Study Case: Identification and Proposal of Improvements to the Process of Monitoring Nonconformity in a Metallurgical Company

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Abstract

Organizations that wish to produce quality products or services should seek to invest and improve their monitoring and control. The objective of this study is to present a case study, where it is proposed to identify and propose improvements to the process of monitoring and control of nonconformities. The present work makes use of BI software to prepare and analyze the data referring to the records of nonconformities of the year 2017 and the use of this together with interviews and quality tools to identify possible improvements to the process of monitoring nonconformities of a company in the metallurgical sector. The results obtained from the analysis of the data in the BI software were that there is information not filled in the system used by the company. From the answers of the interviews was obtained that employees do not have the necessary information on everything that should be filled in the report of nonconformities, there are communicating noises in the process and was elaborate an Ishikawa diagram for this problem based on the answers in the interviews. After these steps, the 5W2H tool was used to elaborate an action plan aiming for improving the process and eliminating the communicating noises.

Keywords — *Quality, Quality Tools, Nonconformities, Interview.*

I. INTRODUCTION

According to [1] quality movement has contributed significantly for the organizations to obtain a competitive advantage. Looking for methods capable to reduce physical effort, reduce execution time, reduce costs and offer products and services with high quality to keep competitive. However, it is necessary that companies know your strengths and weaknesses, intern and extern.

Quality tools are statistic and manager technics with the objective to help organizations to collect and analyze data and information to solve problems in their process. [2]

Reference [3] defends even where not exist a direct competition, quality it is very important. Therefore, an organization who wishes produce products and services with quality should invest in permanent monitoring and control activities and in the improvements to that process.

According to [4] they used in their research Ishikawa diagram and the tool 5W2H with the objective to define the direct reasons associated with the cases of non-conformities and elaborated an action plan objectifying possible corrections and actions to solve the problems. And [2] show in his article the integration of quality tools and report better results after standardization implantation in the process. Where Ishikawa diagram was used to identify the problem due to the lack of a standardization process.

Reference [5] explained the interview can play a vital role in a scientific work because if combined with other methods of data collection, intuitions and insights who came from that, can improve the quality of a data collect and interpretation.

Based on these assumptions, a work on methods of how to improve a system of control and monitoring of nonconformities is justified. And the objective of this paper is to demonstrate a case study where the intention is to propose improvements to the process of monitoring and control of nonconformities. And the specified objectives of this paper are: use the software Power BI (PBI) to data preparation and visualization; analyze the data and together with an interview and use of quality tools, identify if the process is occurring correctly; identify processes that can be improved and develop actions to improve the process.

II. LITERATURE REVIEW

A. Quality Management and Quality Tools

According to [6] quality tools were developed to help industries to organize, develop, program and improve their quality systems looking for maximum efficiency, better market acceptance and keep their high degree of reliability and produce advantages in relation their rivals.

The seven basic quality tools can produce effective changes when applied, being able to solve most of the existing problems in companies. These

tools are Ishikawa diagram; Pareto diagram; Histogram; Scatter diagram; Control Charts; Check Sheet and Stratification. [7]

According to [8] the use of tools and techniques, how Ishikawa, Pareto, Histogram and 5W2H help organizations to reduce their problems and process variabilities through standardized tasks.

Reference [9] the use of flowchart is essential for the standardization and understanding the process.

Poka yoke is an approach that seeks to detect or prevent failures that may occur in processes. The main idea of poka yoke is a process where mistakes and failures are impossible or at least easily detected and corrected. [7]

B. Non-conformity monitoring

According to [3] the main objective of the monitoring and control activities is looking for more quality and continuous improvement of products and services. Therefore, is essential for companies to monitor their nonconformity indicator.

The monitoring of nonconformities requires a robust system, where is possible to monitor the occurrence indexes continuously. The main basis for good monitoring is a well-structured database and this database should contain an appropriate information for each organization, where is possible extract, stratify and conclude. Thus, this database must contain important information for decision-making, studies of causes, trends, areas that need action and fragilization points. [10]

C. Quality of information

If the information is imperfect, directly affect the decision to be made and there are basically three types of imperfect information: the asymmetric, the incomplete and the ambiguous. Normally, the information is imperfect in some way because there will hardly be a complete and perfect information.
Thus, the objective is always to seek to minimize the imperfection of the information. [11]

According to [12] the information is directly related to the way of think and produce a new product, improve an industrial process, or provide a customer service. Thus, operates in different organizational contexts, improving the quality and productivity of processes and organizational flows. Consequently, it is necessary to obtain reliable information and at the right time for the establishment of actions to be taken by the organization to evolve any industrial sector.

