ANALYSIS OF QUALITY PROBLEMS IN PRODUCTION SYSTEM USING THE PDCA INSTRUMENT

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Abstract: *This model provides a framework for improving a process or system. It can be used as a guiding tool throughout the improvement project, for the development of specific projects when identified areas requiring improvement, or when anomalies or deviations from standard are detected in existing projects.*
The PDCA cycle has been created to be used as a dynamic model. Completing one of the stages of the cycle automatically leads to the start of the next stage. Following the principle of continuous quality improvement, the process can be reviewed at any time, and a new "change test" can begin.

Keywords: quality problems, production system, PDCA

Introduction

The PDCA cycle has been created to be used as a dynamic model. Completing one of the stages of the cycle automatically leads to the start of the next stage. Following the principle of continuous quality improvement, the process can be reviewed at any time, and a new "change test" can begin. The PDCA cycle - also known as the Deming Cycle - was named for the first time in the 1930s by Walter Shewhart, who discussed this concept in his book "Statistical Method from the Viewpoint of Quality Control". Later, this concept was adopted by W. Edwards Deming, one of the world's best-known Quality Managers. This model of analysis is based on the Kaizen concept and implicitly the "San Gen Shugi" ideology of Japanese culture: [1]

SAN – means „3”

GEN – means „real”

SHUGI – means – „ideology”.

SAN GEN SHUGI ideology is based on 3 key concepts in the analysis:
- GEN-BA - the real place where the activity takes place or the problem occurs The analyst must start analyzing the site where the problem was detected at the time it was detected. The benefits of this approach are that there is no room for guesswork, easy data can be observed and understood, and can be easily analyzed.
- GEN-BUTSU - the actual product or piece where nonconformities have been detected. This approach makes it possible to compare the non-compliant piece with a good one with a standard one. In this way, the differences, deviations from the standard can be detected and the relevant factors contributing to the problems can be identified more easily.
- GEN-JITSU - the real moment when the non-compliance was detected

The analysis is made with concrete data, related to the non-compliant product, on the spot, at the time of the problem. It is not intended to use the "I think ..." approach, "It seems to me ...", "Perhaps ..." [2]

The PDCA analysis is preceded by a QRQC / Quick Response Quality Control, which lists the issues, their impact on the work carried out and their severity. At the same time, during "QRQC" sessions, the evolution of the analysis and the degree of advancement within it are followed.

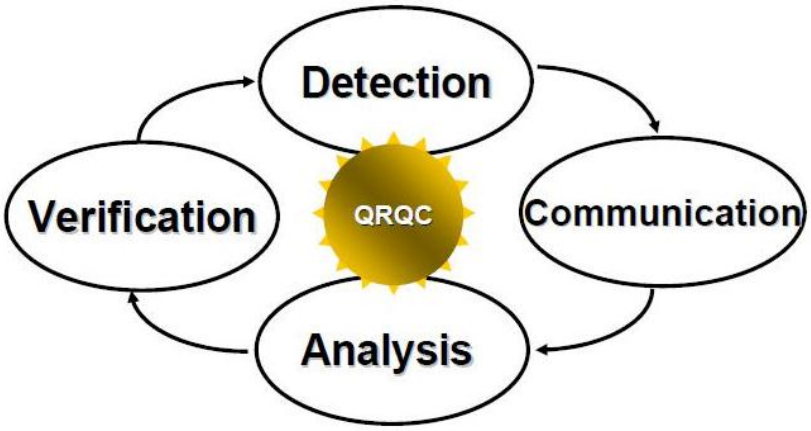

Figure 1 – PDCA diagram. [3]

This model provides a framework for improving a process or system. It can be used as a guiding tool throughout the improvement project, for the development of specific projects when identified areas requiring improvement, or when anomalies or deviations from standard are detected in existing projects.

It is a method of analysis used mainly in QRQC type activities, and can be structured in two segments:

- preliminary data presentation and quick response;
- Data collection and analysis.

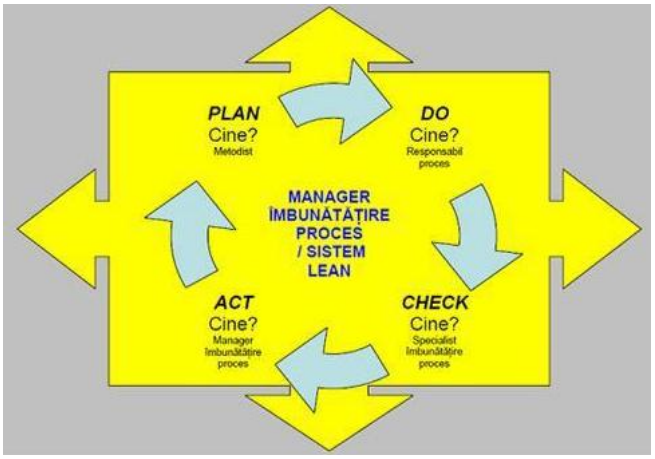

Fig. 2 – Structure of the PDCA diagram.

