

Analysis of production processes for optimization of non-quality costs: Application to the company Alpha

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Abstract

Nowadays quality is a distinguishing factor in the market essential for companies hold their customers as well as to increase their competitive advantage. However, it is necessary to adopt techniques that reduce errors and flaws in the process, especially before the products are placed on the market. It is in this sense, that the opportunity arose to optimize non-quality costs of Alpha company, a market leader in several branches of activity. Using the integration of the Balanced Scorecard with the PDCA cycle and 5W2H methodology, it was possible to establish essential foundations to optimize the non-quality costs of the company. Through the inclusion of production processes in the methodology outlined, it was possible to fit the business plan objectives, in a strategic map and establish performance indicators with realistic targets that trigger initiatives, properly characterized by 5W2H methodology.

Keywords: non-quality costs, quality management department, Balanced Scorecard, performance indicators, PDCA cycle, 5W2H methodology

1 Introduction

The cost control in a company is essential for maintaining a stable financial health both in the short and long-term. Having the end customer, the power of decision on the purchase, it becomes extremely necessary that companies have as main objective the satisfaction of their needs, efficiently and at the lowest possible cost. To reduce the number of errors/failures, there are quality control mechanisms to ensure that the processes of adding value are carried out according to the established standards.

The business relevance of the problem under study, is the review and verification of the origin of the company's non-quality costs Alpha company that are at the source of the errors detected. In this way, it is intended to evaluate the reliability of current quality checking system to reduce the number of incidents and complaints as well as the associated costs. Business motivation, portrayed through the emerging need of Alpha company¹ to optimize the non-quality costs, made possible the realization of this work with scientific relevance by integrating three methodologies for cost optimization: The Balanced Scorecard, the PDCA cycle and 5W2H. This combination of methodologies resulted in the mapping of strategic goals and the establishment of a set of performance indicators adapted to the context, with well-defined goals. To help achieve the objectives, initiatives have also been proposed properly characterized by 5W2H methodology, which may constitute an excellent basis for instilling a preventive business climate and high accuracy.

1.1 Company Presentation and Market Analysis

Alpha company operates in a highly competitive market, where increased competition imposes on the company the study of innovative alternatives that can be differentiated from its competitors (Pohlmann, 2005). However, and also due to the current time, it is necessary to optimize production costs in order to channel resources to the sustainable growth of the company. In this sense, the existence of high compliance costs, constitutes an obstacle to the strategy outlined.

Alpha company was born in August 1967, in the locality of Carnide (Lisbon) as a printing company, which focused on the Portuguese banking sector having a protocol with the Portuguese Banking Association and with the Bank of Portugal since 1980. To reach new markets, Alpha company acquired several companies and the purchase of Paragon, made it the largest graphic producer of Portuguese market. In 2008, with the certification obtained in 2005 by Visa and MasterCard to produce bank cards and also due to technological developments observed, led Alpha company to create a new department dedicated to this issue. In 2010, Alpha company has created a specific

¹ For confidentiality reasons, the company name was safeguarded.

structure for envelopes production. Currently Alpha company is divided into three main areas: Formats, Data and Performance. The Formats area covers all graphic solutions ranging from security documents, paper rolls, ticketing to the customization of various types of cards (banking, identification and loyalty), office supplies, envelopes as well as digital printing. Concerning Data area include consulting services, multichannel communication and bank cards. Regarding the Performance area, includes software development, business web applications, business intelligence and mobile solutions.

1.2 Non-Compliance Procedures and Relevance of Non-Quality Costs Study

Alpha company, through its Quality Control Department, currently has a quality monitoring system that aims to combat the illegal use, sale or use in the process of all products which do not comply with the requirements. The procedure begins with the detection, internally, of non-conformities or by receiving a complaint from a customer. After registration in the company software - Quality Module, the occurrence is checked. Then, it's started the process of analysis of Internal Communication by sending the computer record to the responsible areas, or speakers, of the problem concerned. After a detailed analysis of the problem, a technical opinion is formulated that, depending on gravity of the situation requires intervention by the Direction or the Quality Control Department. After a final decision, if necessary ask any kind of customer information, the process will pass to the business contact that will gather the necessary information. When the decision suggests corrective or preventive actions, the Quality Control Department will give a process follow-up. This process is only terminated with the evaluation of the effectiveness of actions taken, and being its closure, a responsibility of the Directors or the Quality Control Department.

