Optimization of the paper bag process by reducing waste

Optimización del proceso de sacos de papel mediante la reducción de mermas

LAGUNA-AGUILAR, Fabiola†, MARTÍNEZ-SÁNCHEZ, Sergio, SERRANO-CABALLERO, Amando and GUERRERO-REYES, Rosalba

Universidad Tecnológica Tula-Tepeji. Academic Body Optimization of Productive Processes, Avenida Universidad Tecnológica No. 1000, Col. El 61, El Carmen, Tula de Allende Hidalgo., C.P. 42830

ID 1st Author: *Fabiola, Laguna-Aguilar*

ID 1st Co-author: *Sergio, Martínez-Sánchez*

ID 2nd Co-author: *Amando, Serrano-Caballero*

ID 3rd Co-author: *Rosalba, Guerrero-Reyes*

DOI: 10.35429/JEDT.2020.6.4.11.15 Received January 20, 2020; Accepted June 30, 2020

Abstract

This project presents a proposal to reduce the amount of loss that generates a company of paper sacks for the optimization of their processes. Use the methodology of Six Sigma, DMAIC (Define, measure, analyze, improve and Control) methodology for the detection and reduction and/or elimination of problems. In the development of this project is looking for the root cause of the problem through data collection and statistical analysis. Proposed indicators for monitoring the verification and functionality of a proposal made to observe the impact of its implementation and to be able to improve those areas that seem relevant to the project.

Optimization, Paper sacks, Reduction of wastage

Resumen

El presente proyecto presenta una propuesta para disminuir la cantidad de merma que genera una empresa de Sacos de Papel para la optimización de sus procesos. Apegándonos a la metodología de Seis Sigma, DMAIC (Definir, Medir, Analizar, Mejorar y Controlar) metodología para la detección y reducción y/o eliminación de problemas. En el desarrollo de este proyecto se busca la causa raíz del problema mediante la recolección de datos y análisis estadísticos. Se analizan todos aquellos factores implicados en la problemática, se agrupan, se observa su tendencia, se analiza cada dato para hacer propuestas asertivas en la optimización del proceso. Se proponen indicadores de seguimiento para la verificación y funcionalidad de la propuesta realizada, para observar el impacto de su implementación y poder mejorar los aspectos que parezcan pertinentes al proyecto.

Optimización, Sacos de papel, Reducción de mermas

Citation: LAGUNA-AGUILAR, Fabiola, MARTÍNEZ-SÁNCHEZ, Sergio, SERRANO-CABALLERO, Amando and GUERRERO-REYES, Rosalba. Optimization of the paper bag process by reducing waste. Journal-Economic Development Technological Chance and Growth. 2020. 4-6:11-15.

† Researcher contributing first author.

Introduction

MERMA is called to all those "losses" that occur throughout the distribution chain. These losses are a scourge when it is not controlled properly, directly affecting the profitability of the business, placing the Loss in a primary objective in terms of its results, when profit margins cause a strong analysis of expenses to be produced, in order to continue in the race and make the business profitable. (Zamora, 2011).

The company had a problem related to waste, there was a lack of control in the generation of waste. This situation was reflected in costs and customer complaints towards the company, due to the poor quality of the products or the appearance of defective products in their orders.

The company had a waste monitoring and measurement system, in which an autonomous record was kept by the operator who weighed their own waste and prepared a report, which was delivered to the production manager who in turn prepared a monthly report that was handed over to management to report what happened during the period; In this process, the data was not true since on some occasions the measurement was not real because they did not report what was happening for fear of being sanctioned, this was revealed when they began to work with the standard costs and quality of the products.

Shrinkage was found to be one of the main factors driving up product costs; likewise, the quality of the bags was deficient, and a lot of waste was generated.

Then it was decided to control in a different way, in which each shift ends it is required to weigh the amount of waste that comes out of each process and a more in-depth and detailed analysis of the origin is made, a monthly list of said quantities is kept; control and monitoring is done personally by the supervisor. Over time they have realized that the levels that they claimed to have of wastage were wrong, the percentages thrown are very high, these data vary each month depending on the products that are made, but on some occasions, they have reached more than the 4% established maximum acceptable for cost and quality control.

