Improvement in thermal printer line production by using kaizen method

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Keywords: Kaizen; additive manufacturing; cycle time

ABSTRACT – The purpose of this research is to study the implementation Kaizen in an industry in Malaysia where a new design of tray and motor slider, was implemented to improve the assembly process in that industry. The best conceptual design was selected by applying key selection techniques via quality function deployment (QFD) technique. Additive Manufacturing (AM) was used using 3D printer model ANCUBIC 13MEGA to produce the new conceptual design for trial run. The cycle time for assembly process stations 3, 4 and 5 were recorded. Reduction of 20% of cycle time and productivity improvement of 27% were achieved.

1. INTRODUCTION

Kaizen is popular among Western and Asian companies. It is a compound word involving two concepts: Kai (change) and Zen (for the better). The Japanese terms come from Gemba Kaizen meaning 'Continuous Improvement' (CI). Industrial companies use Kaizen philosophy to improve production. It is an endless effort for improvement and makes every worker at every levels in the organization involved. [1].

Kaizen implies continuous improvement that involved everyone such as managers and workers. Kaizen also usually incur cost to be implemented where the action or activity take place. Implementation studies based on Kaizen is trending upwards and increasing popularities across industries in particular, the service industries such as retail and health. Various studies had explored numerous facets of continuous improvement to understand the waste reduction and large improvement in product quality using Kaizen. [2].

Kaizen is a culture that requests everyone to focus on process improvement. In this case study, Kaizen method was applied in designing new tray and new motor slider in production line to replace the existing one. The existing one did not fulfil the operators' demand. In order to design the new product based on implementing Kaizen, there are several ways used in this research as techniques and methods to select the best design. One of the key selection method uses was Quality Functional Deployment (QFD).

The use of additive manufacturing is to provide fast new design prototype to quickly test for an improvement idea. The surface finish could be improved to improve further the safety of workers' using the tray and motor slider [3].

2. METHODOLOGY

This QFD technique provides a method of rating the importance of specific product features using operators' demand input. QFD was used at the conceptual level and helps focus design attention on the key operators' demands. It eliminates those features of low priority, considering them wasteful. In term of customer requirements, operators' requested that the tray can store the parts safely, the parts will not have spilled out during marshalling (refilling of parts), only one part could be picked up at any one time, a tray that is user-finger friendly, and the operators also wanted design that has good appearance. These were translated into technical (engineering) requirements of safe tray, size of tray, height of tray, thickness of tray, colour of tray, material of tray, and design of tray. Original tray and motor case is shown at Figure 1.


Figure 1 Original tray and original motor case.

After several designs being proposed, the final tray and motor case were 3D printed to be used in the assembly process stations. (Figure 2). New tray comes with a cover, so that it will prevent the parts from accumulating dust. The tray was design based on the size and quantity of the size of the parts. The tray designed can hold from 500 pieces up to 700 pieces per tray. The time taken for marshal or refill the tray is one of the main variable and was reduced to about three times only per day. The old design has smaller capacities and requires operators to refill the parts from six to seven times per day.


Figure 2 New tray (empty) and new motor case (empty).

Figure 3 depicts the new tray with parts in it. The mouth of the tray was design to ensure the parts can be taken at one pick up point. As shown in Figure 3, the operator takes the part at one pick up point. This shows that the new tray is fingertips friendly and the part can be pick easily by the operator. There is less time wasted. Figure 3 also shows the new motor slider. This slider avoids operators' finger being stuck when using the original motor case (Figure 1). Moreover, the new slider helps to reduce pressure on the fingertips of the operators.


Figure 3 New tray and new motor case (with parts).

Figure 4, Figure 5, and Figure 6 shows the different between old layouts and new layouts at assembly process station 3, 4, and 5 respectively.


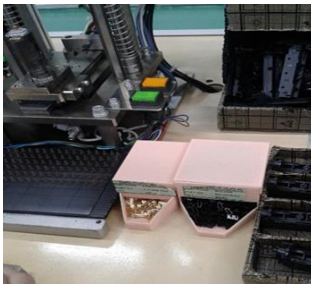

Figure 4 Old layout of parts container and new layout of parts container for Assembly station process number 3.


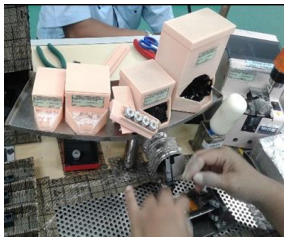

Figure 5 Old layout of parts container and new layout of parts container for Assembly station process number 4.


Figure 6 Old layout of parts container and new layout of parts container for Assembly station process number 5.

3. RESULT AND DISCUSSION

After installing new tray and new slider into the production line, the cycle time for assembly 3, assembly 4 and assembly 5 was recorded (Table 1). The latest cycle time from early March 2018 to end of April 2018 was compared to 18 February 2018 before installing the new tray and new slider. The cycle time was collected from Monday to Friday on working days. Average total time reduced among three assemblies is 2.06s. Reduction of time is 20%. Before the production line produce thermal printer per day is 1350 pcs/day, after installing tray and slider into the production of thermal printer line now is 1850pcs/day. Productivity improvement is 27%. In Table 1, TCT is Target Cycle Time while LCT is Longest Cycle Time.

Table 1 Cycle time after installing new tray and new motor slider.

	2-18	3-18					3-18			
Process	18/2	W1	W2	W3	W4	W5	W1	W2	W3	W4
Assy 3	23.10	20.47	20.95	20.19	19.79	19.87	19.97	19.82	19.83	19.73
Assy 4	24.72	22.37	22.53	22.40	21.77	21.96	21.56	21.57	21.43	21.66
Assy 5	22.63	22.47	22.67	22.40	22.27	22.23	21.75	21.50	21.26	21.25
LCT	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1	24.1
TCT	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6	21.6

4. CONCLUSIONS

The implementation of Kaizen to improve the productivity of thermal printer production is a success. The workers like the new parts container and motor slider, and the company gains more profit by the improved cycle time and productivity.

ACKNOWLEDGEMENT

Authors are grateful to Universiti Teknikal Malaysia Melaka for the financial support through JURNAL/2018/FKE/Q00006.

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