Alpha company established a base value of €17.00 that reflects the cost of analysis and validation of any opening of Internal Communication. This cost reflects the time "spent" of the actors in the process (except Administration). Whenever it is necessary the Administration intervention, to the more complex cases, the base value goes up to €17.00, totaling €34,00. In addition to this cost, if the company doesn't come to an agreement with the customer and it is proved that the fault was their responsibility, a reparation of the non-conforming products is processed. Regarding to non-quality costs, these costs amounted to €36 801.75 in the year 2014, representing 0.36% of this year's billing and 666.43% when compared with the net profits of the company.

2 Literature Review and Methodology

For Hinckley (1997), one of the problems of methods based on statistical quality control is that only sense errors/failures after they have already been produced. Thus, it becomes necessary to make an inspection at source to prevent the causes of errors, before the start of the process. Just avoiding quality issues, is that it is possible to reach it. According to a study carried out to a sample of British companies, the choice of accounting management system according to the ABC model, delivers cost savings in the order of 27% over three years, with regard to companies that do not adopt this model. In addition, the ABC model adds more value to companies, which is justified by improved asset utilization and financial control (Kennedy & Affleck-Graves, 2001).

Simon & Canacari (2012), although the manufacturing are using Lean Manufacturing principles for several years, also the health care industry can benefit from its implementation, to improve their processes. For example, health care providers (especially private ones, that establish a business) can take advantage of Lean principles to monitor quality indices, which are required by law, so as to reduce their costs and to bridge the frequent miscommunications.

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2.1 Implementation Plan of the Balanced Scorecard in the Organization

Although there are several options for implementing this method, it was decided to use an adaptation to the most known currently of Kaplan & Norton (1996). According to the authors in question, the construction of a BSC can be made according to four stages:

- 1- Definition of measurement architecture;
- 2- Strategic objectives establishment;
- 3- Definition of performance indicators;
- 4- Definition of an implementation plan.

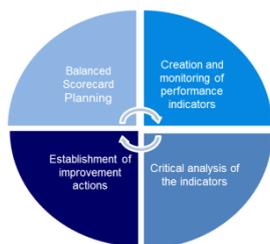


Figure 1 - Adjusting the PDCA Cycle for the BSC Implementation

To make the most of the Balanced Scorecard, it is necessary to implement it in the Organization, establishing a continuous quality improvement process. This process of continuous improvement can be applied, according to PDCA cycle, much popularized by William Edward Deming. This cycle, comprises the four stages, is an iterative process which improves the knowledge of production processes, as the number of repetitions increases (Pietrzak & Paliszkiwicz, 2011). The Balanced Scorecard implementation plan proposed, through the PDCA cycle, can be visualized by Figure 1.

2.2 Integration of PDCA Cycle in the Balanced Scorecard

In order to simplify the whole explanation about each phase that characterize the Balanced Scorecard and the PDCA cycle as well as the integration of the two methods, along with the 5W2H methodology, the main tasks that characterize each phase, were resumed in table 1.

Table 1 - BSC Integration with PDCA Cycle and 5W2H

BSC steps	Strategic objectives establishment	Performance indicators definition	Setting targets for performance indicators	Definition of initiatives to performance indicators
PDCA phases	Planning Balanced Scorecard	Creation and monitoring of performance indicators	Critical analysis of the performance indicators	Establishment of improvement actions
				5W2H Questions

3 Implementation Balanced Scorecard

3.1 Distribution of Non-Quality Costs

Internal Communications can be recorded in the company software – Quality Module, according to three components:

1. **Complaint:** when the information comes directly from the customer;
2. **Internal Anomaly:** when the information is uploaded by company's employees or interdepartmental affections. Internal Anomaly has the potential to give rise to a complaint by the customer because it is an internal fault in the process, however, the customer never complained;
3. **Internal Document:** when an opportunity for improvement is identified by company's employees or when a customer requests a change to the product ordered initially.

The histogram presented on Figure 2, represents the evolution of the non-quality costs, by type of internal communication, since the year 2007 until 2015.