Materials and methods

The DMAIC methodology was applied whose acronyms mean: Define, Measure, Analyze, Improve, Control (Define, Measure, Analyze, Improve and Control), which are phases of the six-sigma method for the improvement of processes reducing their variability through the use of statistical tools; the application of the phases was carried out as follows:

The first phase of defining the problem involved observing the sources of variation focusing on the main elements of a process such as work methods, machinery, labor, measurements, environment and raw materials; Historical data were collected to be able to correctly pose the problem, such as a description of the production process and capacity analysis of each machinery from a process map or flow diagram identifying the cycle time in each stage, the bottleneck and the equipment preparation times. From this mapping it was defined that the machines with the most impact on the production time in the process are the printer, the pipe and the anchor, which is where the transformation of the product is made, these require making changes of parts when the product design It is different from what I know I was handling or when a product is received from a new client for the first time, the exact quantities of materials with which to work are not known, so when changing the batch waste is generated.

Table 1 shows shrinkage figures for the months of June to December 2014 with their respective percentage with respect to paper.

Derma registration				
Criteria / month	Jun	Aug	Oct	Dec
Total paper supplied	58236	59,935	48,516	72,158
(Kg)	5,103	6,140	7,451	5,787
Total shrinkage	53,133	53,795	41,065	66,351
(Kg)	8.76	10.24	15.35	8.01

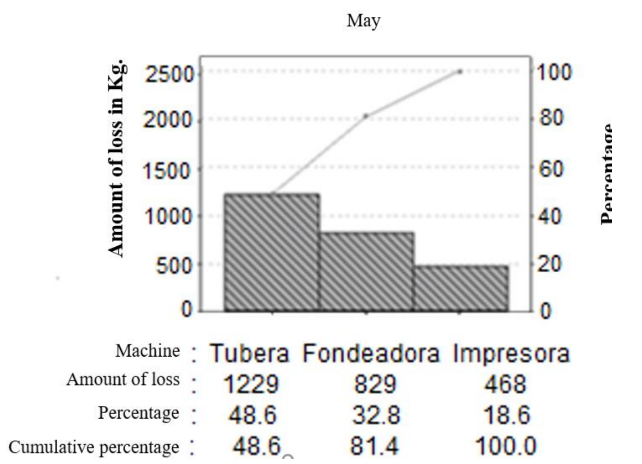
Table 1 Paper waste record

As can be seen in the table and in Figure 1, the amount of waste was considerable since the approximate percentage of waste that the company should handle as a quality objective is 4% and from what is observed in the table in some months it reached exceedingly up to 10% loss and other even more critical cases up to 15% loss.

Figure 1 Decrease in anchoring area

In the second phase, the processes were measured, to analyze the losses that were generated in each one of them to later identify the type of defect based on its characteristics by attributes and variables to have a statistical basis to determine the frequency of appearance by means of worksheets. record.

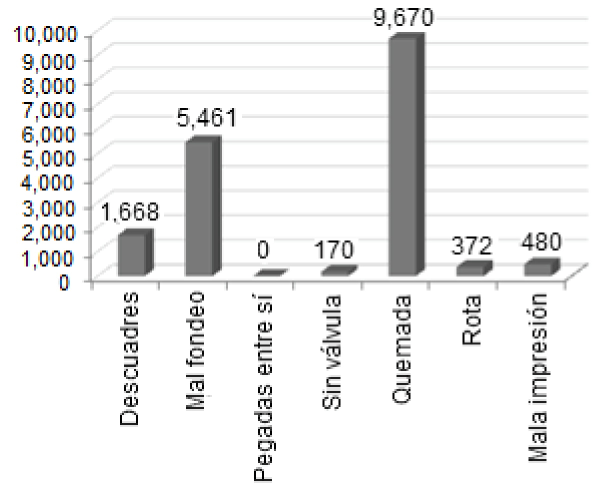
The third phase of analysis to propose the improvements, consisted of analyzing the statistical data obtained; using Pareto diagrams in order to attack the causes in the equipment that originated the highest percentage of loss.



