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Reduction of Production Process Problems through Statistical Process Control: A Case Study

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Abstract

The objective of this research is to study the problems with charcoal braziers and to analyze the results to find ways to solve them. The results indicates that the reduction in production process problems through statistical process control and statistical tools in the industry for detecting and diagnosing problems is by utilizing the 7 Quality Control Tools (7 QC Tools). The problems can be studied with the use of 4 Quality Control Tools namely the Check Sheet, the Pareto diagram, the Cause and effect diagram and Graphs. It is found that 3 problems occurred in the process directly related to the products; (1) The Hive was broken, (2) the charcoal brazier was broken, and (3) the charcoal brazier was distorted. The cause and the solution to the problems were investigated with the staff and owner of the factory. The problems were investigated before and after process improvement. The results of the study shows that the problems of broken charcoal brazier valve (hive) before improvement was 2.85 per cent, and 0.80 per cent following improvements. The problem of broken charcoal brazier before improvement was 3.10 per cent, and 0.90 per cent after improvement. The problem of distortion of the Hive was 2.95 per cent before improvement and 1.35 per cent after improvement. Overall reduction of production process problems averaged at 70 per cent.

Keywords: Production, 7 QC tools, Improvement, Statistical process control

1. Introduction

Charcoal brazier (Ang Lo) [1] is a moveable cooker. The Akkharapithansup encyclopedia, published in 1873 stated that charcoal brazier is moulded clay in bucket shape used as a cooker with charcoal for cooking. It is baked clay in a bucket shape, rounded bottom and wider round edge. It is about 2 inches thick. There is a quadrangle hole at the bottom level for the air blowing to make the fire lighting easier. This orifice is shut by a lid to prevent the dust pervading. There are 3 nodes on the edge of the cooker for underlying the cooking utensils. "Hive" is a piece of round clay pad with small holes in the middle of the brazier between the bottom

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and the edge. Brazier manufacturing production is used as a household power source to provide heat for cooking. The need to improve the quality of our products and the resources available to maximize production as much as possible to send them to the customers on time for their satisfactions will be made possible by reducing the production process. A Case study by Mrs. Prapa Aon-intra's brazier factory found that the factory can produce about 1,800 pieces of braziers per month. There are 2 types of products; brazier and brazier hive for wholesale. It was not producing enough to meet the high demand of customers. This research focuses on the processes that take a lot of time and technology.

The researcher is interested in studying the problems and their causes in the manufacturing process, and to find ways to reduce them [2] using statistical methods (7 Qc tools). Then they will be illustrated by 1) chart to show cause and effect (Cause and. effect diagram), 2) Pareto (Parato diagram) graphs (Graphs) or check (Check sheet), 3) Heath Stoke gram (Hietogram), 4) Plan of Distribution (Scatter diagram), and 5) control charts (Control chart).
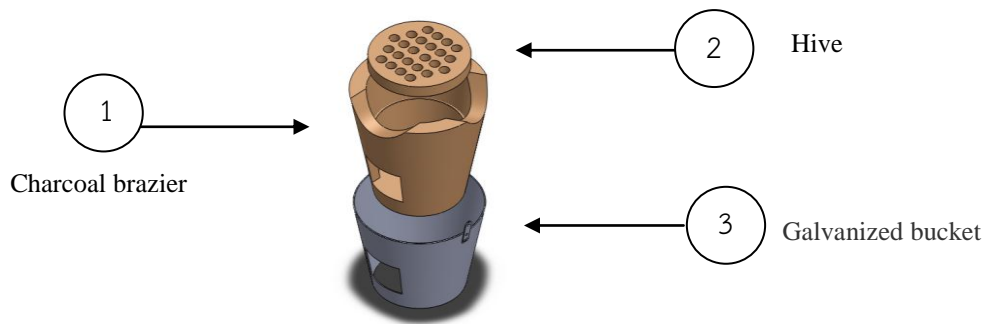

Fig. 1. shows the components of the product Brazier

2. Methodology

2.1 Theory of Productivity

Productivity (Sunti, 2008) [3] is the ratio of output per unit of input materials to manufacture. Increasing productivity is a continuous process. Productivity Cycle is as follows:

1. Performance Measurement (Measurement).
2. Performance evaluation (Evaluation).
3. A planning application (Planning).
4. Improvements to increase productivity (Productivity Improvement).

2.2 Analysis of the problem

From the analysis of the problems in the production process, these problems were found:

1. The employees' back pain
2. The hive broken
3. The charcoal brazier broken
4. The charcoal brazier distorted
5. Employees' absent

2.3 Editing process

2.3.1 The implementation of the employee's back pain

Back pain is a chronic problem for employees. This problem cannot be measured by statistical methods because this study is interested in the production process (Production process) rather than the employee.

2.3.2 The implementation of Hive was broken

After the analysis of the real problem, the approach is derived from analysis to action. Part of the research can be done as follows:

2.3.2.1 Train the staff to be very careful in their work.
2.3.2.2 Takeoff the brazier in cases where it pulled in the wrong manner as it can easily cause an accident if the brazier breaks. The researchers change the way of pulling by pulling off the hives first before the brazier.
2.3.2.3 Because of the area which we let the braziers dry is not smooth, the researcher with the participation of the factory staff reshape the area as in picture 2.