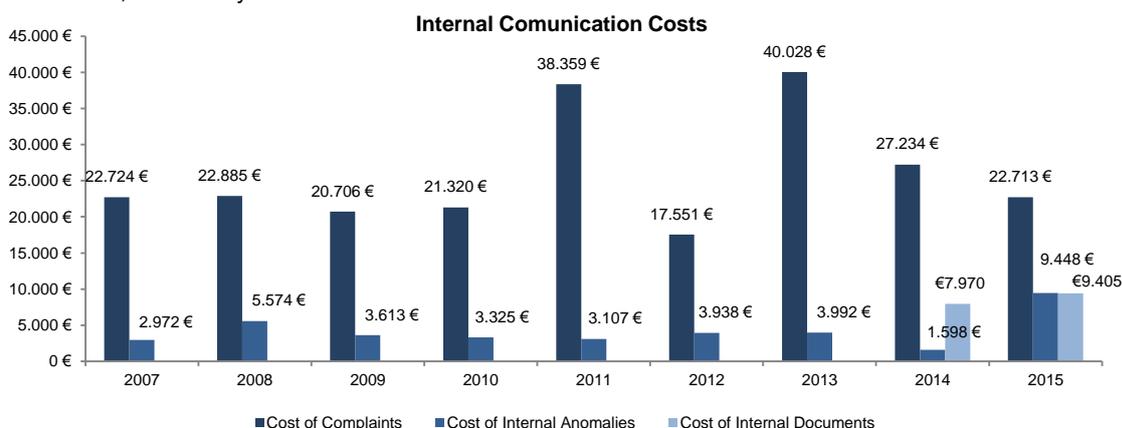


Figure 2 - Non-quality costs Histogram by Internal Communication

3.2 Distribution of Non-Quality Costs by the Categories and Entities

Beginning by viewing the cause and effect diagram shown in Figure 3, where are the most common causes that gave rise to the non-quality costs during the analysis period (from 2007 to 2015).

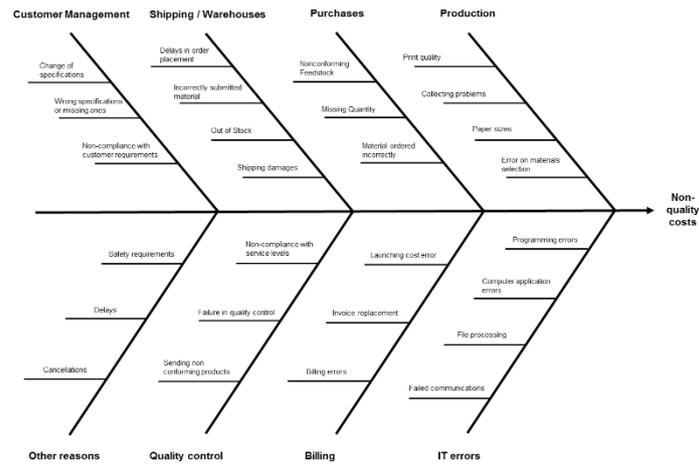


Figure 3 - Cause and Effect Diagram applied to Alpha company

It should be noted that the category "Other Reasons" includes, in addition to the non-compliance with the safety requirements, delay and cancellations, all Internal Communications where it has not been possible to reach a conclusion on the cause of non-compliance.

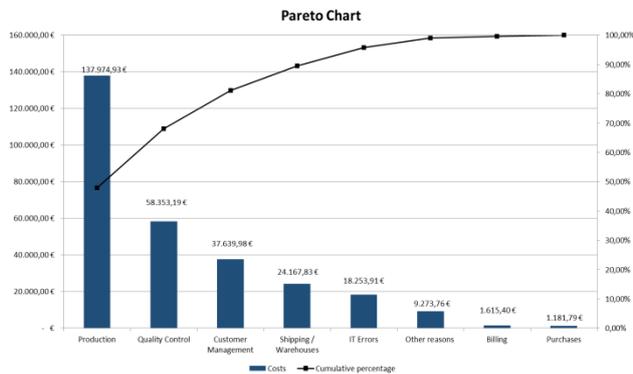


Figure 4 - Pareto Chart relative to the Costs of each Cost Category

To visualize the impact of each category in the non-quality costs, let's start by showing the Pareto Chart, corresponding to the figure 4. The Pareto chart confirms that the causes where the organization needs to focus more attention on their elimination are the 'Production' and the 'Quality Control'. Although these causes are interconnected, since quality control is performed during the production process, before the following product has been shipped, represent almost 70% of the costs identified for the period under review. This information is according to the scope of this work that will focus on these two aspects, although it has also taken account of the other sources that influence the entire production process. The current and complete list with the responsible entities for Internal

Communications generated, can be consulted through the table 2. It should be noted that the responsible entities, match the origin of non-conformities, after the procedure has been completed and accepted by both such as the Quality Control Department and by the liable entity.