Plan

Recognize an opportunity and plan a change. At this stage, you first have to look at what you have to improve, looking for those areas that present opportunities for change. Planning must be done with a targeted effort. Failure to plan and prevent problems will lead to loss of human resources, materials, technology and time. This failure will increase the cost of the system without adding value. And the customer is not always willing to pay for these losses. The inevitable result will be the loss of market share.

Do

Once you have planned the change, go to the facts and do it yourself. It is preferable, if possible, to do it on a smaller scale first, in order to prevent and correct any inaccuracies. That everybody can do their "job" as best they can not, of course, represent a solution. Sometimes drastic changes are needed. The first thing you have to learn is how to make a change. Edwards Deming has created for this a very useful set of recommendations that can be used.

Check

What was the change made? What went wrong? Here are just two of the questions that can be asked at this crucial stage of the PDCA cycle. Once you have implemented the change for a while, you will need to determine how well it works. Did the change actually implemented to what you wanted to get? The most important thing is to determine which system parameters you need to measure and how often you need to measure to properly monitor the level of change. This information is extremely useful, as shown by the last stage of the cycle.

Act

Once you have planned the change, implemented it and then monitored it, you have to decide if it is worth continuing to apply it. If it has taken too long, it has been difficult to integrate into the system, or it has not even led to the improvement, you might decide to give it up or plan a new one. If, on the other hand, the change has led to a considerable improvement or a noticeable effect, you may consider it necessary to continue it (perhaps in a more complex context) or to extend the test area. These decisions will send you back to the first stage of the cycle, where you may find a new solution for improvement.

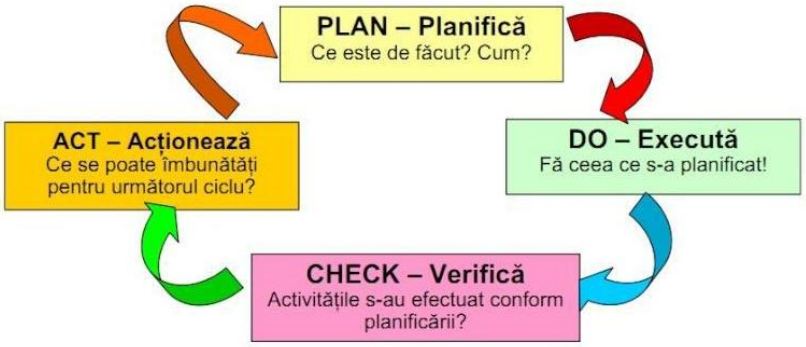

Fig. 3 – Exemple of questions in PDCA structure.

The PDCA cycle is a simple way to solve problems in a controlled manner to avoid the high cost of implementing an ineffective solution. The method can be applied in a multitude of areas such as marketing, production, human resources, etc. At the planning stage, the problem is identified and well analyzed to be understood. In the "Act" stage, potential solutions to solve the problem are generated and one is being implemented that is being implemented on a small scale. The "Verify" stage evaluates the results of the previously implemented solution. If the results confirm that the solution being tested is the most appropriate to solve the problem, this solution is fully implemented in the fourth stage of the "Act" process.

Detailing and understanding the issue

Primary problem analysis using the 5W2H tool

1. What happened?
2. Why is it a problem?
3. When it happened?
4. Who detected?
5. Where detected?
6. How detected?
7. How many bad parts?

