



*3<sup>rd</sup> International Conference on  
Project Evaluation*



# CONFERENCE --- PROCEEDINGS

**ICOPEV 2016**  
16<sup>th</sup> and 17<sup>th</sup> June  
Guimarães – Portugal



# International Conference on Project Evaluation

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*Title:* Proceedings of the 3<sup>rd</sup> International Conference on Project Evaluation.

*Publisher:* University of Minho

*Publisher address:* Campus de Azurém, 4800-058, Guimarães, Portugal

*ISBN:* 978-989-97050-5-0

*ISSN:* 2183-3974

Message from the  
**Programme Committee Chair**

We would like to invite you to come to the **3rd International Conference on Project Evaluation**, in Guimarães, Portugal.

The conference is being organized by ALGORITMI Research Center, through its research line on Industrial Engineering and Management, School of Engineering of University of Minho. It will take place in Guimarães on the **16th and 17th of June 2016**.

Our main goal is to join together in this event academics and practitioners from a variety of fields with interest on the issue of project evaluation. We expect to provide a forum of debate for researchers and practitioners, contributing to support the sharing of experiences, to promote cross-knowledge and strengthen the academic-industry relationship.

You will also have the opportunity to visit Guimarães, a magnificent city of medieval origin known for being the cradle of the Portuguese nation. You may then admire the remarkably well preserved Historical Quarter of Guimarães classified by UNESCO as World Heritage site since 2001, getting also in contact with the popular traditions and taste the famous gastronomy of the Minho region.

We are looking forward to meeting you in Guimarães in June 2016!

**Madalena Araújo**  
General Chair ICOPEV 2016

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## THE IMPACT OF HIDDEN QUALITY COSTS: A CASE STUDY IN A MATTRESS MANUFACTURING COMPANY

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**KEYWORDS** Hidden costs. Quality non-compliant. Cost management.

### ABSTRACT

This article aims to analyze the impact caused by the hidden quality costs, generated by non-compliant products during the production process of a mattress industry. The research was conducted by a case study with a qualitative approach, using the inductive method of reasoning, on a mattress industry in the city of Vilhena, considered the Amazon Portal. This is an exploratory and descriptive study, which were used as techniques: documentary survey, the interview, the application questionnaire and the non-participant observation, with the study participants productive leaders of each sector, quality control, manager and supervisors of cost, quality manager and production manager. The results with the triangulation of data show the need, in the research industry, a measurement and analysis of the hidden costs of quality non-compliant, and that the company has no knowledge of the value of these costs, nor can cherish them, and not You know what it is in relation to the profitability of the organization. Consequently, does not understand how this management information can serve to improve their performance against their competitors, becoming an important factor for innovation, in order to overcome any difficulties that the economic market can present.

### INTRODUCTION

The national scene is undergoing transformations in relation to the costing systems and the development of quality. This makes managers seek to improve their processes to avoid waste and losses in order to minimize costs prorated on the products. Bornia (2009) states that one of the modern enterprise characteristics are to highlight a continuous process of improvement, combating waste and improving the overall quality of the entity.

Some of the challenges of large companies have been developing quality products without exceeding production costs, and thus achieve competitive prices.

For this, they invest in process improvements, in professional training, in research and development of products and various other tools that enable the achievement of that objective. Faced with the situation presented, the problem assumes the following outline: what is the strategic impact caused by the hidden costs of not quality as in the production process on a mattress industry?

It is necessary to highlight the hidden costs of not quality as that according to Oliveira and Pacheco (2013) are costs caused by the inefficiency of the structure of the management system, leading to blind spots in the perception of their existence. The management of hidden costs incurred in the production becomes, then, a challenge for managers, and with that, comes the need to analyze them.

This article seeks to analyze the impact caused by the hidden costs of quality generated by non-compliant products during the production process of a mattress industry, with the following objectives: i) know the conceptual aspects related to the hidden costs of quality non-compliant; ii) identify the flow chart of the particularities of the production chain mattresses; and iii) measure the hidden costs of not quality as mattresses produced between September 2014 and August 2015, a cost that is usually invisible in the process, but significantly reflected in the reduction of the company's profit.

