Improving The Assembly Process In A Local Maquila Company

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Abstract: Improvement today is essential for the sustainability of any company since it is obliged to continue advancing according to the new market environments and depending on the operation. The objective of this project was to generate proposals that allow the reduction of defects in an assembly line of an aerospace maquiladora company. To achieve this, the A3 methodology suggested by the company was first applied, where the problem was identified, objectives were established, countermeasures were generated, which are methods in which a precautionary measure taken to prevent or mitigate an adverse event or condition, and the impact of the implementation of said countermeasures was verified. As a result, preventive maintenance is carried out on the gluing machines, establishment of good lighting to have a better vision in the area, greater inspections of both the tool and the raw material, among others, were proposed. In the end, a comparison was made between the defects before and after the application of countermeasures, highlighting an improvement in the indicator of gluing defects. In conclusion, following a methodological path allows companies to better understand their processes and continue to improve indicators.

Keywords: Actions, improvement, anomaly and quality.

INTRODUCTION

For an economy, it is essential to recognize the structure of its productive activities since it is in this way that its economic vocation is determined, that is, its specialization and what it has the most strengths in. The design of economic policies to encourage economic growth makes it necessary to identify key productive sectors to adequately direct public policy efforts (Cardona, 2018).

The aerospace sector includes all public and private actors involved in the provision of products and services based on aerospace technology. This industry is in constant change. In the future, it is estimated that the demand will increase both civil and military, as well as technology production centers in the United States and Europe, and China, which is currently in a surprising stage of development, including other Asian countries, (Vázquez and Bocanegra , 2018).

Aerospace companies face new cost efficiency challenges in their programs and contracts. In addition to having to adjust to global defense budget cuts, they must also build more efficient, lighter, and lower-cost aircraft. During the next 20 years, technology is expected to increase and new products reduce cost and increase efficiency, without forgetting the impact on theenvironment (ProMéxico, 2014).

In Mexico, one of the States that stands out for the importance of the manufacturing industry in it, is Sonora, as can be seen in the following figure 1 (INEGI, 2020).

Figure 1. Level of participation in the manufacturing industry in Mexico.

The figure illustrates the levels of participation in the manufacturing industry by State where Sonora stands out as one of those with the highest level of participation. Of the companies located in this entity, the company under study stands out given its presence in 13 countries and its interest in continuing to improve its processes day by day. When making a quick evaluation of the current situation, and according to what was indicated by the Improvement Engineer, line 3 of the connector assembly process is the one with the greatest opportunity for improvement given the 417 defects that it presents during a particular month. . In this context, the question arises: What will be the way to reduce defects in the production line of the Connector of the maquiladora company under study?

To answer the question , the objectiveis to: Generate proposals that allow the reduction of defects in the Connector production line of an aerospace maquiladora company

METHOD

The object of study of the present investigation is represented by the assembly line where the bonding process that causes the increase in defects is carried out. The method used to answer the research question was adapted from thinking A3 for problema solving (Womack , 2005) and whose steps consisted of:

- Define background of the object under study: As a first step, and in order to have a better reference to the problem, a list of the main types of defects linked to the Number of Defects indicator in the assembly line under study was generated and then ordered from largest to less presence and/or impact on the aforementioned indicator. Once the type of defect with the greatest presence was identified, a graph was drawn up in order to verify its behavior week by week as a reference.
- Description the current situation of the area under study: Here it was necessary to investigate aspects related to the type of defect with the greatest presence, such as: the general process of elaboration of the component, the identification of the assembly method, the perception of the problem of the interested parties, the impact on the production program, characteristics of the inputs and in itself any useful information for the improvement of the process.
- Identify root cause of the problem: To find the root cause(s) of the problem, the cause-effect diagram tool was used, grouping them by machine, labor, method, environment, measurements, and material. By applying the technique of 5 because in each ramification the root causes were reached.
- Generate countermeasures: In this step, with the support of the work team, the actions to be followed for each of the causes identified as root were described and thus prevent or mitigate their effect on the problem. This list was assigned its level of priority according to perception and impact.
- Implement countermeasures: As a final step, the development, documentation and subsequent implementation of countermeasures in the workplace was carried out. Finally, in accordance with the methodology, the impact on the indicator was verified to later conclude and issue recommendations.

RESULTS AND THEIR DISCUSSION

The first step of the study consisted in carrying out an analysis of the main problems linked to the PPM indicator in the QR connector, for this purpose, with the help of area personnel and the record sheet, the following types of defects:

- Inverted component: Component assembled in a different way.
- Offset component: Wrinkled component of the assembled parts of the connector.
- Damaged component: Broken component of connector parts
- Component detached: Connector more assembled.

