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Implementation of an improvement plan through a performance evaluation model

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Abstract: This paper addresses an improvement plan implemented at both tactical and operational levels to obtain effective results concerning the Process Performance Index (Ppk) of torque, which is the force applied to a cap in the opening/closing system. The research was carried out at CVI Refrigerante Ltd., a franchisee of The Coca-Cola Company and Heineken Brazil that owns a factory in Santa Maria and distribution centers in Passo Fundo and Santa Cruz do Sul. In order to accomplish the major objective of this study, the Quantum performance evaluation model was adopted as a tool to implement the improvement plan. Such tool is a measurable model that reaches specific levels in accordance with the goals defined by the organization. The results obtained were an increase of 75.06 percent in the Ppk value for Product A in the bottling line 02 and 43.96 percent in the Ppk value for generic Product B in the bottling line 03. It was possible to observe that the improvement plan adopted was satisfactory, as well as the performance evaluation model, presenting effective values for the process.

Keywords: performance evaluation, improvement plan, quantum model, process performance index.

1. Introduction

According to Santos and Martins (2008), the implementation of an improvement plan interests organizations from different industries, since it does not only favor higher quality products, services and processes, but also promotes a significant improvement in organizational performance, culture change and human capital.

The improvement plan aims at adding the implantation of the strategic planning. According to Terence (2002), there are several kinds of planning, which are positioned at different hierarchical levels in an organization and can be characterized as strategic, tactic and operational. The improvement plan may comprehend from the strategic to the operational planning, thus closing the cycle of activities. Sellitto and Ribeiro (2004) claimed that results measurement is an important part of the strategic planning of organizations. For Hubbard (2008), measuring refers to being in accordance with certain criteria that are almost unreachable. If the measure is incompatible with the strategic goals, the latter may not be achieved, and eventually the results will not be satisfactory.

In such a context, performance measurement can be understood as the process of either quantifying or qualifying the performance of a product or process of an organization (CARPINETTI, 2000). That is the reason why the use of a suitable evaluation model is so important. Savolainen (1999) suggested that performance measurement was associated with the goals established by the improvement plan, considering that it is an evolving process. According to Sink and Tuttle (1993), before improving the performance of any process, it must be measured.

For Bititci (1995), a system to measure results should be able to: (i) provide a global view, avoiding local suboptimization; (ii) unfold the strategic goals down to operational levels; (iii) provide total understanding of the structure of objectives and conflicts; (iv) adopt a hierarchical format, similarly to an information system, considering the operational capability of the organization to collect and store the required data; and (v) consider aspects of the organizational culture.

Ansoff and Mcdonnell (1993) claimed that the management system is a crucial component of the ability to respond to environmental changes, since it determines how management perceives challenges, diagnoses their impacts, decides what to do, and put their decisions into practice. Continuous improvement, according to Caffyn (1999), may be conceptualized as a wide process concentrated on incremental innovation, comprehending the whole organization, i.e. all of the departments are involved to reach the projected results.

With a well-structured strategic planning framework, the implementation of an improvement plan was performed at CVI Refrigerante Ltd., which is a franchisee of The Coca-

Cola Company and Heineken Brazil that owns a factory in Santa Maria and Distribution Centers in Passo Fundo and Santa Cruz do Sul, in the State of Rio Grande do Sul. CVI operates in the food industry by producing, marketing and distributing beverages of The Coca-Cola Company and Heineken lines, with about 706 collaborators. The factory in Santa Maria has 23,000 m^2 of built area in approximately 90,000 m^2. The company supplies all the region of Santa Maria, Santa Cruz do Sul and Passo Fundo. The total area supplied by CVI is 126,533 km^2, which represent 55.9 percent of the area and 25.3 percent of the population of the State of Rio Grande do Sul.

The company operates with modern manufacturing equipment. Presently, it has four lines: one for cans, two for PET and one for returnable glass bottles. The factory is self-sustainable both in glass and PET bottles as well as in aluminum cans.

