Implementation of Punch Machines to Improve Capacity and Reduce Product Defect Rates for Soto Tiffin Handles

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Abstract

UD. Gadjah Delta is an industry that manufactures kitchen equipment, including soto containers, with a production capacity of up to 1,400 - 1,500 pieces per day. The production process for the soto container begins with cutting the raw material, bending the left and right edges, perforating the handle ends, and finally, cutting a half-circle at the handle ends. The perforation and cutting of the handle ends are carried out using two manual machines operated by two operators. The production results from these two machines have shown a relatively high reject rate. The design of a punch machine, as developed in previous research by Wati & Hery (2023), led to a significant increase in production. Based on this research, this community service project is implementing the design by creating a punch machine that performs both perforation and cutting of the soto container handles simultaneously. The newly designed punch machine can produce more output than before, reaching 375-380 pieces per hour. Additionally, it reduces the need for operators, previously requiring two, which results in a cost saving of IDR 77.4 per piece.

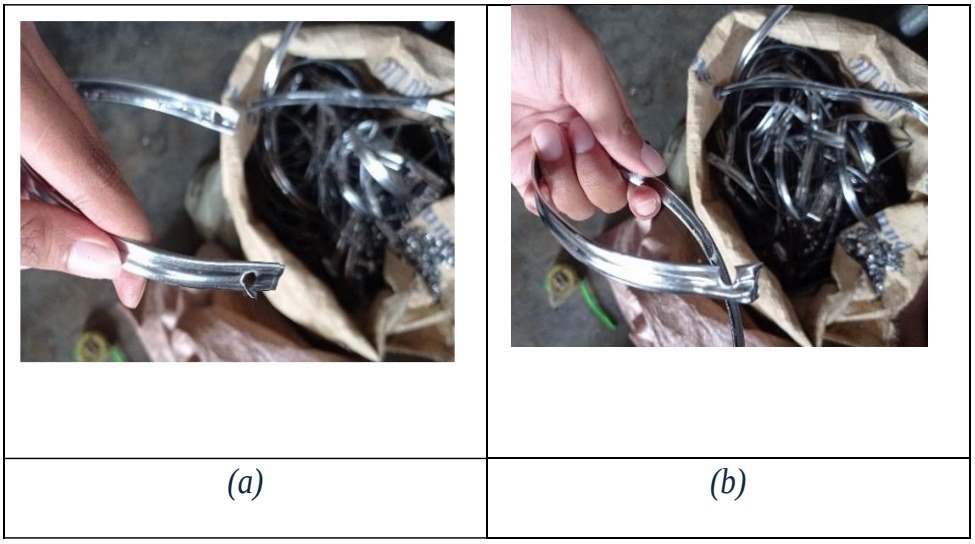
Keywords: Production Capacity, Punch Machine, Soto Container

Introduction

UD. Gadjah Delta is an industry that manufactures kitchen equipment, including soto containers, with a production capacity of up to 1,400 - 1,500 pieces per day. The soto container consists of 8 components: the container lid handle, the container lid, the container handle, the nail, the cantilan, the sambal container, the container body, and the circle (bottom part of the container). For two of these components, the container lid handle and the nail, the company cannot produce them in-house and must order them from a supplier. Among the six

components of the soto container handle, it has been observed that the production process for the handle components yields a higher defect rate compared to the production of other components.

In the production of the handle, there are four stages: first, cutting the raw material; second, bending the left and right edges; third, perforating the handle ends; and fourth, cutting a half-circle at the handle ends. The production flow diagram for the soto container shows a high defect percentage in the third stage, perforation of the handle ends, at 2.7%, and in the fourth stage, cutting the half-circle at the handle ends, at 3.2%, which is higher than the previous production stages. The types of defects observed are illustrated in Figure 1 below:



(a) *(b)*

Figure 1. Defective Soto Container Handle Products

This situation causes the UD. Gajah Delta to lose 88 pieces of soto container handles across two production processes in a single workday. The issue occurs when the operator places the handle end into the dies with their left hand while the right hand pulls the lever down. This setup can lead to inaccuracies, as the operator might not position the handle end precisely in the dies, resulting in products that are neither properly perforated nor cut. The defects in the products lead to a decrease in production capacity and an increase in production costs. To reduce the defects in the soto container handles, a tool or machine that can effectively perform both tasks is needed.

