A review on optimization of cycle time by using various techniques

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***Abstract*—This article provides the literature review on optimization of cycle time by elimination of non-value added factors. The study shows that cycle time can be optimized by implementing various PPC techniques and engineering methods. Cycle time optimization is essential from the point of view of economic progress of an organization.**

IndexTerms—**Cycle time, Automation, Design, PPC techniques**

I. INTRODUCTION

In today's fast moving world, it is very much significant for the manufacturing industries to fulfil customer's demands on time to ensure customer satisfaction. Thus, manufacture needs to find ways to reduce the cost of the product and the processing time along with the improved performance and quality of the product.

Cycle time is the time required for performing various machining operations on the product at workstation. It is the total time elapsed for converting raw material into the finished product. It not only includes service time for machining but also comprises of the idle time or setup time between two consecutive operations. Cycle time reduction is of highly essential today since long cycle time results in high inventories, high cost and loss of customer's goodwill. Cycle time can be considerably reduced by proper demand management. For this forecasting techniques, can be used to determine the market demand and accordingly plan the manufacturing operations. Reduction in cycle time holds the advantages of reduced inventory, reduced cost and effective utilization of resources. With proper communication between various concerned departments the idle time between two consecutive operations is reduced and thus ultimately reducing the cycle time.

Just as cash flow is a direct measure of company financial performance, cycle time is a direct measure of process and equipment performance. In a mass production setting, cycle time improvements are driven by management with the goal of maximizing machine productivity. A key measure of cycle time performance is customer Satisfaction.

Tact time is the average time between the start of production of one unit and end of that unit or the start of production of the next unit, when the production of organisation start to achieve the customer demands. Cycle time is the total time from the beginning to the end of your process, as defined by the organisation and their customer. In cycle time contents process time, during which a unit is acted upon to bring it closer to an output, and delay time, during which a unit of work is spent waiting to take the next action.

II. LITERATURE REVIEW

Jeffrey W. Herrmann, presented the paper on "Design for production: a tool for reducing manufacturing cycle time". It is essential for the manufacturing department to have methods that can determine the manufacturing cycle time of a given product design. If the predetermined cycle time of the product is large, it is essential to reduce the same by redesigning the product or modifications in manufacturing process. Estimating the product cycle time in advance helps the manufacturing department to plan the process more efficiently and saves the work of redesigning and reworking. In this study, Design for Production (DFP) and Design for Manufacturing (DFM) are the two techniques that are used for cycle time reduction. DFP method examines the product design by comparing its manufacturing requirements with the available capacity and estimates the product cycle time. [1]

Mr.Rahul.R.Joshi et al., presented the paper on Reduction in Setup Time by SMED a Literature Review. This article basically explains the concept of setup time and reduction of setup time by SMED technique. Setup time is the time elapsed between completions of first product and putting the material for second product at shop floor for performing various operations. Single Minute Exchange of Die is an approach to reduce the setup time as an element of continuous improvement process. SMED basically aims at elimination of non-value added factors to meet the customer demands and ensure customer satisfaction. Single minute exchange does not mean the setup should be completed in one minute only. Single minute refers to single digit minute meaning that setup should be completed in less than 10 minutes. [2]

A.S. Aditya Polapragada et al., published the paper on pneumatic auto feed punching and riveting machine in (IJERT). In this paper, they prepared the design and fabricate the unit and proved the benefits of the pneumatic press tool had an advantage of working in low pressure, a pressure of 6 bar was enough for operating the unit. It helps them to use various type of punch dies in turns enables wide range of products.

The pneumatic press tool has an advantage of working in low pressure, that is even a pressure of 6 bar is enough for operating the unit. The die used in this is fixed such that the die of required shape can be used per the requirement. Different types of punch as requirement can be thus got per the work material the operating pressure can be varied. The working principle of die is based on

the operation of pneumatic cylinder. The compressed air is supplied at one end of the piston thus forcing the piston to perform the operating stroke. Once the piston reaches the desired position, it is controlled by position control valve and it is actuated in reverse direction to complete the return stroke. This results in reducing the cycle time by fraction of seconds which is highly significant in mass production industries. [3]

G.HarinathGowd et al., presented this paper on "Optimal selection of machining parameters in CNC turning process using Intelligent Hybrid decision making tools". The machining parameters like feed, cutting speed etc. are mainly responsible for efficient machining operation within optimum time and are main concern of manufacturing environment. To find out the optimum machining parameters author applied intelligent hybrid decision making tools. In this author used the ANN module to predict the relationship between input process parameters and output variables. After this the value of simple design and ANN design are compared and best model is identified and selected to optimize the machining time of the production process by selecting the optimum machining parameters. [4]

Subhash C. Sarin et al., in their paper, have explained methodology to reduce the idle time of the machine. The first method is based on heuristic procedure and second one is based on mathematical programme.
In the first method, efficient and systematic sequencing of the lots to the machine is done to reduce the idle time of machine as far as possible. The lot with leaser production time is done first.in the second method Linear and integer programming based model used to analyse manufacturing systems.it gives optimal solution for reduction of idle time in turns the efficiency and productivity is increased. [5]
AshwinkumarArivoli et al., Performed an experiment on process flow with help of various production planning and control technique like Cause and effect diagram, Pareto chart, Value stream mapping and line balancing for reduction of cycle time to achieve the optimum tact time at bottleneck stations. Tact time is the average *time* between the start of production of one unit and the end of production of that unit or the start of production of the next unit, when these production starts are set to match the needs of the customer. The author used the cause and effect diagram to determine the reasons behind the variations in takt time from optimum limits and then by using the line balancing technique the flow is balanced to meet the optimum limits of takt time. With the help of these efficient technique the author can reduce the cycle time and the involvement of worker has been reduced to achieve the more production rate and optimum cycle time. [6]

K. Venkataraman et al., in this paper addressed Value stream mapping method of Lean manufacturing for improving the inventory flow and information required to produce a product to achieve the customer satisfaction. In the value stream mapping process, visual representation of production process is to done to determine where the waste occurs. With the help of value stream mapping process a company can track their process flow to identify the factors like:

a) 1 Value added time (time taken for producing the product),
b) 2 Non-Value added time (time taken which do not contribute to the production of product),
c) 3 Cycle time (time required to perform a process) and
d) 4 Changeover time (time required to change tool and programming etc.).

Due to which identification and elimination of the unnecessary task or waste can be done efficiently to reduce the cycle time.
In this paper the author applied three KAIZEN principles to the production process for optimizing cycle time which are:
KAIZEN 1: Implement the Modified Process by eliminate and combine operations
KAIZEN 2: Implement the modified process by optimizing the parameters which affects the process flow
KAIZEN 3: Implement the modified process by improvement in tooling arrangements. [7]

III. CONCLUSION

The cycle time of any machining operation is of great significance for any manufacturing industry. The cycle time is affected by various parameters such as machining conditions, human involvement, bottlenecks in process, idle time etc. To reduce the cycle time, it is necessary that all these parameters must be within optimum limits. Various PPC techniques, automation of machines, systematic sequencing of jobs and many other methods can be applied to manufacturing process for optimization of cycle time which in turns responsible for improve productivity and efficiency of industry.

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