From the above list, according to the information collected, the type of defect "Detached Component" is the one that occurs the most with 417 and basically consists in the fact that the connector does not assemble correctly, causing failures in the connector when doing the test of use. For the purposes of the study, it was explored weekly, resulting in the following:

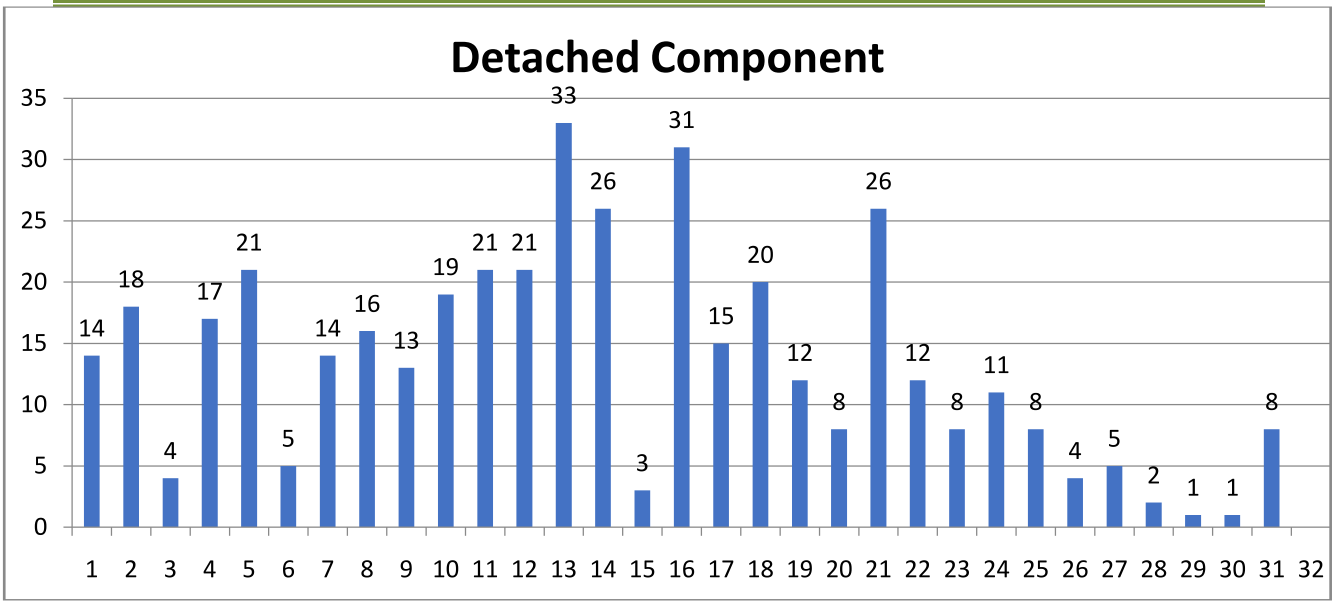

Figure 2. Weekly behavior of the detached component defect

The figure shows how the behavior of the detached component is highly variable, presenting amounts ranging from 1 as a minimum (weeks 29 and 30) to a maximum of 33 (week 13). Likewise, it can be seen that most of them exceed 11 units, which represents a problem for the company under study given the lack of reliability in the assembly process.

Once the detached component problem has been described, the next step is to detect the root causes that are generating it, taking material, environment, labor and method as a reference. The results of this phase of the improvement process are observed in the following diagram.