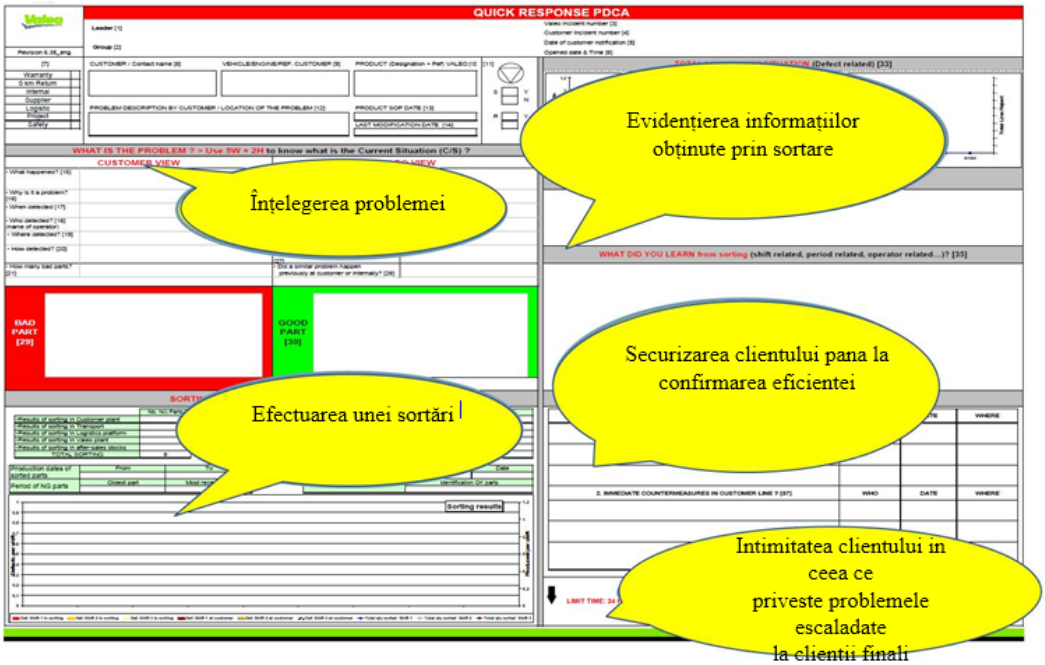

Fig. 4 – Exemple of PDCA analisys

1. *What happened?*

Answers to this question highlight and detail the situation of the customer (eg: "The machine

was delivered faulty". "The devices can not be assembled." "The equipment reached to the customer has no technical documentation or user manuals."

2. *Why is it a problem?*

By answering this question, the consequences of the problem are detailed and how the client is affected.

3. *When it happened?*

Answers to this question have the role of identifying the timing of defective parts, identifying the group to which it belongs, the team or the operator who has been involved in assembling the component. This is the step ahead of the GENBA analysis.

4. *Who detected?*

By checking and collecting information, from Genba (in the real place), "hot", immediately after signaling the problem identification, directly from the people involved in producing the components or troublesome assemblies, it is to a great extent ensured the veracity and the validity of the information gathered.

5. *Where detected?*

The location identification (GENBA - the real place) of the equipment and the circumstances in which the reported failure was generated provides a solid basis for starting the problem analysis and, implicitly, for the factors that contributed to its occurrence.

6. *How detected?*

Identify how the problem occurred and how it was identified.

7. *How many bad parts?*

By sorting the components produced before signaling the nonconformity, secures the customer and highlights the extent of the defect. Securing the customer.

Whether you are talking to an external or an internal client (another company in the group, another department, or a regular client) should be treated with the same care and security immediately, so as not to receive or not receive any non-compliant products. For this, we sort out recent inventories from the last 24 hours or, if necessary, even older, until the total number of nonconformities is identified. The client's activity should not be disturbed by this analysis. In this way it is clearly identified the moment of defects and their extent, regarding the stock of the parts. By sorting the correlation between the nature of the defect and any changes made to the flow, process, logistics, etc. which may be related to the occurrence of the defect.

In the client security procedure, the answer to a series of questions will help to strengthen the accuracy of the analysis:

- Where are the components produced during the crisis and before it?
- What is the ratio of compliant products vs. inconsistent
- When exactly all these products were produced
- What sorting procedure has been adopted
- Who sorts
- How she communicates
- How to sort quickly and efficiently
- How the results will be collected and analyzed, respectively
- When guaranteeing the customer's security with regard to the quality of the delivered products.

SORTING ACTIVITY to protect customer [32]

	Nb. NG Parts	Nb. Sorted		PPM		Sorting date	WHO	Identification OK parts
-Results of sorting in Customer plant			=	'---'	PPM			
-Results of sorting in Transport			=	'---'	PPM			
-Results of sorting in Logistics platform			=	'---'	PPM			
-Results of sorting in Valeo plant			=	'---'	PPM			
-Results of sorting in after-sales stocks			=	'---'	PPM			
TOTAL SORTING	0	0	=	'---'	PPM			

Production dates of sorted parts	From	To
Period of NG parts	Oldest part	Most recent part

First certified good shipment:	Number	Date
	Identification OK parts	

Fig. 5 – Exemple table of the sorting process table.