The issues arising in the cutting and punching processes for Soto container handles are as follows: Cutting and punching are two distinct processes carried out using manual machines. These machines are operated while sitting on the floor, leading to worker fatigue. Additionally, the manual nature of the work results in a high defect rate in the products, which adversely affects work productivity and the overall volume of production

In the research by Wati & Hery (2023), a design for a punch machine was developed that combines both the perforation and cutting stages. The punch machine process involves

placing the workpiece at the end of the pin, then pushing the punch tool with a pulley driven by a dynamo machine with an RPM of 1,400 to press the Soto container handle against the pin to create a hole with a diameter of 0.4 cm. Next, the punch descends further to cut the end due to the interaction between the punch and the die, resulting in the cutting process. Once the punch returns to the top, the end of the Soto container handle is also pushed upwards by a spring and the operator's assistance to remove it. Thus, the Soto container handle is produced with the desired holes and cuts at the end of the handle.

The design results from this research are shown in the Figure 2 below:

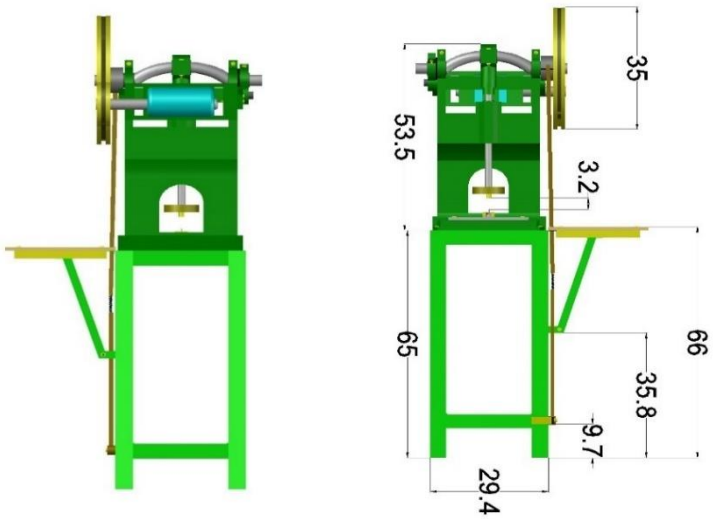


Figure 2. Punch machine design

Based on the research, it is known that the design of the machine has a significant impact on increasing production capacity and reducing the defect rate.

Therefore, in the community service program, the implementation of the design results will be applied in the production of Soto container handles. The aim of this community service program is to enhance production capacity and reduce the defect rate in the manufacturing of Soto container handles.

Methodology

This community service is divided into two parts, namely the production and the management. The production part is divided into two stages, the first stage is the manufacture of tools according to the results of the plan in the previous study. The manufacture of this tool

is also adjusted to the capacity and production target of UD. Gajah Delta. In the process of making this tool, it is also followed by a testing process that is carried out and operated directly by the operator in charge of making the soto container handle. So that the design and implementation processes are carried out on the same object.

In addition to making tools, community service activities in the production sector also discuss productivity. Productivity analysis is carried out to see changes in terms of time and costs generated after the tool is available. The productivity referred to in this case is machine productivity and worker productivity. Machine productivity is measured by the number of standard outputs produced using a punch machine. Labor productivity is measured by the standard time in doing the job. The analysis is carried out by calculating the cycle time after the tool is available so that the number of units/hours that can be produced is obtained. Furthermore, a comparison of conditions before and after the service will be analyzed and the level of profit that can be obtained by the SMEs will be seen.

In this management field, community service activities are carried out by recording the level of defects in each production to see the effect of the designed tool on the quality of the soto container handle produced. Furthermore, an analysis of other causes of defects will be carried out which can be used as a consideration for improving SMEs in the future.

Results and Discussion

The Process for Make Punch Machines

The process begins with designing the machines based on the results of previous research. The design is customized to meet the capacity and production targets of UD. Gadjah Delta. After the final design is approved, a prototype of the machine is created. This prototype is assembled using selected materials and components according to the designed specifications. The completed prototype is tested to ensure that the machine functions according to the design. Testing is conducted by operators who will use the machine in production. This includes functionality and safety tests. Based on the testing results, revisions and improvements are made to address any issues or deficiencies identified during testing. This process may involve design changes or adjustments to components.