The research focused on studying the hidden costs of not quality as in a mattress industry, restricted to the only factory courtyard of mattresses and box. The purpose of this article did not explain about the various costing systems in more depth, detail or other hidden costs that do not relate to quality.

The result of this research aims to contribute to the academic environment, society and business, to increase knowledge on how to identify the hidden costs of elements in the quality of production.

### HIDDEN COSTS

Know and measure the company's costs is necessary for a good performance of business management, most of these costs are already evident, such as fixed and variable, direct and indirect. Besides those already known, there is a hidden cost, which according to Silva and Severiano Filho (2011), and Oliveira and Pacheco (2013), are costs caused by organizational dysfunctions of the company, and which are not measured, nor recognized, ie, they are difficult to control.

According to Savall and Zardet (2010), "the source of hidden costs lies in a complex interaction between two groups of variables, ie, there is a constant interaction between the company's structures and human behavior, those created from ortofuncionamento (proper functioning) and failures (malfunction)."

One factor that may show the hidden cost is absenteeism, because according to Frick, Goetzen and Simmons (2013), some companies believe that providing performance pay incentives or productivity conditions workers to increase production quality, however, end up requiring they spend more time performing their functions in working machines, leaving finally performing preventive maintenance. The results come in the form of great stress and fatigue among employees, causing absenteeism, and with that, the institutions they cease not to increase their actual productivity, and generate hidden costs for manufacturers.

The hidden costs are more relevant than managers assume, because even if it is not easy to measure its existence is evident and accounted for at the end of the period, may prove to be significant, affecting, and direct and severe manner, profit or loss of the company.

## QUALITY COSTS

The quality cost can be understood as all spent used for the promotion and disclosure of planning and quality control. This that according Padoveze (2013) must be born with it to meet the customer's desire for quality, cost and delivery. Some authors distinguish the quality costs in four categories, Giakatis, Enkawa and Washitani, (2001); Alves and Trindade (2012) and Padoveze (2013), expendem that quality costs are exposed frequently in four categories, they are: Prevention, are costs that seek to avoid future failures, evaluation, the costs are used for control quality, internal flaws, are the costs of identification of defects when the product is still in development in the industry, and external faults, are the costs when the defect is discovered only to reach the end consumer. Among the four categories mentioned, the latter requires special attention, since the defect went through the whole process and quality control and still reached the final consumer.

In Padoveze agreement (2013) and Williams, Khan and Naumann (2010), the quality generates future income, which would be the behavior of customers in relation to the attributes of a product or service, being related based customer retention, which in time would be customer satisfaction for the products and services, thus, increasing

and / or maintenance of the company in the market in which it operates.

There is also a need to develop data with the main objective to manage all costs, including quality, not just relate them to the product. Stolber (1991) says that the inspection control system, as well as cost management, it is important to generate accurate and consistent information effectively. It further states that it is important to measure the costs of quality, so that the effects of changes in the costs of the total costs can be seen.

## HIDDEN COSTS OF QUALITY NON-COMPLIANT

Among the cost variables is the hidden cost of quality not as that is all spending generated by the lack of quality that is hidden in the production process.

Oliveira and Pacheco (2013) say that of all the different types of hidden costs is the hidden cost of non quality. These are unnecessary costs incurred by not quality and lack of efficiency in the management system of the company.

Padoveze (2013) states that, to measure the hidden cost of quality non-compliant, it is necessary that the organization has a good information system, which enables the buildup of spending, and to promote the creation of cost centers in each sector or department, or organization needs a more complex system.

According to Cheah, Shahbudin and Taib (2011), to reduce costs adequate and prudent solution is needed, ie to develop projects and products effectively and implement quality improvement programs and efficient cost structure, tracking and suppressing so, the hidden costs of quality non-compliant.

In this context, to assess the reduction in COQ, one must measure the effectiveness of quality improvement programs. Krishnan, Agus and Husain (2000) expound that when there is need to control something, the first thing to do is measure it, so it can be shown and controlled effectively.