This study addresses an improvement plan at both tactic and operational levels to obtain effective results in terms of Ppk values of removal torque. Ppk is a measurable result that indicates how a process is, and whether there has been some evolution with the actions taken. Concerning the improvement plan, one should clearly know what efficiency and effectiveness mean to attain the best results. According to Silva and Araújo (2006), efficiency is related to the amount of economically determined resources that are employed in a process to obtain a particular result. Effectiveness, in turn, is related to the extent to which the result of a process meets the expectations of results of the process. This improvement plan fundamentally involved three sectors regarded as critical to success in the approach adopted: quality control, maintenance and production. One of the main goals is to guarantee the quality of 10 attributes that are essential for the company to reach a favorable positioning in the franchise rating. The attribute selected was the removal torque, which is the force applied to the cap in the opening/closing system. When this force is not standardized or when preventive equipment maintenance is not performed periodically, its application on the caps by the magnetic heads will be out of the specifications determined by the company.

To make the measurement of the improvement plan possible, the Quantum model was adopted. This performance evaluation model has been used since the last decade. According to Muller (2004), the Quantum model was described in 1994 by Steven M. Hronec, a partner of the Arthur Andersen consulting company, in the book called *Vital Signs*, making an analogy between company systems and human body systems. Hronec (1994) emphasized that performance measurements are like ‘vital signs’ of a company that show collaborators what they are doing and what their performance is like from the interaction between the performance measurement and the company strategy, aiming at the unification of all the concepts by the collaborators.

Hronec (1994) affirms that it is in this situation that collaborators unite to broaden, implement and use performance measurements, allowing communication to occur along the process.

According to Hronec (1994), the following benefits of performance measurements can be addressed:

- Customer satisfaction: This is what keeps a company functioning;
- Process monitoring: The progress of the action plan adopted for correct performance measurement is continuously monitored, thus making the process improvement possible;
- Benchmarking of processes and activities: It provides information to spot the best processes and the best companies;
- Change generation: Correct performance measurements help companies make necessary changes effectively.

According to Lima (2010), better performance measurements balance the company operations by intertwining strategies and processes. Performance measurement can be divided into two kinds: process performance measures and output performance measures. Both must be defined in a cascade manner, associating mission, strategy, goals and processes inside the organization, and must be evaluated from a horizontal perspective.

The model proposed by Hronec (1994) aims at associating mission, strategy, goals and processes inside the organization. It works with a matrix, which is schematically represented in Figure 1 in three dimensions: Quality, Cost and Time, with the purpose of balancing these three strategic dimensions.

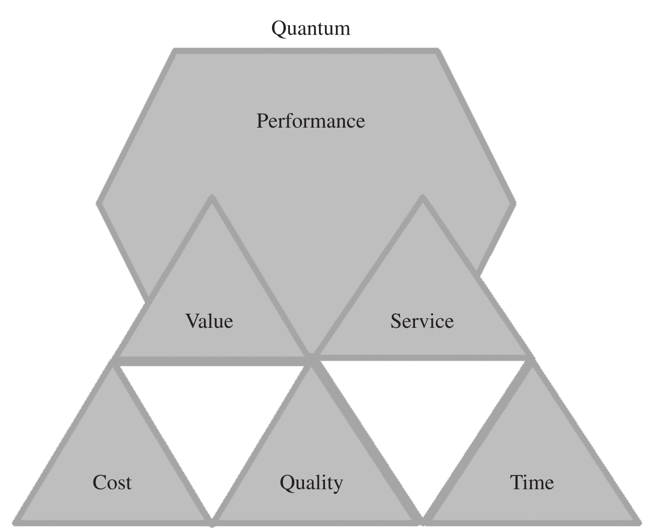

Figure 1. Relationship of the dimensions of the Quantum model. Source: Hronec (1994).

- Quality: Quantifies the excellence of the product or service;
- Time: Quantifies the excellence of the process;
- Cost: Quantifies the economic component, translating the company excellence.