III. METHODOLOGY

The present work was based in a first moment on bibliographical researches in books, monographs, articles published in periodicals, congresses and masters and doctorate thesis, with the objective of scientifically supporting the paper.

A. Type, approach and search method

This work is a case study, which according to [13] consists of the acquisition of knowledge and information in relation to a real problem. And for [14] the case study is evidenced through interviews, direct observations, physical artifacts, documents and records in archives, where the researcher faces different technical circumstances due to the real phenomenon.

B. Target process

The company under study in this work is a metallurgical industry and belongs to the capital goods market, which is the production of goods used to produce other goods, which has been active in Brazil since 1978 and is located in the Zona da Mata Mineira. Always seeking to meet the highest quality standards, the company has ISO 9001: 2008 certification and is in the process of ISO 9001: 2015 certification.

The target process of this work is the process of monitoring nonconformities of the company object of study, which englobes the process of issuing and disposal nonconformities. The process of emission and disposal of a nonconformity can be visualized in Fig. 1. The process of monitoring nonconformities occurs through excel spreadsheets. where the information contained in the physical paths of the report is plotted.

C. Data collect

Data collection was obtained during the month of June, from the nonconformities records in the electronic spreadsheet of the company object of study for the year 2017. And based on interviews with the organization's employees.

The interviews aimed at the employees of the production area responsible for the emissions of the Reports of Nonconformities (RNCs) had the objective to identifying peculiarities of this process and the difficulties encountered by employees in carrying out the processes related to the issuance of these reports. The interviews took place during the months of August and September of the year 2018 and were performed face-to-face with the interviewees.

D. Interview and type of interview

According to [15], the interviews have as advantages the flexibility of application, ease of protocol adaptation and make it possible to prove and clarify answers.
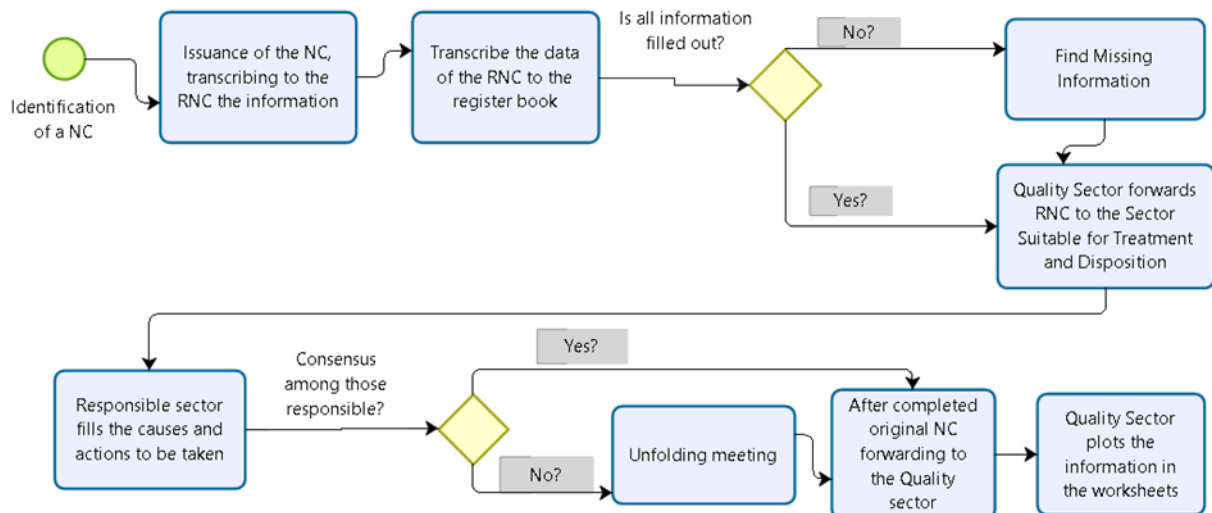
Fig. 1 - Procedure for issuing and disposal of a nonconformity.

The type of interview chosen was by guidelines which according to [16] is characterized by some degree of structuring, is guided by a list of points that are of interest and which the interviewer will explore during the interview. The interviewer performs few direct questions and lets the respondent speak freely.

To prepare the guidelines, the following steps were used: It was planned what would be measured, the guidelines were formulated for obtaining the necessary information, defining the text and order of the guidelines and after these steps two pre-tests were performed with the 4 employees of the quality sector, with the objective to correcting problems encountered during the previous pre-test. These processes occurred during the month of July of the year 2018.

The chosen guidelines were: Guideline 1 - Ask about the most common types of cases of nonconformities in the sector; Guideline 2 - Ask about the existence of special cases in the issuance of nonconformities; Guideline 3 - Ask about how root causes of nonconformities are obtained and their difficulties; Guideline 4 - Ask the employee about the fill of each field; Guideline 5 - Ask what the main difficulties of the collaborator to fill the report.