Non-measurable losses are also known as COQ. This which, according to Vieira (1999), constitute major concern to managers seeking to generate quality to its products and sevicees. The same states that a tool used to identify quickly and objectively losses is the Histogram as the manager aims to address the few causes that generate many losses. When doing production planning is necessary for him to be handed the specifications to avoid waste.

Given these facts, it can be observed that managers still lack an information system that provides sufficient data to measure the hidden costs of quality non-compliant; these costs are not the focus, it is difficult to identify.

## MATERIALS AND METHODS

This work was conducted by a case study with a qualitative approach on a mattress manufacturing

company in the city of Vilhena, known and considered as the "Amazon Portal".

The study was characterized as an exploratory and descriptive, and aimed to identify and analyze the hidden costs of quality as not to further determine the effects on the company.

According to Yin (2010), case study aims to thoroughly study a few objects in order to generate detailed knowledge on the subject. He also claims that the case study does not address the issue in a comprehensive way, with more general view of the problem, seeking an in-depth understanding on the above subject.

To create opportunities to study the aspect of a problem, it made it imperative to use the case study method which according to Ribeiro, Pasqualini and Siedenberg (2013) to understand the subject exposed is necessary to study the theme of the object, and thus determine the level depth of subject, within a limited period of time.

The processing of the data, this paper aims to present the results in a qualitative way, with the use of inductive reasoning method, starting from the particular to the general on the subject without trying to generalize the proposed subject, but expose an issue little discussed about control of management of hidden services of quality non-compliant.

In order to triangulate the information obtained and comparing the data with each other and the literature, the research was technical documentary survey, interviews, a questionnaire and non-participant observation, with the participants in this study productive leaders of each sector, quality control manager and supervisors of cost, quality manager and production manager. Thus, the research sought to understand if there is concern about the hidden cost of quality not as this entity regarding the investigation and control of such costs.

## RESULTS

With the data analysis of this research, we seek to expose and measure the hidden costs of not quality as in the mattress company.

Search is still in the analysis of the data, get the leadership of the production, management and headquarters costs of supervisors, responsible for affiliate cost area searched, their perception about the hidden cost of quality non-compliant.

The results were divided into three sections, namely: results of interviews applied to the array costs of supervisors, the questionnaire administered to employees who work in the local production sector, and the calculations made from reading the forms filled out by the sector.

### *Analysis of the perception of the hidden costs of the Matrix cost supervisors*

Analyzing the responses of each supervisor in Table 1, it is clear that both know the concept of hidden costs, however, there is a divergence from the track of them, as

the first stated that there was no específico control, and the secondHe said there is a partial control.

Regarding the percentage, it is clear that both assume a similar idea in relation to revenues, which in their view, ranging from one to two percent, and that percentage is relevant or very relevant.

Both in the perception of the first supervisor, and in the second opinion, we can see a consensus that it is necessary to analyze these costs, since both would help in controlling these, as would help improve target of overall results of the company.

Table 1: Perception of the hidden costs of the Matrix cost supervisors

Question	1st respondent perception	2st respondent perception
Knowledge of hidden costs	The Hidden Costs are costs that can not measure easily, they are related to the company's production activity, however, there is no knowledge about them, from when a Hidden Cost is discovered and worked on it, it stops being hidden.	Cost that you can not measure.
Control of hidden costs	It has no specific control	Partial control. Reports generated in Sabium system, analysts prepared to perform that function.
Percentage of the industry's hidden costs	Assumes in relation to net sales: 1% on average.	It assumes that less than 2% in revenues.
The relevance of this percentage	Very relevant.	It is relevant. Because it leaves the process as a whole be 100%.
The relevance of the analysis of the industry's hidden costs	The target result is 5%, and 1% hidden costs could further maximize this result.	Help control costs, including possible to discover hidden errors by those in charge of them.

### *Analysis of the questionnaires*

Figure 1 shows what best represents the meaning of the term quality, where there were two assertions, the first emphasizes the adequate quality standards, as stated by Padoveze (2013), and the second assertion underscores the quality focused on customer satisfaction, as stated by Alves and Trindade (2012).