The dimensions mentioned are interrelated. Therefore, when customers receive high quality products which meet or even exceed their expectations, at a reasonable cost or lower, they receive high value, i.e. the cost/quality relationship corresponds to value for the customer. Lima (2010) claims that when customers receive a high quality product or service that meets or exceeds their expectations, they believe they are obtaining a high level service. The relationship between quality and time dimensions was called 'service' by Lima (2010). The 'Quantum' performance is the level of realization that optimizes both the value and the service of a company for its stakeholders. Such optimization must be global and not occur only in a section or department, a function or factor; it must involve the three dimensions simultaneously – cost, time and quality.

For Lima (2010), the Quantum model follows the three levels of mobilization of performance measures of Rummler & Brache model: organization, process and people. The Quantum model aligns these levels with the three dimensions of performance measurement: quality, cost and time, as Table 1 shows.

In this matrix, we can see that people, process and organization are related and connected to values and services so that they can interact in a Quantum Performance.

2. Methodology

The Quantum model of performance evaluation was adopted as a tool to implement the improvement plan. According to Hronec (1994), the main objective of the Quantum performance is to optimize the values and services of an organization for its stakeholders, such as customers, workers and shareholders. It is a measurable model and reaches specific levels in accordance with the goals defined by the organization. The Quantum model is schematically illustrated in Figure 2.

Figure 2 shows that continuous improvement is the key factor for the development of this performance model. In this study, the communication stage is emphasized; it comprehends the stages of brainstorming and the Ishikawa Diagram. Improvements can be structured for the process under analysis, which in our study is the torque attribute, controlled by the quality department.

This work was determined through the analysis and scoring of *Rating,* which offers a ranking in comparison to other franchisees in Brazil by means of the correlation of the torque attribute and the carbonation-gas attribute.

At the level of Control of Statistic Process (CSP), which aims to recognize the process, visualize stability and follow its parameters along time (ROSA, 2009), a history analysis of Ppk of torque was conducted during 17 months to check

Table 1. Matrix of quantum performance measurement.

	Performance quantum		
	Value		**Service**
Organization	Financial Operational Strategic	Empathy Productivity Reliability Credibility Competence	Speed Flexibility Responsibility Malleability
Process	Inputs Activity	Accordance Productivity	Speed Flexibility
People	Remuneration Development Motivation	Reliability Credibility Competence	Responsibility Malleability

Source: Adapted from Guzman (1998, p. 61).

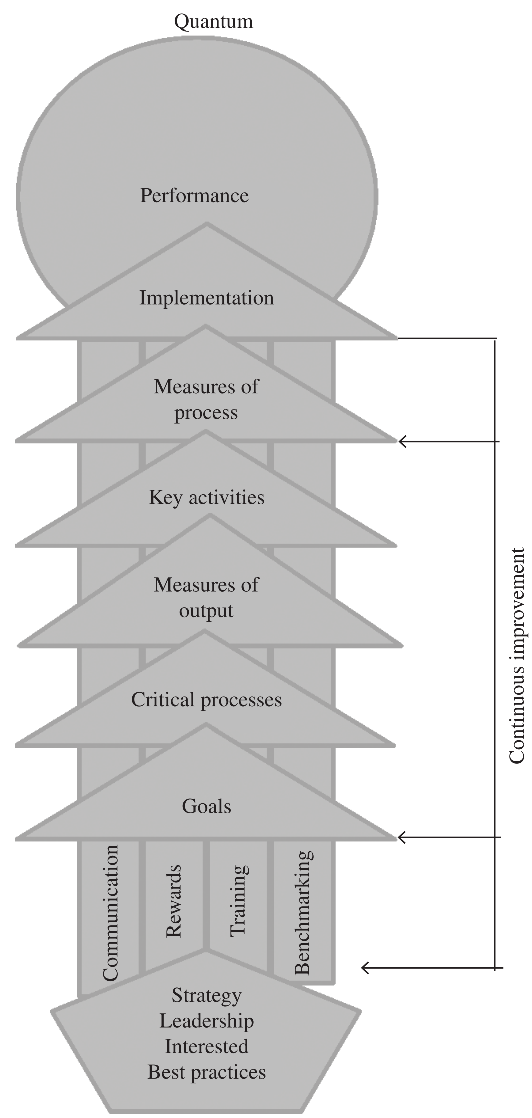

Figure 2. Quantum Model. Source: Hronec (1994).

the long-term behavior of this attribute. The tools adopted to carry out the plan were the following: Ishikawa Diagram, Brainstorming, Pareto Diagram, 5W1H, Control Chart, Histogram and Trend Analysis.