Table 2 - Responsible Entities Definition (source: internal documentation)

Responsible Entity	Description
DC10	Sales Team for Large Accounts
DC20	Sales Team for Exportation
DC30	Sales Team for SMEs
Graphic production	Area responsible for the production of documents and forms
Envelope Production	Area responsible for producing, exclusively, envelopes
PFD Production 1	Printing and Finishing paper documents
PFD Production 2	Printing and Finishing cards (banking, loyalty, etc.)
Computer development	Area responsible for computer development company
Expedition	Shipping / dispatch of products to the customer
Network Administration	Area responsible for network management
Administrative / Financial	Administrative and financial areas of the company
Customer	Last actor in the supply chain
Purchasing / Warehouse	Purchasing Department (may involve suppliers) and warehouse management
Subcontracting	Outsourcing services / Outsourcing
Others	When the allocation of responsibilities is not conclusive

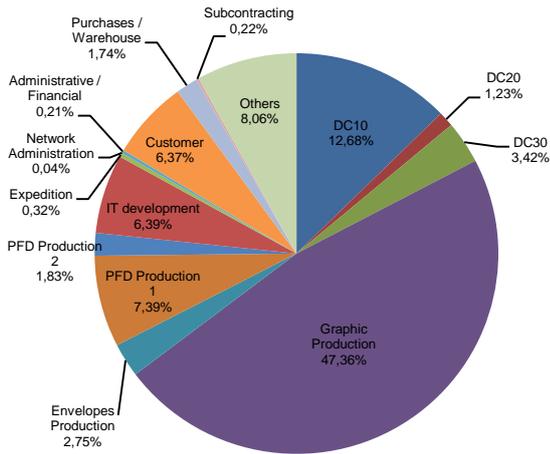


Figure 5 - Distribution Costs of Internal Communications for Responsible Entities

From the data relating to the costs charged to the responsible entities from 2007 to 2015, it was possible to build this chart in Figure 5. By viewing this figure, it can be concluded that the main responsible area for the majority of Internal Communications generated is the 'Graphic Production'. The sales teams, all together, represent a little more than 17% of Internal Communications costs reviewed while the rubric 'Other' represents approximately 8% of the non-quality costs.

Despite the same study have been made to the number of Internal Communications generated, it's interesting to note that a higher number of internal communications for responsible entity it's not indicative of a larger volume of money spent by Alpha company.

3.3 Balanced Scorecard Application

As the scope of this work focuses on the analysis of the productive processes for non-quality costs optimization, it was decided to address the costs related to the category 'production', in particular the responsible entities 'graphic production' and 'Envelopes Production'. This choice is justified by the fact that these two entities correspond to two distinct organizational areas, that can be found in the same physical space and are coordinated by the same person. During the analysis period, these two areas represent 50.11% of the total non-quality costs and 22.96% of the Internal Communications number generated.

3.3.1 Strategic Objectives Establishment

For a correct visualization of the production objectives, let's start by analyzing the strategic map corresponding to the figure 6. It should be noted that this map has been drawn up on the basis of inputs received from the Alpha company, regarding their business plan, mission and values outlined.

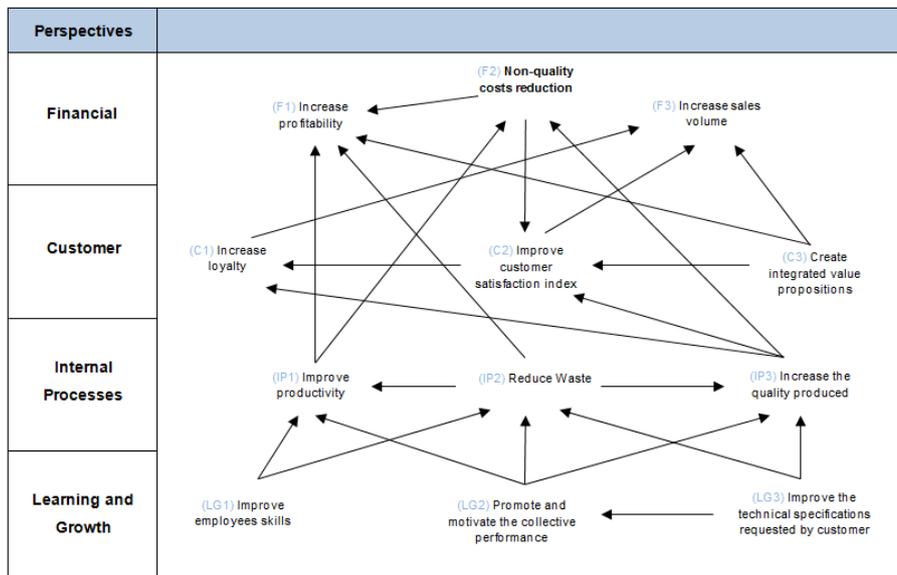


Figure 6 - Strategic Map (Adapted from Kaplan & Norton, 2004)

3.3.2 Definition of Performance Indicators, Targets and Initiatives

After the strategic objectives establishment, it's necessary to determine how to measure them and monitoring. In this section, will be established the most suitable performance indicators for each strategic objective, calculation formulas

will be indicated and the targets will be established in a justified way. In order to achieve the defined targets, initiatives were created and characterized for each indicator, according to 5W2H methodology.