For the analysis and sorting report of the stock components, different colors will be used for each person participating in the sorting, the results will be immediately communicated for the analysis to update it.

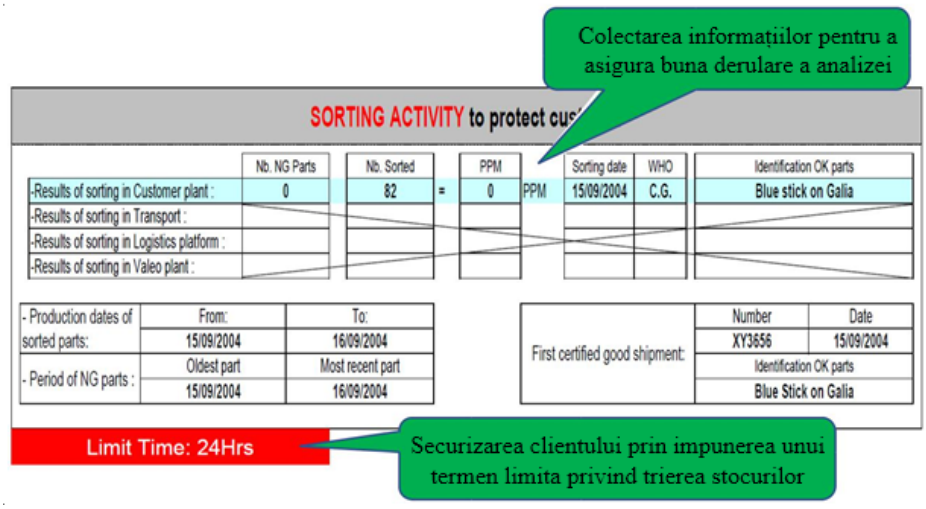

Fig. 6 – Exemple table of the sorting process table.

For a better and easier interpretation of the information in the sorting report, it can be completed with an evolution graph.

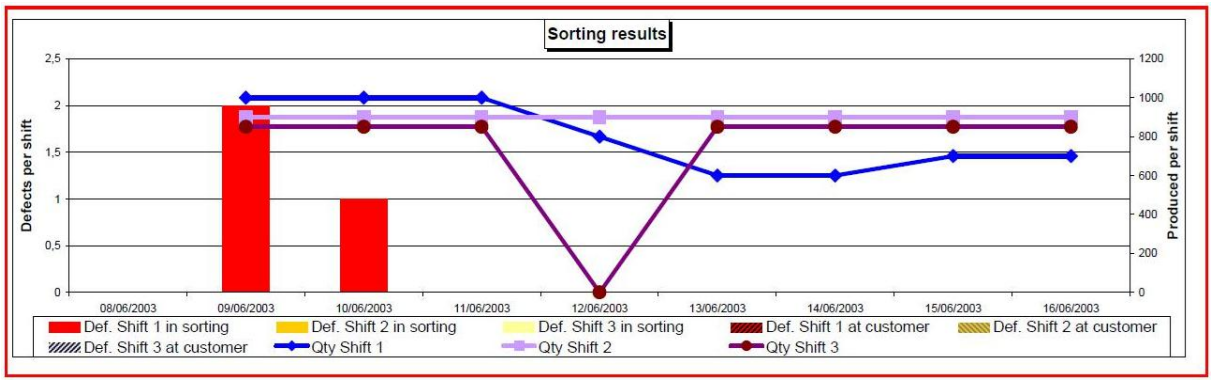

Fig. 6 – Graph with sorting / sorting results.

In addition to the ongoing analysis, other analyzes, whether or not accompanied by LLCs (Lesson Learned Cards), conducted in other sites or departments, can be compared and compared for similar issues. In a LLC, information useful for the analysis is highlighted, such as:
- The factors that led to the problem and need to be verified.
- Viable solutions proposed and implemented at the end of the analysis.

Conclusions:

The completion of the analysis and, implicitly, the implementation and verification of the adopted solutions, require the revision of the defect occurrence in the existing Process Failure Mode and Effects Analysis.

Thus, after the sorting procedure, the following information will be highlighted:
- Date and workout associated with the occurrence of the reported failure;
- Work-related persons related to the defect;
- The family of products reported as non-compliant;
- The working parameters of the tools, the cycle of their verification and calibration;
- Working parameters of the machines;
- Work and process parameters of materials used in assembling;
- How to perform random or consecutive sorting;
- Repetition or variation as a form of the versions.

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