The 6 M's – material, mother nature, measurement, method, manpower and machine – were applied to the Ishikawa Diagram, also called Fishbone Diagram, Cause-and-Effect Diagram or 6M Diagram. The defined structure is referred as a specific problem that affects the company and it is represented at the central axis of the diagram. Next, diagonal lines are included containing elements that take part in the scenario – such as workers and machines. Such elements are called 'categories'. After that, factors are identified for each category: causes are the factors that may contribute to either increase or reduce the problem, i.e. the effects.

For the application of the Ishikawa Diagram, weekly meetings were scheduled for brainstorming, which is a 'storm' of ideas. This initiative is one of the most effective ways of generating creative proposals, which are fundamental for the construction of the Diagram. For Fecomércio (REVISTA…, 2011), despite being simple, this tool can be used to generate concepts and solutions to any situation.

Training focusing on all the ones involved in the process was provided to lay the foundations for a training culture and point out the need for standardization of the process procedures and concepts. The trainings were based on lessons, handouts for both tactic and operational levels, and theoretical and practical evaluations of each one of the three sectors involved. Ppk was our main element to quantify the effectiveness of the action plan derived from the Ishikawa Diagram, together with the process control charts. For the process to be capable, the Ppk value should be above 1.33. The process was considered incapable when values were lower than 1.0.

3. Results

Through the company position in *Rating* and tests performed with a sample defined at the factory, it was noticed that torque was influencing the gas loss until the arrival of the product to the consumer. In other words, a percentage of gas was being wasted because of faulty cap application.

Therefore, for the application of the action plan defined through the Ishikawa Diagram to become possible, the values of the torque attribute and carbonation attribute were analyzed, and a correlation between these two attributes was established. The objective of this test was to check to what extent the removal torque was related to gas loss. Along 10 days, the behavior of the removal torque in relation to gas loss was analyzed in bottling lines 01 and 03. The samples were collected from lines 01 and 03 because line 01 operates with glass, and line 04 with cans. The test did not address the line of glass bottles because the capping system is different from lines 02 and 03. For the correlation and the certification to be possible, it was necessary to adopt the same capping system. In this test, it was found that, along the 10 days, both torque and gas decreased proportionally, which shows that there was a significant gas loss through the bottle cap.

Table 2 and Figure 3, as an exemplification and representation of the tests, show the torque behavior in relation to gas in line 03. For 10 daily analyzed samples of product X, there was a 50-percent variation in torque and a gas loss of 17.32 percent, considering the reduction from the 1st to the 10th sample. For acceptable levels, 5-8 percent

Table 2. Carbonation and torque test in line 03.

Sequence	Date	Torque (lb.in)	Carbonation (Vol)	
1º	04/05/2011	12	4.85	% Torque variation: 50% % Gas loss: 17.32%
2º	04/06/2011	10	4.57	
3º	04/07/2011	11	4.57	
4º	04/08/2011	8	4.51	
5º	04/13/2011	10	4.36	
6º	04/14/2011	12	4.28	
7º	04/15/2011	11	4.31	
8º	04/16/2011	10	4.46	
9º	04/18/2011	6	4.20	
10º	04/19/2011	6	4.01	