▪ **Financial Perspective**

In order to increase the profitability of graphic production and the Envelopes production, it's essential to produce more with the lowest possible resources, having for that to optimize the production processes, making them more efficient. To establish the goal, corresponding to the increase in EBITDA, consider the histogram present in Figure 7. The values indicated refer to the evolution of Alpha company EBITDA². It was assumed that these values were very similar to the operating margin of the graphic production and the Envelopes Production areas. By calculating the average growth rate for the values represented, a value of 6.07% was obtained. Applying the growth rate to 2015, the target for 2016 of **10.71%** was established, corresponding to an increase of 0.61 percentage points.

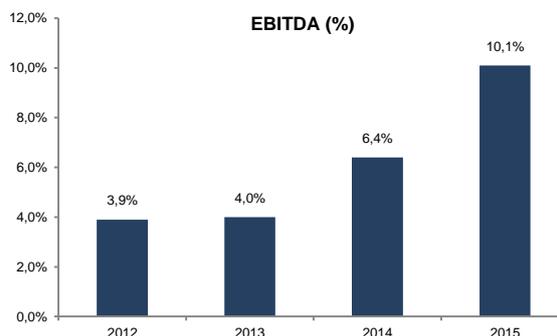


Figure 7 - Historical Evolution of EBITDA

For the other two objectives, the indicators that more reflect the results of their own rubrics were settled: measuring the non-quality costs and the sum of sales and services rendered, relative to the graphic production and Envelopes production areas. To obtain the target for the non-quality costs, were added in a table all values from 2007. After that, annual variations and the respective average growth rate were calculated. By multiplying the values in 2015 by the respective average growth rate, both the annual targets were defined for the graphic production and for Envelopes production of **€ 6,607.59** and **€ 1,431.21**, respectively. Regarding the definition of the target for the sum of sales and services rendered, it has been obtained the growth rate between 2013 and 2014. Assuming that Graphic and Envelopes Production represent 42% of the total revenues of Alpha company in recent years and that growth in 2015 and 2016 are based on the same growth rate, it was established the goal of **€ 4,656,174.26** for 2016. The compilation of all the information concerning the Financial Perspective can be found in table 3.

Table 3 - Performance Indicators according to the Financial Perspective

Perspective	Strategic objective	Performance Indicator	Calculation formula	Target	Initiative
Financial	Increase profitability	EBITDA	Accounting clearance	10.71%	Quantity discounts by increasing volumes by order
	Non-quality costs reduction	<ul style="list-style-type: none"> Non-quality costs for Graphic Production Non-quality costs for the Envelope Production 	<ul style="list-style-type: none"> Sum of non-quality costs for Graphic Production Sum of non-quality costs for the production Envelopes 	<ul style="list-style-type: none"> € 6607.59 € 1431.21 	Improve Manufacturing Specifications
	Increase sales volume	Sales and services	Accounting clearance	€ 4,656,174.26	Increase sales value per customer

By analyzing the table 4, it is possible to view the characterization of the initiatives proposed, which correspond to the acts of management which help to achieve the targets outlined for performance indicators.

Table 4 - Definition of Initiatives for the Financial Perspective

Initiative / Action (What)	Why	Where	When	Who	How
Quantity discounts by increasing volumes by order	To take advantage of quantity discounts	In order notes	Whenever possible to predict the need for future purchases	Purchasing department	By planning the most efficient production and take advantage of quantity discounts
Improve Manufacturing Specifications	To avoid non-compliance with specifications and customer requirements	In the registration system	When preparing the Manufacturing Specification	Sales teams	Through better coordination between the customer and the different sales teams
Increase sales value per customer	To improve current sales levels	In budget made	Where there are sales opportunities	Sales teams	Through the development of marketing plans and setting goals for sales teams