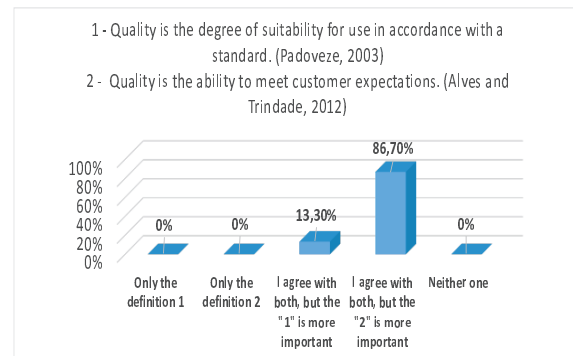


Figure 1: What is the best term quality

The answers revealed, as shown in Figure 1, 86.7% agree with both assertive, but believe to be the second most important; and 13.3% agree with both assertive but think is the most important first. None of the respondents judged that only one of the statements form the concept of quality or neither. As the theoretical framework of this work, it is perceivable that both assertive form the

concept of quality as meeting the standards is also a way to satisfy the customer and, says Sellés, Rubio and Mullor (2008), market competitiveness brings need for companies to invest in processes that maintain the quality of the products or services.

Table 2 shows the degree of relevance of the forms used in the production process, and based on the data presented, it is clear that the majority of respondents deem to be very important or extremely important, all the forms used.

Table 2: Percentage of relevance degree that best represents the company forms

ORDER	FORM	ER*	VI*	I*	LR*	NR*
6	001 Loss of raw material stitching.	50%	30%	0%	20%	0%
7	009 Spring-loss molejo.	44,44%	44,44%	0%	11,12%	0%
8	010 Spring fault log.	33,33%	66,67%	0%	0%	0%
9	012 Defect record.	41,67%	50%	8,33%	0%	0%
10	014 Control of non-compliance.	41,67%	50%	8,33%	0%	0%
11	018 Compliance Control.	36,37%	45,45%	9,09%	9,09%	0%
12	021 Daily maintenance embroiderer.	33,33%	55,56%	11,11%	0%	0%
13	022 Loss of control.	45,45%	36,37%	0%	9,09%	9,09%
14	023 Loss of raw material packaging.	44,44%	44,44%	0%	11,12%	0%
15	024 Loss of raw material litter box.	55,56%	33,33%	0%	11,11%	0%
16	027 Colchoaria loss.	50,00%	37,50%	0%	12,50%	0%

Legend:

\*ER (extremely relevant); VI (very important); I (indifferent); LR (little relevant); NR (not relevant).

Table 3 shows the degree of use of the forms used in the production process for management decision making, and, based on the data submitted, it is noticed that the vision of respondents varies widely in the degree of use of forms for management decision making, ranging from "very used"; "widely used" and "underutilized".

Table 3: Percentage of the degree of use for management decision making that best represents the company forms

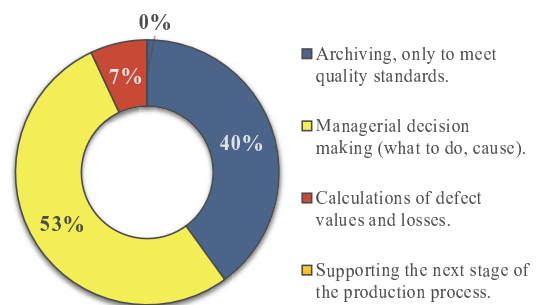
ORDER	FORM	EU*	VU*	I*	LU*	NU*
17	001 Loss of raw material stitching.	22,22%	33,33%	11,12%	33,33%	0%
18	009 Spring-loss molejo.	20%	20%	10%	50%	0%
19	010 Spring fault log.	33,33%	33,33%	11,12%	22,22%	0%
20	012 Defect record.	16,67%	66,66%	0%	16,67%	0%
21	014 Control of non-compliance.	36,36%	27,28%	0%	36,36%	0%
22	018 Compliance Control.	16,67%	58,33%	0%	25,00%	0%
23	021 Daily maintenance embroiderer.	12,50%	25,00%	13%	50,00%	0%
24	022 Loss of control.	40,00%	10,00%	10%	40,00%	0%
25	023 Loss of raw material packaging.	12,50%	37,50%	12,50%	37,50%	0%
26	024 Loss of raw material litter box.	33,33%	0%	16,67%	50,00%	0%
27	027 Colchoaria loss.	0%	33,33%	16,67%	50,00%	0%

Legend:

\*EU (extremely used); VU (very used); I (indifferent); LU (little used); NU (not used).