E. Population, sample and research subjects

To calculate the sample size of employees to be interviewed was used the tool provided by the site survey monkey [17], considering a confidence level of 95% and a margin of error of 5%. The result obtained for the sample size was 33 employees to be interviewed.

F. Data analysis

To analyze the records of nonconformities obtained and the answers from the interviews was opted for the use of Excel software and PBI software, because according to [18] excel is a versatile and established tool in business, often used in analysis, but excel has some limitations, as their spreadsheets are very restrictive for the visualization of the acquired data and the interface is not very interactive.

For [19], [20] the PBI software provides resources for data preparation, user-driven analysis and visualization, not needing specific programming expertise, being easy to use for creating reports and dashboards, allowing you to connect to multiple data sources and having an interface like excel.

IV. RESULTS AND DISCUSSION

After the data has been processed and loaded into the PBI software, the data visualizations were elaborated. The Fig. 2 shows the percentage of empty fields for the following information: Operation number, root cause, place of origin, and corrective action. This information relates to non-conformities of internal origin, in other words, the nonconformity occurred due to some reason related to an intern failure of the company object of study.

	Total (%)
No. Operation Not Filled	17%
Corrective action Not Filled	14%
Root Cause Not Filled	9%
Origin Cell Not Filled	4%
Place of Origin Not filled	3%

Fig. 2 - Fields not filled in RNCs of internal origin

These data presented in Figure 2 demonstrate that 46% of the non-conformities of the year 2017 of internal origin, some information is missing in the monitoring records. The non-fulfillment of the operation number, corrective action and root cause are responsible for 85%, as can be seen in Fig. 3.
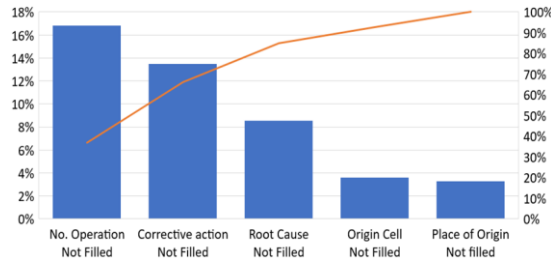
Fig. 3 – Pareto chart of unfilled information

According to the data in Figure 3 we have among the three categories of unfilled fields that are in the representation of 85% of the Pareto chart one is a responsibility of the employees of the production sector to fill and the others are a responsibility of the sectors responsible for the disposition of the NCs.

It also identified RNCs classified in an inconsistent manner, like non-conformities of material failure in raw material as an internal source, however as the raw material came from the supplier, then the origin of the nonconformity is external because it has resulted by an inadequate supply by the supplier. Another case is porosity of raw material classified as internal origin, nonconformities due to internal error classified as external cause and the place of origin of non-compliance is the supplier and is classified as internal. These non-conforming classifications represent 1.35% of all non-conformities issued in 2017.

The interviews provided the following information: where 29% said that the nonconformity comes attached incomplete from the previous process in the plan of operations, 29% replied that the plan of operations comes from the previous process without the non-conformity attached. According to 63% of the employees interviewed they did not have access to the invoice number, 38% does not have access to supplier name and the place of origin to fill in the non-conformity and 14% that the collection of information is not so simple.

Based on the answers obtained by the interviews a cause and effect diagram was developed to the problem of not filling in the information, illustrated in Fig. 4.

In this way it is evidenced that employees do not have the necessary information on everything that must be filled in the report, demonstrating that certain fields should not be the responsibility of these employees.

Questioning the employee responsible for plotting the information of nonconformities in the system, he stated that the supplier and place of origin fields must be completed by the issuers, while the invoice is your responsibility. However, there is no document describing these responsibilities or a template document to guide the fill.

Thus, it can be seen that there are communication noises in this process, due from the evidences presented, where it is considered the responsibility of the issuers to fill an information that they claim does not have access and is acting in a way that does not allow the process occur in a satisfactory form and the responsibilities of each on this are duly agreed.

A. Elaboration of an action plan

Using the 5W2H tool the action plan illustrated in Fig. 5 was elaborated with the objective to an alignment of information among the collaborators on the process of issuing and fill the nonconformities in order to reduce the indexes of not fill the information and the incorrect fill.

To align the responsibilities of those involved in the process, a meeting should be held with them to align the filling responsibilities. After this meeting the formalization of responsibilities should occur through the elaboration of a flowchart and a model document, to obtain greater standardization of the process. Once these steps have been completed, it is necessary to train employees to they be aware of the responsibilities defined for this process. To avoid the presence of incorrectly filled fields and the empty fields in the worksheet, poka yokes should be elaborated, aiming for the greater consistency of information.