² EBITDA means Earnings Before Interest, Taxes, Depreciation and Amortization

- **Customers Perspective**

To measure and quantify the strategic objectives outlined for this Perspective, the established indicators are a bit more robust. To measure the increase in customer loyalty, and according to the information provided, it was decided to use the classification obtained in question "8.6 Evaluate your interest in continuing using company's products and services", which come from Customer Satisfaction Surveys (CSS). In Alpha company case, there's a scale of 1 to 5, where 1 represents the classification of "very bad", 2 represents "bad", 3 "enough", 4 "good" and 5 "very good". Having ratings obtained and, since the average growth rate in this case is negative, and also because the median and average present values below the year of 2015, it was decided to establish the target, by calculating the average between the two higher values recorded. So, adding the ratings 4.115 (from 2011) with 4.085 (from 2015), which are more representative, and dividing by two, the goal of **4.10** was obtained for the classification of this question.

Table 5 - Growth Rates Evolution

Year	Weighted average	Weighted Growth Rate
2011	4,085	
2012	4,045	-0,97%
2013	4,109	1,56%
2015	4,183	1,82%

Related to the objective of improving the customer satisfaction index, can also only be obtained through Customer Satisfaction Surveys (CSS). The evolution of the classifications and the calculation of their annual growth rates for the question "3.1 Evaluate the products quality related to demanded" can be viewed in table 5. Such as the calculation of the target related to question 8.6, the results to the CSS are related to each sales teams (DC10, DC20 and DC30), it has been calculated the weighted average.

After calculating the weighted growth rate, the average growth rate for the years was calculated and the value of 0.80% was obtained. By applying this rate to the last classification obtained, it has established itself as a goal, the value of **4.217** for 2016 classification. For the target associated with the strategic objective of creating integrated value propositions a target of **5%** was established (Real Results Marketing). The information concerning the Customers Perspective, that was established for each strategic objective, is summarized in table 6.

Table 6 - Performance Indicators according to the Customers Perspective

Perspective	Strategic objective	Performance Indicator	Calculation formula	Goal	Initiative
Customers	Increase loyalty	Customers pretention to continue to use the products and services	Direct (Source: CSS)	4.10	Increase customer retention
	Improve customer satisfaction index	Customer reviews in ISC	Direct (Source: CSS)	4,217	Follow customer increase
	Create integrated value propositions	% of sales from cross-selling	Sales from cross-selling / total sales	5%	Increase cross-selling of products / services

Table 7 contains the description of each initiative, for the Customers Perspective, in accordance with the 5W2H methodology.

Table 7 - Definition of Initiatives for the Customers Perspective

Initiative / Action (What)	Why	Where	When	Who	How
Increase customer retention	To increase current loyalty levels	Trade agreements (or sale) established	From the time of customer acquisition	Sales teams	By meeting the product requirements and delivery times established
Follow customer increase	To increase customer satisfaction index	Customer communications	From the time of customer acquisition	Sales teams	Through frequent contact with the customer and feedback collection
Increase cross-selling of products / services	To create integrated value proposition for the customer	In trade agreements (or sale) established	When a customer orders a product / service	Sales teams	Through the products packs establishment and incentives to buy complementary products

- **Internal Processes Perspective**

According to the indicators map made available by Alpha company, for the productivity measurement, two items must take into account: one for the graphic production which measures the number of rotations per man-hour and another for the Envelopes Production that measures the number of envelopes produced by man-hour. The concept of rotation sets the number of times a roll gives a complete turn on itself. As the evolution of the rotation number per man hour has been decreasing, it was decided to establish its target, through the calculation of the median. Thus, the goal of **7101 envelopes per man-hour** for this indicator was obtained. To define the target for the number of envelopes

produced per man hour, the annual growth rate was calculated. Then, a value of 3.17% was obtained, regarding the average growth rate for the years 2011 to 2015. Applying this rate to the value of 2015, a target of **7109 envelopes per-man hour** was established.

As the evolution of the volume of waste in the two areas has been increasing slightly, it was decided to calculate the target according to median. So, the values of **12.73%** for graphic production and **5.91%** for the Envelopes Production were obtained. To set the target for the performance indicator, number of complaints received, it was used the same reasoning that the number of envelopes per man-hour, and being obtained the following maximum values reach to 2016: **25 Complaints** for Graphic Production and **3 complaints** to the Envelopes Production. By viewing the table 8, it is possible to check the performance indicators chosen, its calculation formulas and targets and, finally, the initiatives proposed from the perspective of Internal Processes.