Figure 2 highlights the divergence presented in the analysis of data in Table 3, as in Figure 2 the majority said the forms are used for management decision making, but in Table 3 was between little and used. Thus, as can be seen, 53% of respondents said that the notes made on the forms are used for management decision making, and 40% said that these same forms are used for archiving only to meet the quality standards. Only 7% of respondents said it used the notes for calculation of defect values and losses, and none of the respondents stated that these notes serve to support the next stage of the production process.

Figure 2: The notes made on the worksheets are used



It was asked also to informants about their knowledge regarding the amounts related to monthly defects and losses, of which 100% said they lacked knowledge regarding the subject matter presented. Thus becoming clearer divergence, as to make managerial decision would be necessary to know its value. If the informant answered possess knowledge of this matter would have to answer the question that inquired where the average monthly amount of defects and losses. Since there was no positive answers that question, the latter has not been answered. The analysis of these issues reveals that although most respondents claim to be the relevant forms, and many are claiming these useful, no one possessed the knowledge related to the monthly defects and loss, nor knew inform their value.

#### Measurement of the hidden costs of quality non-compliant

With the analysis of the measurement of the hidden costs of this research, we sought to expose through assessments of documents provided by the company overall value found, presented the results of monthly and overall shape.

Below, Table 4 shows the value in kind found after investigation of the forms described in Tables 2 and 3, along with the non-participant observation, which made possible the calculations to find that figure expressed below. This amount becomes significant, since the sample is summarized in the mattress industry and litter box of a subsidiary of the searched company, and hidden

costs is restricted only for the hidden cost of quality not as these sectors.

Table 3: Value of the hidden costs of quality non-compliant

TOTAL	
MONTH	VALUE R\$
SEPTEMBER 2014	R\$ 17.320,56
OCTOBER 2014	R\$ 24.061,49
NOVEMBER 2014	R\$ 18.344,67
DEZEMBER 2014	R\$ 18.032,30
JANUARY 2015	R\$ 21.076,07
FEBRUARY 2015	R\$ 20.350,01
MARCH 2015	R\$ 27.279,89
APRIL 2015	R\$ 28.186,24
MAY 2015	R\$ 19.905,78
JUNE 2015	R\$ 20.745,75
JULY 2015	R\$ 21.067,48
AUGUST 2015	R\$ 18.349,01
<b>TOTAL</b>	<b>R\$ 254.719,22</b>

Of the total hidden costs presented in Table 4, R\$ 53,224.22 were calculated in relation to rework, ie an average time it takes to service a product was timed, and based on notes taken in defect registration forms that period, was calculated on the value of the hours worked by the persons responsible for performing rework of defective part.

Compared with the total payroll paid to this sector on average R\$ 338,946.00 per year, it is noticed that 15.70% paid during the study period was intended to retrace products not in conformity; or every 5,280 annual hours worked, referring to a pair of work 4240 hours is used as rework, about 80.30% of the total working hours of this double.

Failure to observe the amount invested hours in rework this sector is because of repairs for defective products are divided in the industry today consists of twelve people, or six double. It is noted then that in the year of analysis, almost a double was used only for repairing non-compliant products.