In this way it is intended from this action plan, to achieve reductions in the rates of non-fill of information in physical and electronic form, incorrect classification and eliminate the communication noise of the process of emission and monitoring of nonconformities.

V. CONCLUSIONS

The importance of this work is due to the need for organizations that wish to generate quality products and services should seek to invest in permanent monitoring and control activities and that information in organizational environments has to be as much as possible best managed, treated and organized, because in this way the organization can become more competitive in relation to their process, products, and services.

During this research the electronic records of nonconformities of the company object of the study were obtained, where these data were processed and analyzed using the PBI software together with Excel software. After treated, the data were visualized and analyzed in the PBI. Where the absence of information in the registers was verified, being: operation number, corrective action, root cause, the cell of origin and place of origin. Once this information was identified, guidelines were drawn up to interview the employees of the production sector who were according to the records the issuers of the nonconformities analyzed, aiming to identify the peculiarities of the process and the difficulties to fill the RNCs. After the interviews, an Ishikawa diagram was prepared in order to structure the causes.
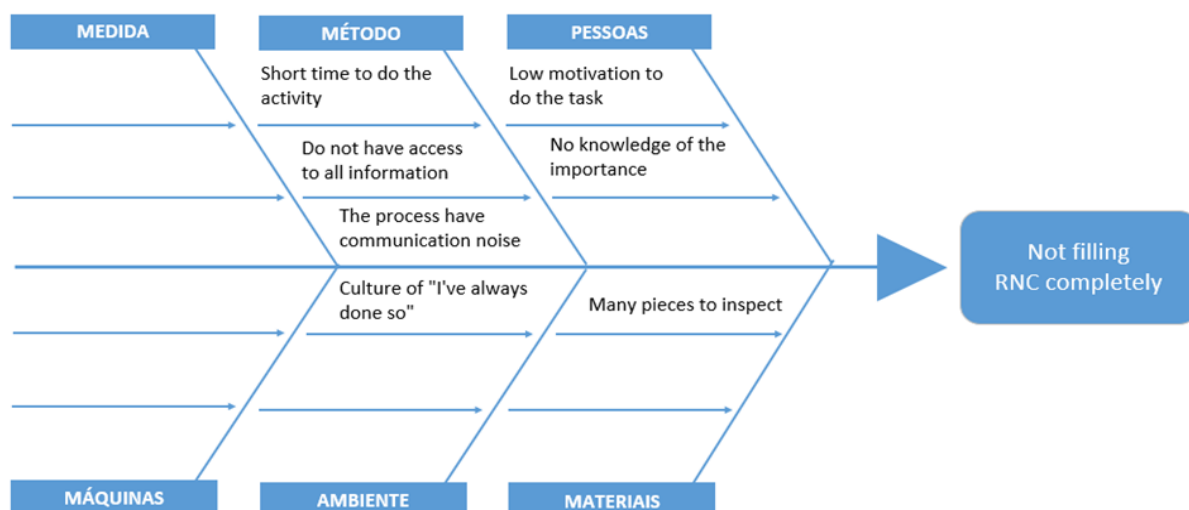
Fig. 4 – Ishikawa diagram

Based on the analysis of PBI, interviews and Ishikawa diagram, the 5W2H tool was used to elaborate an action plan aiming to reduce the indices of not filling information and inappropriate classifications.

The present work had as objective to identify from the analysis of the records of nonconformities in PBI and the use of interviews and quality tools to identify improvement points for the process of monitoring nonconformities and from the results obtained, propose actions to be taken to improve the process. Thus, the proposed objectives were achieved.

Therefore, this work has a contribution, the explanation of the steps used to identify and propose improvements within the process of monitoring nonconformities.

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O quê? (What?)	Porque? (Why?)	Onde? (Where?)	Quem (Who?)	Quando (When?)	Como? (How?)	Quanto custa? (How much?)
Meeting to align information	The process contain communication noise and it is necessary to eliminate them	Conference table	Quality sector and production leaders	30/11/18	Defining and formalizing the decisions	N/A
Preparation of flowchart and document model for the process	To assist the process of issuing RNCs	Software	Quality Coordinator	03/12/18 to 06/12/18	From the documents that were formalized at the meeting	N/A
Training for employees on the importance of correct completion of RNC	Provide employees to better understand of the process and reduce non fulfil of the reports	Producion Sector	Production leaders and collaborator responsible for monitoring	07/12/18 to 11/12/18	Using the elaborated flowcharts and document model	N/A
Elaboration of Poka Yokes for the electronic filling of RNCs	Ensure that incorrect data is not entered	Monitoring Worksheet	Quality Coordinator	07/12/18 to 11/12/18	Use available software features	N/A

Fig. 5 – 5W2H Tool