Table 8 - Performance Indicators according to the Internal Processes Perspective

Perspective	Strategic objective	Performance Indicator	Calculation formula	Goal	Initiative
Internal processes	Improve productivity	<ul style="list-style-type: none"> ▪ Graphic Production (Rot / MH) ▪ Envelope production (Env / MH) 	<ul style="list-style-type: none"> ▪ Rotation Number per man-hour ▪ Envelopes Number per man-hour 	<ul style="list-style-type: none"> ▪ 7101 Rot / MH ▪ 7109 Env / MH 	Increase the cutting-edge technology adoption
	Reduce waste	<ul style="list-style-type: none"> ▪ Waste in Graphic Production (%) ▪ Envelopes waste in Envelopes Production (%) 	Sum of the volume of waste / total production volume	<ul style="list-style-type: none"> ▪ 12.73% ▪ 5.91% 	Inform employees with the best practices and procedures
	Increase the quality produced	<ul style="list-style-type: none"> ▪ Number of Complaints received in Graphic Production ▪ Number of Complaints received in Envelopes Production 	Sum of Complaints received	<ul style="list-style-type: none"> ▪ 25 Complaints ▪ 3 Claims 	Improve quality control

Having already a set targets defined as well as initiatives that can contribute to be reached, each initiative has outlined. This information is presented in the table 9.

Table 9 - Definition of Initiatives for the Internal processes Perspective

Initiative / Action (What)	Why	Where	When	Who	How
Increase the cutting-edge technology adoption	To increase the productivity of actuals production equipment	At the productive process	Whenever opportunities were found for the productive process improvement	Graphic and Envelopes Production	By checking and replacement of equipment with lower productivity rates
Inform employees on best practices and procedures	To reduce waste from the production	At the productive process	Upon hiring and always exist an update with the procedures	Graphic and Envelopes Production	Through training and communication actions with employees
Improve quality control	To reduce Complaints	At the productive process	Where reached the limits for collecting samples	Graphic and Envelopes Production	Decreasing the intervals to remove samples

▪ **Learning and Growth Perspective**

Table 10 - Growth Rate Evolution of Annual Number of Training Hours

Year	Number of Training Hours	Growth rate
2013	3194	
2014	1143	-64.21%
2015	5202	355.12%

To improve the employees qualifications, it is necessary to define and carry out a good training plan that's satisfies the needs and business trends. The evolution of training hours and the growth rates can be found in table 10. Calculating the average growth rate, the value of 27.62% is obtained. Applying this value to the number of training hours from 2015, a target of **6639 hours** was established, to 2016.

Regarding the promotion and motivation of collective performance, it was defined that the best performance indicator, according to the information provided, was the number of Internal Anomalies and Internal Documents. As the average growth rate is positive (15.99%), it was decided to calculate the median to establish the target. Therefore, the maximum value to be reached for this indicator is **53 Internal Communications** (only includes the Internal Anomalies and Internal Documents).

Regarding to the strategic objective of improving the technical specifications requested by the customer, it was established the indicator that measures the number of Communications from the category of causes 'Customer Management'. As it can be seen by the Pareto chart, Figure 8, this category of causes is in second place, as regards the number of Internal Communications, generated with 27.08% of total internal communications between 2007 and 2015 (520 of 1920). By calculating the median, the value of **14 Internal Communications** was obtained to the target of this performance indicator. According to table 11, it is possible to check the information relating to the performance indicators that have been outlined as well as the associated initiatives, for the Learning and Growth Perspective.

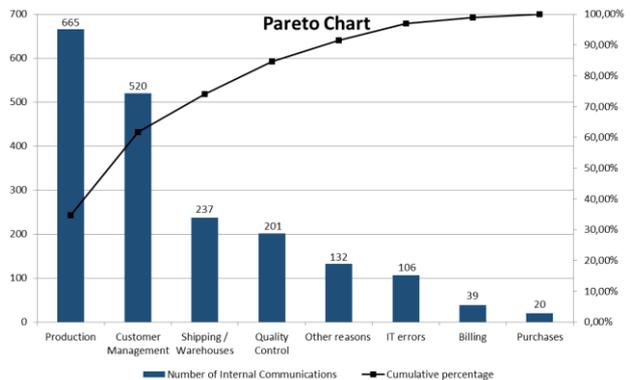


Figure 8 - Pareto Chart relative to the Number of Internal Communications to each Cost Category

Table 11 - Performance Indicators according to the Learning and Growth Perspective