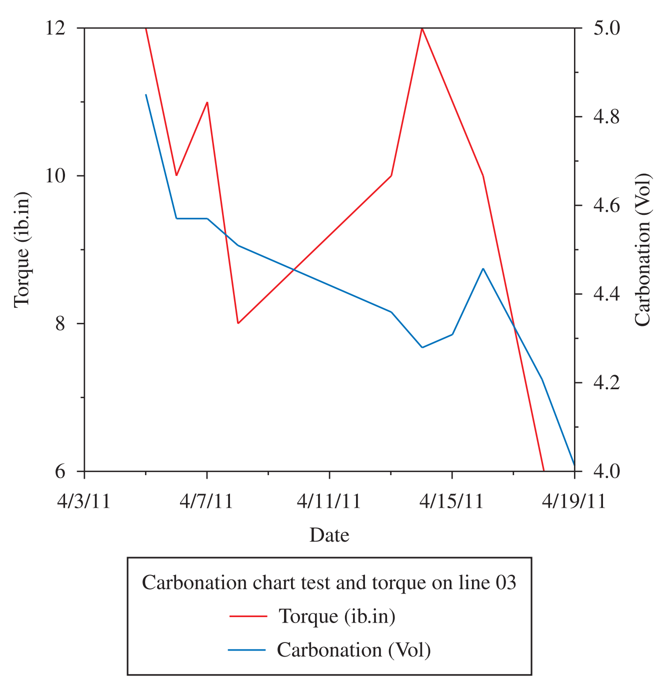

Figure 3. Carbonation chart test and torque in line 03.

of gas can be wasted through the cap because of the plastic deformation provoked by the magnetic head.

The analysis and study of these results pointed out the need of an action plan for both types of capping systems, i.e. lines 01, 02 and 03, comprehending all the products. However, in this study, only the results of lines 02 and 03 will be presented, as Tables 3 and 4 and Figures 4 and 5 show, respectively, for two types of products, generically called "Product A" for line 02, and "Product B" for line 03.

The results obtained were measured in order to show whether the action plan was effective for that attribute and whether the improvement plan was in accordance with the strategic planning.

For generic Product A from line 02, the mean Ppk recorded from January 2010 to June 2011, i.e. along the 17 months analyzed, was 0.50, thus the process was regarded as incapable. Therefore, an action plan founded on a single Ishikawa Diagram was designed for both lines so that Ppk could be higher than 1.33. In this case, in August, Ppk was 1.35; in September, it was 1.57; and in October, it was 2.00. There was no Ppk value in July because the product was not packaged in that line. During the months following the actions, there was an increase of 75.06 percent in comparison to the mean recorded before the actions were taken. Therefore, this was a quite satisfactory result of the action implemented.

For Product B from line 03, the mean was also recorded along 17 months, from January 2010 to June 2011. The Ppk value was 0.82, i.e. it was below 1.0, and so the process was considered as incapable. Consequently, an action plan also based on the Ishikawa Diagram was carried out, with the same parameters and objective determined for line 2, aiming at raising Ppk to values at least above 1.00. The Ppk value was 1.67 in August, but it decreased to 1.46 in September and October. The variation for Product B after the actions taken was of 43.96 percent. Product B was not packaged in this line in July.

Table 3. History Ppk of Product A.

Months	Ppk	% Variation	Capable process
Mean (Jan/10-Jun/11)	0.50	75.06	1.33
Aug/11	1.35		1.33
Sept/11	1.57		1.33
Oct/11	2.00		1.33

Table 4. History Ppk of Product B.

Months	Ppk	% Variation	Capable process
Mean (Jan/10-Jun/11)	0.82	43.96	1.33
Aug/11	1.67		1.33
Sep/11	1.46		1.33
Oct/11	1.46		1.33