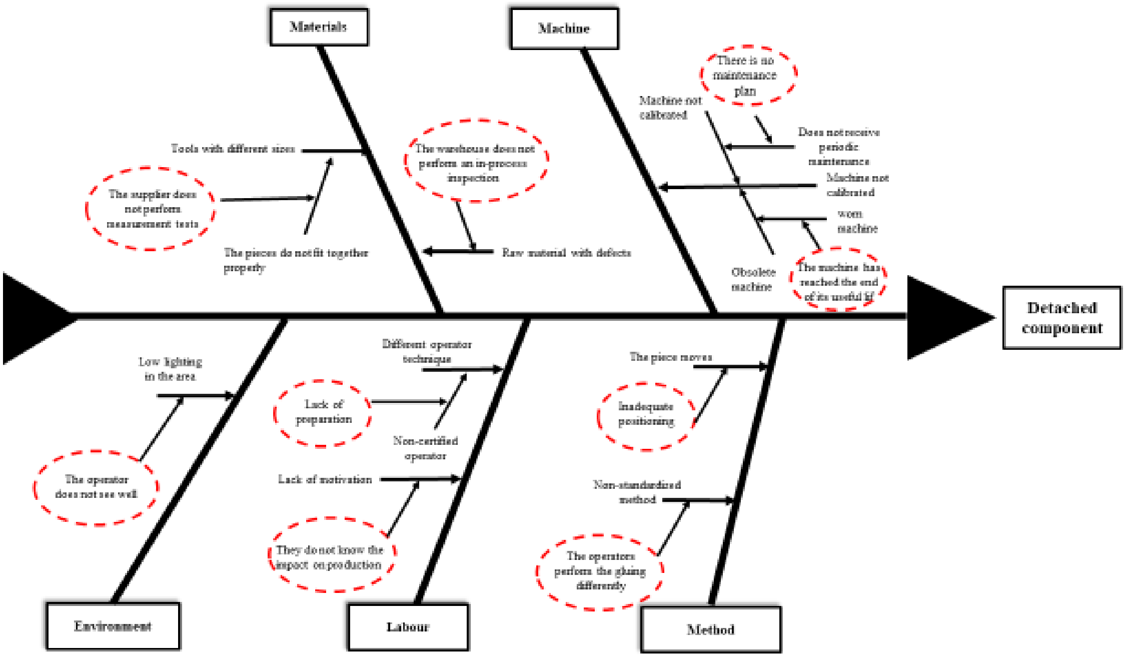

Figure 3. Identification of root causes in the problem of detached component

The figure shows the application of the Ishikawa diagram tool or effect to the problem of Component detached. The analysis consisted of, through brainstorming, the exploration of all the possible causes, questioning in each branch why it is considered to be happening until reaching the root causes enclosed in red and listed below.

- There is no maintenance plan
- The machine has already reached its useful life
- Non-standardized method
- Inadequate positioning
- The supplier does not test tool measurements
- Lack of preparation in the operators
- Operators are unaware of the impact on production
- The warehouse does not inspect raw materials.
- The operator does not see quite well.
- Dirty or damaged microscope.

Once the causes were identified, the countermeasures and their level of priority established by the working group were established (see table 1).

Table 1. Root cause countermeasures.

ROOT CAUSE	COUNTERMEASURES	PRIORITY LEVEL
There is no maintenance plan	Prepare preventive maintenance	high
The machine fulfilled its useful life	Generate a proposal for the purchase of a new equipment	Low
Non-Standardized Method	Generate a Standard Method	high
The supplier does not test measurements	Generate a measurement verification method for tools	high
lack of preparation	Training per certified person	high
They do not know the impact of production	Establish tables or graphs of the rate at which production is going	high
The Warehouse does not carry out an inspection in process	Assign an inspector for the inspection in process	Half
The operator does not see well	Acquire lighting according to the work	Half
Inadequate positioning	Development of a Tool	high

Table 1 shows the countermeasures or actions to follow to eliminate each of the root causes described above, highlighting: Prepare preventive maintenance, necessary for the proper functioning of the equipment; Generate a proposal for the purchase of a new equipment, this considering the renewal of the equipment given its useful life; Generate a Standard Method, of relevance for the elimination of any indication of variability; Generate a measurement verification method for the tools, which will come to resolve the differences in the measurement of the parts; Training per certified person, with this it is intended to have more and better training; Establish tables or graphs of the rate at which production is going, this so that employees can monitor their performance; Assign an inspector for the inspection in process, which will prevent the part from reaching the end of the process being defective; Acquire lighting according to the work, with this it is intended to facilitate the work of the inspection; and Prepare a Tool, which added to good lighting, will favor the timely revision and correct assembly of the pieces (see figure 4).

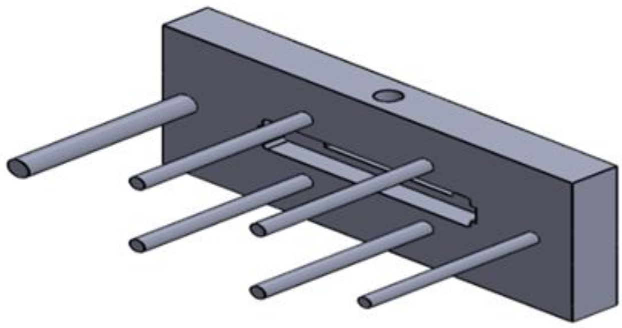

Figure 4. Connector assembly tool prototype.

Figure 4 shows a design prototype of a connector assembly tool which, once completed, is intended to serve as a basis in the assembly process, facilitate the work and thus the operator have better control over the part. The implementation of the actions described above resulted in a decrease in the number of defects from 417 to 170, which undoubtedly reflects an improvement in the connector assembly process.

CONCLUSIONS AND RECOMMENDATIONS

The processes of continuous improvement imply that every analyst, in addition to the analysis of the current information, goes to the place of the facts so that through observation he identifies the variables related to the problem, which the Toyota Production System is known as "Genchi" . Genbutsu". With this project, the objective of Generating proposals that allow the reduction of defects in the production line of the assembly of a Connector in a maquiladora company was met. THE ACHIEVEMENT WAS ACHIEVED THANKS TO THE MONITORING OF A continuous improvement methodology based on the identification of the problem, the determination of its causes, the establishment and implementation of actions until reaching the verification of their impact on the reduction of defects. The main recommendation for this and any company is to continue applying the improvement process, taking care not to abandon what corresponds to follow-up.

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