Graphic 1 Pareto chart

What graphi 1 shows us is that 48.6% of the problems are caused by the pipe, 32.8% by the anchor and 18.6% by the printer. Which indicated that taking care of the pipeline and the causes for which losses are produced would be reducing 48.6% of the problem.

After identifying the greatest source of waste, we proceeded to determine the type of defects that caused the loss in the pipeline using a checklist to stratify the defects and frequencies of appearance, which is shown in graphic 2 where it can be observed that the burned bag and the broken bag are the problems that the pipe generates; the total loss due to these two causes is 10,042 pieces, taking the percentage of loss that each cause represents, it can be deduced that the burned bag generates 96.29% of the total waste in the pipe.



Graphic 2 Number of defective parts by cause

Subsequently, in order to determine the causes of the losses, a cause-effect diagram was made, where all the elements that participate in the manufacture of products will be taken into account: labor, raw material, machinery, method, environment and measurement, with Based on this, propose relevant solutions to have greater control of the problem which is shown in Figure 2.

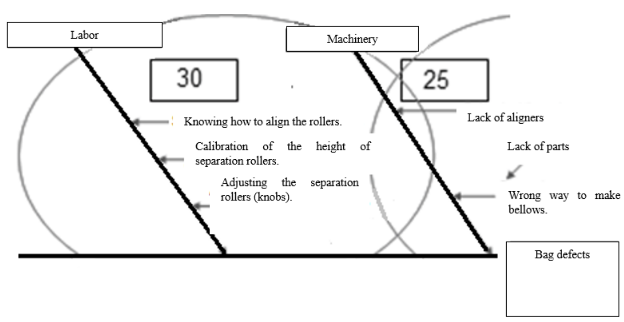


Figure 2 Percentages of the cause-effect diagram

Analyzing the causes of the origin of the burned bag using the cause-effect diagram with the support of stratification and brainstorming, it is identified that the greatest impact is on labor when carrying out the alignment of the rolls and the adjustment of the separation rollers.

When making an order or batch change since all this process is done manually based on the experience and expertise of the worker. Therefore, the equipment was analyzed as well as the adjustment and calibration method in order to move on to the improvement and control phases. In the improvement and control phases, we proceeded to look for error-proof “PokaYoke” tools to facilitate the alignment of the roll and adjustment of separation rollers when preparing the equipment through brainstorming and quality circles, short actions were determined term and long term; In the short term, what was considered more feasible was the use of standard mechanisms for adjusting the paper to eliminate sources of variation due to centering, and for this reason it was determined to use a guide with a numerical scale of the degrees of inclination of each roller, thus The adjustment method was standardized and documented, subsequently proceeding to the practical dissemination of it in all shifts and by all adjusters, in addition to placing it visibly in the workplace with visual aids applying the principles of visual manufacturing, to In the medium term, an evaluation of the paper and ink suppliers was developed with clear specifications of the desired raw material in terms of characteristics such as caliber, humidity, density, delivery times, in addition to a supplier catalog was made and searched other providers in addition to those you already have. For the long term, aligners with movement sensors were quoted to detect in the course of the process when the paper is misaligned and thus automatically stop the process to reduce the waste by implementing an XR statistical control chart that graphs the average sampling. of the alignments during the process every two hours to detect deviations when showing trends outside the specification limits and to take action before it is completely misaligned. With the actions implemented in the short term, the generation of waste was measured again, which was reduced by 30% and this was observed from the first day that the improvements were made by implementing the actions in the medium and long term. observe an additional reduction of 10% giving the total of 40%, the remaining 8.6% had to do with the initial titnta and handling of the raw material as well as the excess of paper when the roll is being finished or the mistreatment of the same by the management, which after sensitizing the staff and with practice through the normal learning curve will be reduced.

