AS SEEN IN:
INNOVATIE NU | MARCH 2021

THE LEARNING CURVE EFFECT

ON MANUFACTURING

ADVANCED MANUFACTURING CENTER

ISSN 2772-428X

THE

LEARNING CURVE EFFECT

ON MANUFACTURING

Remarkable increases in productivity are typically realised as organisations gain experience in production. A variation is observed between those who learn and those who show little or no learning. Reasons can be found in organisational learning curves including organisations "forgetting" employee turnover, transfer of knowledge from other products and other organisations, and economies of scale.

In manufacturing, productivity is defined as a degree of getting imperative work done efficiently and consistently which improves over time. The term "Productivity" is mostly applied in production environments and it is associated with cost reduction and getting the most out of finite resources. It is acquired by understanding the production process through which work is done and it is a measure of the number of important tasks performed in a specific period. Understanding of production processes in manufacturing is obtained through actually doing the work. Efficiency in a job improves if it is done diligently over time with repetition. The manner of acquiring knowledge by doing work is known as the "Learning curve" and leads to productivity improvements within an organisation.

A learning curve is an interaction between an employee's performance on doing work and the time it takes an employee to complete the work. The learning curve in manufacturing is realised by looking at the Takt time and the lead time within the organisation. Under this effect, the Takt time is reduced which consequently reduces the lead time and increases productivity and competitive advantage by ensuring that customer demands are satisfied in time.

It is also important to note that productivity increases when the costs of production – including labour costs – decrease with increasing performance. Most manufacturing firms leverage on the advantages of experience and learning curves effect while others do not understand the advantages and the competitive edge that come with this effect. Manufacturing leaders, however, are aware of the learning curve effect and somewhat aware of the benefits that come with it. This awareness is seen in the skills development projects that are taking place within organisations as workforce skills improve with practice over time.

In today's competition, skills development has been realised as one of the tools to gain a competitive advantage and increased productivity. Manufacturing organisations invest resources in this area which enhances the workforce's ability to do work efficiently and consistently and through repetition the learning curve effect improves. The learning curve effect on manufacturing is prominent and measurable and should be treated as one of the improvement tools. This is because manufacturing variables are repeatable measurable and can be tracked over time.

Although the learning curve effect may be a convenient way of improving productivity, it is not always the case in other manufacturing organisations. This is observed in some manufacturing organisations showing outstanding productivity improvements while other organisations show little or no learning at all. In some of these organisations, lack of productivity is influenced by employee turnover, the transfer of product and process knowledge from one employee to the other, and it is highly influenced by organisational culture and values.

Employee turnover affects productivity in manufacturing organisations because new resources will be invested on training new employees and during training productivity is reduced. The learning curve effect is established from the principle that manufacturing organisations gain knowledge by performing work and repeating it. Under this effect, the workforce gains process, product, and production knowledge that develops into perpetual changes within the organisation. Hence, the way learning is executed in an organisation is very important in ensuring workforce development through the experience and the learning curve.

The significance of the experience and learning curve effect on manufacturing cannot be disregarded due to the nature of working and learning. However, some manufacturing organisations struggle to leverage on this effect. The struggle to leverage on the learning curve is influenced by a decrease in employee turnover, the organisational culture and values, and the learning strategy in the organisation. Manufacturing organisations should review their learning and development strategies, their organisational culture and values on their workforce learning and development to at least decrease their employee turnover and also ensure knowledge transfer between employees.

When looking at Takt time in a practical sense, it can be considered a measure of what a manufacturer needs to do to meet our changing demand at any one point in time. A simple ratio of the available time over unit demand can highlight to a manufacturer where there

are opportunities for process improvements to better meet that demand. If a manufacturer can balance their Takt time and processing times, then their throughput to meet the demand will be efficient.

In a similar manner, measuring Takt time can also highlight when processing areas are underutilised which can show opportunities for further value adding or even chances for rolling out new product manufacturing operations.

A real-world example of Takt in action can be seen by many manufacturers' response to the global COVID-19 pandemic. With the product demand across many industries facing erratic surges and drops, many manufacturers were forced to rely on good lean principles and reduce Takt to meet this demand. For example, in the automotive industry an unusually high demand for previous conventional car models remained, even while manufactures are ramping up early production of newer hybrid models. Couple this abnormal surge in demand and required production throughput with pandemic related labour restrictions and

Takt time *refers to the amount of time a manufacturer has per unit to produce sufficient goods to fulfil customers' demand. It is an essential tool in ensuring that goods flow through each build station in the most efficient manner.*

$$T = \frac{Ta}{D}$$

Ta= Available production time

D= Customer demand

T= Takt time

forced shutdowns and there is suddenly a real need to be able to reduce Takt time to improve the process and meet the demand with lower human and resource investment.

The car manufacturer was able to look at its existing hard wired digitally connected tools used for assembling and measuring fastener values across a range of assembly steps. It was identified that the current systems were cumbersome to use and taking up valuable operator time due to the tools being slow to use and data entry difficulty. The skilled tasks that involved feeding the tool readout data back into the quality systems were only able to be performed by a small handful of very skilled and well-practiced operators throughout the assembly team. The company learned about a process inefficiency through having historical repeated problems with these tools. Learning by doing.

An opportunity was then identified to reduce Takt time by improving tool use and measuring the process by migrating wireless tool readouts and data collection instead of the existing cumbersome system. These tools were far easier to use and allowed for a greater number of operators to upskill and learn how to feed faster data back effectively and efficiently to the quality and traceability systems. This allowed a better meeting of the current market demand as well as providing continuous improvement in the process. The improved tool that allowed operators to become highly skilled in a much shorter time is critical when operating under conditions imposed by the global pandemic. Where turnover might be higher or temporary contract workers might be bought in temporarily, proficiencies in operations and reduced learning curves such as the tool use example become critical.

Using Takt time ratios and measurements of the expense and investment was justified to provide value and an improvement over the old methods of work. Takt time was reduced and the overall learning curve to become proficient at a particular tool type was reduced. This resulted in a factory that was able to far better meet the demand while maintaining or improving the quality and traceability.