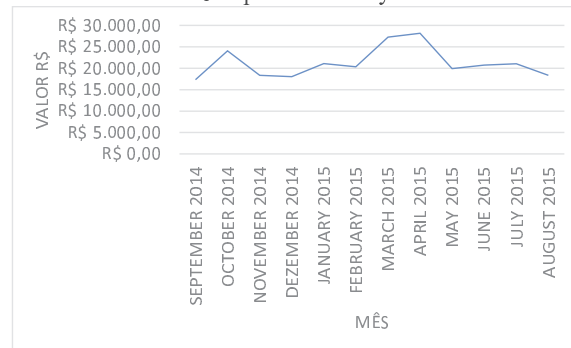
Through observations do not participate, you can see that this form is not used for the purposes of this analysis. Therefore, only stored; then, in addition to the amounts shown above, still have over R\$ 1,919.03 being paid to your employees fill out the document will only be filed. Found other hidden costs were the losses of raw materials, which in total amounts to R\$ 193,065.25 during the study period. Thus, approximately 75.80% of the hidden costs of quality are not found as these losses. To find the values of these losses were used the loss of specific forms filled out by company employees, multiplying the amount of loss by its unit cost. Also in relation to these forms, two of the 021 and 022 due to its characteristics, since the semi-finished products are recorded and non-unitary fashion, first had to be found which would be lost by formulas and then make calculation of loss multiplied by the cost.

It is noticed that these hidden costs found, require special attention of company managers, for though seem insignificant, as a cost difficult to measure, to be

calculated become a significant value, as expende Gama, Souza and Sato (2009), that even if managers having knowledge of the existence of hidden cost, do not seek to determine it, because it is difficult to measure, and, most often, become higher than expected by the company.

Were not considered for purposes of these calculations the forms that record the non-compliance in the period analyzed due to its complexity, so in addition to the values shown in Table 4, there was further 1,207 products in non-compliance that were not calculated.

Figure 3: Total amount of hidden costs of quality non-compliant monthly



By examining Figure 3, it is clear that the months between March and April showed the higher values of R\$ 27,279.89 and R\$ 28,186.24, respectively; ie 21.77% of the hidden costs are found between these two months. Since the month of September, it was demonstrated that the lowest calculated value of R\$ 17,320.56, ie only 6.8% of the total hidden costs are of this month.

Analysis of the calculations shown in Table 3 shows the need to seek to know and measure the hidden costs of the company, as this organization has as a general monthly profit target at 5% of revenue, or about R\$ 300,000 per month, and in average were found in hidden costs of not quality as monthly R\$ 21,226.60 just in mattresses sector and litter box. This represents 7.08% of the profits of a month. Or, it can be said that the total value found in hidden costs of quality not as roughly equivalent to a searched-twelfth of the year compared to a month profit target this company.

## CONCLUSIONS AND FURTHER RESEARCH

Research has demonstrated the strategic impact caused by the hidden costs of quality generated by non-compliant products during the production process of the analyzed company, noting then that when analyzed and controlled, such costs become significant, which would help the company in management decision making. Even though most leaders and managers have stated that use it for decision making, it was noticed a contradiction, since no one could tell us how much of these costs.

The conceptual aspects related to such costs were known in the second section of this article, and this introduced the concept of quality and costs, hidden costs and quality,

and quality costs and quality does not conform; and finally, the concept of the study of the subject, which is the hidden cost of quality non-compliant. I have not found many references of this specific topic, to be an incipient subject and is not discussed in scientific papers. The hidden costs of quality non-compliant, measured between the period September 2014 to August 2015, showed the importance and the need to find and analyze these costs, as the relevance of the found value, which estimated about one-twelfth of profit a month this industrial.

It is noticed that the company evidenced in this research seeks to improve its performance across the client as well as improve the quality of their products, since they are certified by ISO 9001 (International Organization for Standardization) for quality management. It is also important to note that he was awakened interest in the theme proposed in this study, since the company has provided all the necessary information as well as all necessary assistance for the development and completion of this research, demonstrating his concern for all the costs of the production process.

With the analysis and measurement of the hidden costs of quality not as this organization, it is understood that the company has no knowledge of the value of these costs, and not what it is in relation to the profitability of the same, and how this control can be used to improve performance ahead of its competitors and overcome any difficulties that the economic market can present.

It is recommended that, for future work, is investigated the causal relationship of existence of these costs, and the solution so that these costs can be minimized or even solved. It is also recommended that such analyzes and measurement can be applied in other companies and industries of different branches sales and productions, for the visualization of these costs is possible, which, being hidden, usually do not realize their existence.

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