Perspective	Strategic objective	Performance Indicator	Calculation formula	Goal	Initiative
Learning and Growth	Improve employees skills	Number of training hours conducted	Sum of the number of training hours conducted	6639 hours	Establish an annual training plan
	Promote and motivate the collective performance	Number of Internal Anomalies and Internal Documents registered	Sum of the number of anomalies and Internal Documents Internal registered	<ul style="list-style-type: none"> 53 Internal Anomalies and Internal Documents 	Reward employees of the areas with the lowest number of Internal Communications generated
	Improve the technical specifications requested by customer	Reduce the number of Internal Communications from the category of causes 'Customer Management'	Sum of the number of Internal Communications from the category of causes 'Customer Management'	<ul style="list-style-type: none"> 14 Internal Communications 	Improve communication with the customer regarding specifications and product requirements

Finally, to feature the three initiatives regarding performance indicators established, table 12 was built with the information concerning the characterization according to 5W2H methodology.

Table 12 - Definition of Initiatives for the Learning and Growth Perspective

Initiative / Action (What)	Why	Where	When	Who	How
Establish an annual training plan	To train employees able to perform their duties	Training rooms and training in the field	Upon hiring	Responsible for Graphic and Envelopes Production	Through the formulation of an annual training plan
Reward employees of the areas with the lowest number of Internal Communications generated	Encourage employees to avoid mistakes as let as possible	At the productive process	Semiannually	Financial department	Reaching the objectives established
Improve communication with the customer regarding specifications and product requirements	To understand the detailed costumers aim	Customer communications	When a customer orders a product	Sales teams	Through the compliance of the procedures established for the elaboration of a manufacturing specification

3.4 Final Considerations on the Implementation of the Balanced Scorecard

According with section 2.1, for the Balanced Scorecard planning phase, a team work must be set, that knows the method and has easy access to data that will monitor the production processes. In Alpha company case, it is suggested that this team work be constituted by the Graphic and Envelopes production coordinator and by the Quality Control Department responsible. Going on to the second phase which includes the creation and monitoring of performance indicators, the team work established should link with the main productive processes responsables and approve the proposal from this study. It is suggested a weekly follow-up of all the performance indicators defined and a monthly communication of the performance indicators results, assessed to the respective production areas. Regarding the stage of critical analysis to the indicators, it is suggested that the defined team work perform biannual

meetings with the employees of the productive process, to make known the results accumulated and to try to obtain feedback concerning the main difficulties and potential solutions of the problems. It is recommended that the team work perform two meetings with the Admins per year, in order to evaluate possible adjustments to the strategy outlined. Finally, the establishment of improvement actions should contemplate the establishment of initiatives that help achieve all the strategic objectives set initially.

4 Conclusions

The analysis of this document shows that the topic of quality management is increasingly an important factor in the management of the organizations. However, as is natural, it brings initial costs to the companies. Therefore, it is necessary that the benefits generated are greater than the inevitable cost increase. At times characterized by low rates of economy growth, the decrease of financial resources of the companies, make necessary to understand the objectives that lead to increased productivity and customer satisfaction. In this case, the Alpha company showed concern for the subject, collaborating whenever necessary in the provision of internal documentation and explanation of any issues. To solve this problem, the collection of information was complex. A solution was found that first passed by understanding the current state of all quality control procedures. Then, a depth analysis was made to the non-quality costs since 2007 to 2015, according to three distinct approaches and using various quality management tools.

An empirical contribution to the company must be highlighted, resulting from the analysis made to the data. The grouping of causes of non-quality costs into categories made possible the construction of a cause and effect diagram which, associated with the prioritization of categories through the Pareto chart, can help the Alpha company in the definition of internal policies that optimize the non-quality costs. Also, the costs distribution and the number of internal communications by the Entity Responsible, expanded the view on this topic, confirming that the productive sector is the one that most contributes to the problems analyzed.

Regarding the methodological contribution, the fact of integrate coherently, three methods to approach to non-quality costs must be highlighted: The Balanced Scorecard, the PDCA cycle and 5W2H methodology. This integration allowed the strategic definition from the company objectives (as strategic map of section 3.3.1) and the establishment of performance indicators, with numerical targets (such as in the section 3.3.2). To support the company to achieve these targets, actions and initiatives have been established properly characterized by 5W2H methodology.

So, it was possible with the data delivered by Alpha company achieve a structured framework of productive processes in the Balanced Scorecard and in the PDCA cycle and analyse, quantitatively, the productive processes, through the establishment of performance indicators and objective and real targets, that trigger conscious initiatives. Through a regular monitoring of these indicators, Alpha company can reduce the non-quality costs, improving commercial relations with their customers, taking into consideration the set of solutions that has, and that differentiate the company in today's market.

5 References

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