for development, formally constituting cooperation nets, cooperatives, or association or informally, as clusters for example, to make local productive arrangements or productive chains (AMATO NETO, 2000; NOHRIA & ECCLES, 1992).

The observed tendency that companies implement more the basic tools of quality (for example, Check List, PDCA cycle, 5W2H, MASP, Ishikawa's diagram and Histogram) and systems customers ask for (for example, audits and ISO 9000) reflects the practical aspect of organizations in trying to implement less complex tools which were well divulged and tested in other companies, to use their benefits and at the same time serve the market's demands.

The higher is the number of companies that implement initiatives to improve quality and productiveness the higher is the diversity of obtained results. It means that even if for the greatest part of the companies results are close to expected, for some they may be low and for other above expected. Considering the implementation of changes in organizations demands a lot of effort, planning, and dedication, at the same time it may suffer resistance by workers in several levels, it is understandable some companies have more probability to succeed than others. Thus, it is necessary leaders and coordinators for the efforts of change implementation to provide the necessary conditions to conduct the initiative in good terms and decreasing failure chances (TOLOVI, 1994).

The tendency, pointed by positive and statistic significant coefficients of linear correlation, that basic tools for quality are implemented in a set and that each company tends to notice similar results among them suggests a strategy for companies to pay the same attention to different initiatives in the area of quality and productiveness implemented or in process of being so. The success experimented by an initiative tends to intensify the effort someone else will use, and it may contribute for success, in a virtuous cycle. On the other hand, the failure of an initiative tends to get people unmotivated and skepticism is present when trying to implement the same or other initiative, forming a vicious cycle of failures (BEER *et al.*, 1990; WOOD; URDAN, 1994; DALE, 2013).

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### **Appendix A – Set B of questions from the data collecting instrument**

B – Use the following scale to inform how you evaluate the results your company could get to implement the initiatives in quality area:

- 1 - Implemented, with much lower results than expected
- 2 - Implemented, with lower results than expected
- 3 - Implemented, with expected results
- 4 - Implemented, with higher results than expected
- 5 - Implemented, with much higher results than expected

If the company has no interest in implementing the initiative at this moment, please write 0 (zero).

If the company aims to implement the initiative in the future, please write 9 (nine)

- B01. ISO 9000
- B02. QS 9000
- B03. ISO/TS 16949
- B04. ISO 14000
- B05. ISO 18000
- B06. SA 8000
- B07. Cause and Effect Diagram (Ishikawa's Diagram)
- B08. Flow chart
- B09. Pareto's graphic
- B10. Histogram
- B11. Dispersion's Diagram (Correlation)
- B12. Data collecting form (Check List)
- B13. 5W2H
- B14. MASP (Method of Analysis and Solution for Problems)
- B15. PDCA (*Plan, Do, Check, Act*) Cycle
- B16. 5 S's
- B17. Quality costs
- B18. Kaizen
- B19. Quality Audit
- B20. Lean Manufacturing
- B21. Re-engineering
- B22. Process Statistics Control
- B23. Quality National Prize (PNQ).
- B24. Life quality at work
- B25. Quality control circles.
- B26. Quality Function Deployment (QFD)
- B27. Experimenting Project – Taguchi's Method
- B28. Reliability Engineering
- B29. "Six Sigma" Methodology
- B30. FMEA (Failure Mode and Effect Analysis).
- B31. Total Quality Management (TQM)
- B32. Civil security and responsibility – Customers' defense.
- B33. Customer Relationship Management (CRM)
- B34. Design for Manufacturability (DFM)
- B35. Concurrent Engineering
- B36. Virtual Engineering
- B37. Balanced Scorecard