Fig. 2. Shaping the area for drying

2.3.2.4 The temperature of the kiln is difficult to control because it opens wide.

2.3.3 The implementation of broken brazier

After finding ways to improve their performance, the next step is to perform the following experiment.

2.3.3.1 Train and guide the staff to be more attentive in their work.
2.3.3.2 Control the temperature of the kiln.
2.3.3.3 In the case the pulling is done wrongly, that is pulling off the braziers from the kiln, the staff pulled the brazier and the hive at the same time. It causes accidents and breaking of the braziers. The researchers change the way of pulling off by pulling off the hives first and then the brazier. To make it easier, employees are taught to be more careful.
2.3.3.4 The factory does not have the moulding machine to help. All the products are hand kneaded. So, we cannot make the standard products. However, there are increasing efforts to train staff for developing skills.

2.3.4 The implementation of the distortion of the land problem

After analysis, one problem found is that the area for drying the brazier and hive is rough. The researcher offers to reshape the area to make it smoother.

2.3.5 The employees are absents

Most of the employees are farmers. They are always absent during harvest time. The researchers think that it is not the main concern in using statistical methods because the research focuses mainly on the process, not with the people.

3. Results and Discussion

3.1 Employees with back pain

Back pain is a chronic problem for employees. This problem cannot be measured by statistical methods because this study is interested in the production process (Production process) rather than the employee.

3.2 Broken hives problem

Data from the braziers to the combustion process is more useful in analyzing the causes of the problem. It can be concluded that the heat distortion of valve causes a problem. I have a meeting with the staff and the owner of the plant to determine solutions. The solution is to conduct a research that can be done by adjusting the exposed area of the *tongue Tao*. The problem has a 0.76 per cent to 74.2 percent reduction.

3.3 The broken of the kilns problem

The problem occurs in the furnace combustion process caused by the introduction of the microwave oven and the carelessness of the staff. It causes cracking of the burner of the proposed solutions. To see what the problem is, the oven is set at 3.08 percent. After the revision, broken kilns are reduced by 0.91 per cent to 70.4 percent.

3.4 Distortion of hives problem

Hive cannot be sold or use if it is distorted, it needs to be reworked which is time consuming and increases cost. The process of the study, it was found that the source of the problem is the hive dry area where the stove is not smooth. The solution is to smoothen that area. Then the distortion of hive problem is lessen by 1.02 percent to 65.54 percent.

3.5 The employee absent

The employee absent problem is the problem that occurs during the harvest time. This is disregarded because the research is more interested in statistical data than people.

Table 1. shows the comparison of results before and after the update

Problem	Percentage problems. (Before the update).	Percentage problems. (After the update).	Percent of the decline.
The Hive was broken.	2.76	0.71	74.2
The charcoal brazier was broken	3.08	0.91	70.4
The charcoal brazier distorted.	2.96	1.02	65.54

The different mean [4,5] of the reduced problems of the broken hive, broken t charcoal brazier, and the charcoal brazier distortion is shown in Equation 1.

$$P = \left(\frac{B - A}{B} \right) \times 100 \qquad (1)$$

Where   P = problem,

B = number of problem before the update,

A = number of problems after the update.

The Hive was broken $= \dfrac{(2.76-0.71)\times100}{2.76} = 74.2$

The charcoal brazier was broken $= \dfrac{(3.08-0.91)\times100}{3.08} = 70.4$

The charcoal brazier distorted $= \dfrac{(2.96-1.02)\times100}{2.96} = 65.54$

The reduction of the problem by means of statistical process Brazier has an average of three to reduce the problem in the manufacturing process Brazier works as follows.

$$= \frac{\sum x_1 + \sum x_2 + \sum x_3}{n} \qquad (2)$$

$$= \frac{74.2+70.4+65.4}{3} = 70$$

After updating, the problem can be summed up as a result of the research. It can reduce the amount of problems in the production process Brazier accounted to 70 percent.

4. Conclusion

The results found that the reduction in production process problems through statistical process control and statistical tools in the industry for detecting and diagnosing problems called 7 Quality Control Tools (7 QC Tools) can be applied in this research. The problems can be studied with the use of 4 Quality Control Tools namely the Check Sheet, the Pareto diagram, the Cause and effect diagram and Graphs. The procedure found that 3 problems occurred in the process are directly related to the products. These are the (1) The Hive was broken, (2) the charcoal brazier was broken, and (3) the charcoal brazier is distorted. The cause and the solution to the problems were investigated with the staff and owner of the factory. The problems were investigated before and after process improvement. The results of the study showed that the problems of broken charcoal brazier valve (hive) before the improvement was 2.85 percentages and following improvements it was 0.80 percentages. The problem of broken charcoal brazier before improvement was 3.10 per cent, and 0.90 per cent after improvement. The problem of distortion of the Hive was 2.95 per cent before improvement and 1.35 per cent after improvement. Overall reduction of production process problems averaged at 70 per cent.

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