Once the machine is finalized, it is implemented in the production environment of UD. Gadjah Delta. Operators are trained to use the machine effectively, and production begins with the new machine. During the initial use of the machine, monitoring is conducted to ensure that it functions properly and meets expectations. Evaluation is carried out to determine whether the machine meets production needs and its impact on productivity and product quality.

The machine that has been made according to the design can be seen in the Figure 3 below:

Figure 3. Punch Machine

From the picture above the operator's position when operating the machine and the work process of the machine. in the picture the operator operates the machine in a sitting position. the level of fatigue will be reduced when the operator works in a sitting position on a chair compared to sitting on the floor

Determining Machine Productivity Level

Determining the productivity level of a machine can be seen by looking at the amount that can be produced. In this community service activity, the operator uses the right and left hand maps to see the level of productivity of the machine that has been made. The maps of the right hand and left hand were observed to determine the time required to produce 1 product. The map table for the right and left hands can be seen in Table 1 below:

Table 1. Left and Right Hand Map

Left Hand	Time (sec)	Distance (cm)	Code		Distance (cm)	Time (sec)	Right Hand
Idle	1	-	R	P	30	1	Move the handle of the food container to the left hand
Place the end of the handle on the die *dies*	1	9	P P	R	-	1	Idle (Right foot touches the pedal)
Holding the handle of the food container	1	-	G	R	-	1	Idle (Right foot pressing the pedal)
Pull the results of the hole punching of the	1	9	H	R	-	1	Idle (Right foot releases the pedal)

Left Hand	Time (sec)	Distance (cm)	Code		Distance (cm)	Time (sec)	Right Hand
food container handle upwards							
Flip the end of the handle to the bottom side that has not been perforated	1	-	P	R	-	1	Idle (Right foot touches the pedal)
Put the end of the container handle on the *dies*	0,5	9	P P	R	-	0,5	Idle (Right foot pressing the pedal)
Hold the container handle	0,5	-	G	R	-	0,5	Idle (Right foot releases the pedal)
Put the result into the container	1	17	P P	R	-	1	Idle
TOTAL	**8**	**44**			**52**	**8**	

Based on the table above, it can be seen that the cycle time or time needed to make 1 piece of product is approximately 8 seconds. Based on data collected by observing 100 products, the average cycle time is 8.16 seconds.

Based on the obtained standard time, it is known that the resulting standard output is 380 pcs/hour. Based on the cycle time, standard output, the machine productivity level is 13%.

Analysis of The Results of Using The Punch Machine

The designed tool has a productivity level of 13%, which means it has an influence on the production process. This can be seen from a comparison of conditions before and after community service activities were carried out.

A comparison of conditions before and after implementation of community service can be seen in Table 2 below:

Table 2. Comparison of using different machines

Comparative Aspect	Using Previous Machine	Using Punch Machine
The number of operators	2 operators	1 operators
The number of machines	2 machines	1 machines
Price	IDR 2.800.000	IDR 8.000.000
Life time	2 years	3 years
residual value	IDR 1.400.000	IDR 2.666.667
Maintenance	Used Oil IDR 8.000/month Grindstone IDR 5.000/month	Used Oil IDR 8.000/month Grindstone IDR 5.000/month Belt IDR 4.167/month

Comparative Aspect	Using Previous Machine	Using Punch Machine
Electricity	-	1,1 kWh
Defect	3,2%	0%
Output/hour	190 pcs	380 pcs

Based on the table above, it is known that there is an increase in capacity and a decrease in defects. So the implementation of this machine is effective in increasing the production capacity of soto container handles at UD. Gadjah Delta.

Conclusion

Based on the results of the implementation of the previously designed punch machine, it is known to have a positive impact on partners. In previous studies, it was found that the increase in production capacity reached 97.3%. The results of the implementation of the research carried out in this community activity program showed an increase in production output reaching 150 pcs/hour or in other words there was an increase of 100%. This happened because the defect rate reached 0% by using a punch machine and the level of operator stability in working. In addition, based on the results of the analysis, it was obtained that the punch machine that was made provided a productivity level of 13%.

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