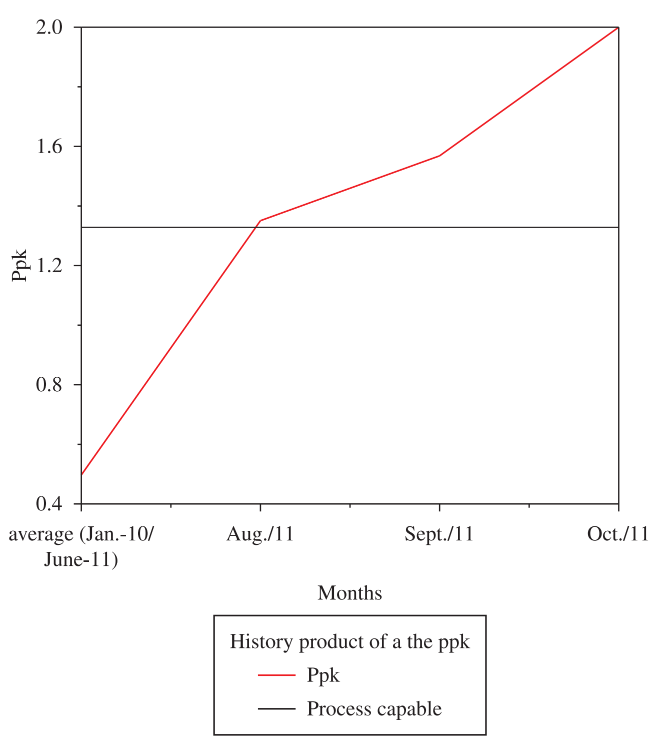

Figure 4. Variations in Ppk of Product A.

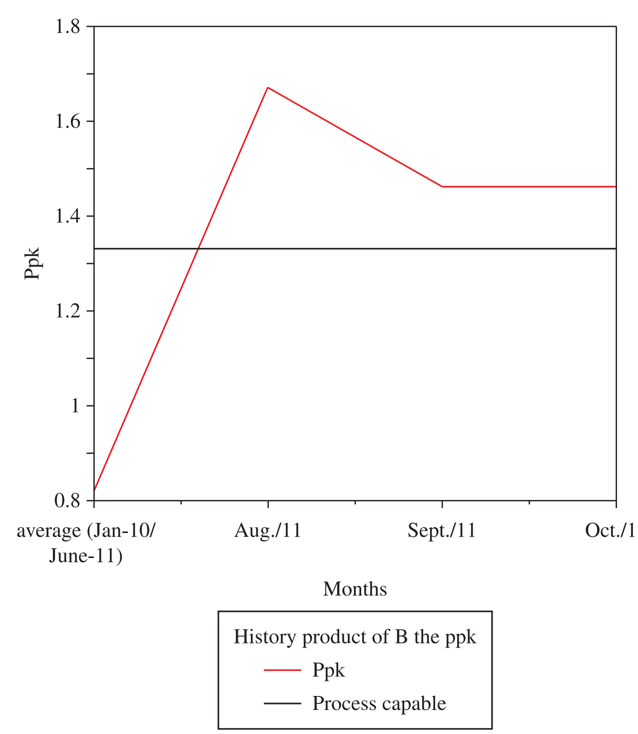

Figure 5. Variations in Ppk of Product B.

From these results, one can see the effectiveness of measuring the improvement plan through the Quantum model. For Bartz, Mathes and Siluk (2012), the use of performance measurement in organizations has shown more remarkable advancements with the measurement of financial results. However, Oliveira et al. (2010) claim that there are still improvements to be made in manufacturing, logistics, marketing quality, etc.

4. Conclusion

This study has attempted to evidence the importance and interdependence of the improvement plan and the performance evaluation model at strategic, tactic or operational levels. It is fundamental to choose an evaluation model to measure its results, so that quantifying, representative values can be used to later analyze the improvement plan. In this case, the Quantum Model has been adopted because it was considered as suitable to the purpose of this work. The communication has been highlighted, and it has become evident that both brainstorming and the Ishikawa Diagram, together with the action plans conducted along the schedule, have consolidated the improvements in the process under analysis, that is, the quality – torque attribute.

In this context, the value of Ppk reached an increase of 75.06 percent for Product A from line 02, and 43.96 percent for the generic Product B from line 03. This shows that the improvement plan adopted was effective, reaching excellent Ppk values.

As future projects, the improvement plan will be measured to check whether it is efficient and effective in our process. In order to do that, a performance measurement system will be employed.

From this, an individual performance evaluation will be performed at the managerial, tactic and operational levels. By the way, the idea is to measure the impact of the individual performance on the global performance evaluation, which will be evidenced in our study either through the Process Performance Index (Ppk) or through statistical control charts for each attribute.

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