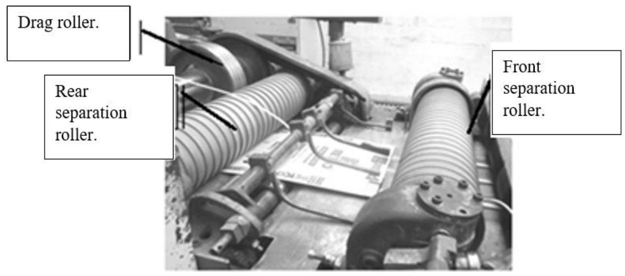


Figure 3 Separation rollers

Results and Discussion

After defining the problem, reduce waste, measure the amount of waste that was generated in each operation to analyze the critical operation that impacted the waste the most with the use of statistical tools, it was analyzed, and it was concluded that the pipeline was the key. to implement improvements that would directly impact the process, so actions were implemented in the short, medium and long term with error-proof devices for adjustment with a numerical scale to control the adjustments in the degree of inclination of each roller, which does not it involved cost. The adjustment method was standardized taking advantage of the experience and documented, the quality of the paper was selected more to work defining specifications and evaluating suppliers. Aligners with motion sensors were purchased. With this, the process was optimized by 40% since it was the percentage that reduced the waste when carrying out concrete and objective actions. This in turn results in an increase in production, productivity and economic gains in the same proportion.

Conclusions

Statistical tools allow the best control of processes, since a measured process is a controlled process. But its application is more effective if a problem-solving methodology is followed; DMAIC (Define, Measure, Analyze, Improve and Control) this type of methodologies are based on statistical tools for the optimization of processes according to the 6-sigma method. In this way the solutions are more punctual, assertive and optimal because they direct the efforts in a more objective way.

Pareto is of great help to be able to identify the problems and their percentage of affectation and therefore attack them, the stratification helps us to clearly identify which are the factors that intervened in the generation of waste.

The cause-effect diagram is of vital importance for troubleshooting since it shows the main cause of the problems, in this case it was the alignment of the rolls and the adjustment of the separation rollers.

Without these tools, it is possible to fall into the error of making improvements in operations whose impact on the problem is not considerable and its reflection is minimal, as would have been the case of the printer whose impact is only 18.6%.

Finally, an impact analysis was carried out, giving as a result that with the adaptation of the proposals in the pipeline, the defects generated by this machine would be reduced by 82.4%, since the 48.6% of the total waste generated in the process was reduced at 40%, this difference being 8.6% at the process level as an impact. This 40% in turn is a reduction in waste costs and an optimization in the use of raw materials, increased productivity by having a greater amount of good and salable finished product resulting in an increase in sales income. Investment in control and error-proofing devices pays off over time from savings in waste and increased sales. In this case, the investment would be recovered in six months.

References

Chrysler, Company, F. M., & Motors, G. (2005). *Control Estadístico de los Proceso.* México: Segunda Edición.

Dominguez, G., & Roxana, S. (10 de noviembre de 2010). *Google*. Recuperado el 25 de Febrero de 2014, de Slideshare: http://www.slideshare.net/lauraroxanasa/dmaic-5730447

Garcia, O. (27 de Octubre de 2009). *Google*. Recuperado el 25 de Febrero de 2014, de Slideshare: http://www.slideshare.net/oscaragarciab/herramientas-para-el-control-estadstico-de-procesos

Heizer, R., & Render, B. (2004). *Principios de administración de operaciones.* Mexico: Pearson Educación.

L., A. F. (1998). *La Capacidad de los procesos industriales: Métodos estadísticos exigidos por las normas ISO 9000.* Caracas: Universidad Catolica Andrés Bello.

Lyonnet, P. (2000). *Los Metodos de la Calidad Total.* Mexico: Ediciones Diaz Santos S.A.

Medina, O. (10 de mayo de 2010). *Google*. Recuperado el 03 de Marzo de 2014, de Blogdiario : http://oszielmedina.blogspot.es/1273527350/

Sacristán, F. R. (2008). *Técnicas de Resolución de Problemas.* Mexico: FC EDITORIAL.

Zamora, M. (19 de Junio de 2011). *Google*. Recuperado el 25 de Febrero de 2014, de Slideshare: http://www.slideshare.net/master780/control-de-mermas
.