Pearson BTEC Level 5 Higher Nationals in Engineering (RQF)

Unit 49: Lean Manufacturing

Unit Workbook 3

in a series of 4 for this unit

Learning Outcome 3

Process Improvement Tools

Contents

INTRODUCTION

Specify a range of the process improvement tools used within lean manufacturing.

- *Common tools and techniques associated with lean manufacturing and process improvement:*
  - Seven Wastes.
  - Continuous Flow.
  - Kanban (Pull System).
  - Just-in-Time (JIT).
  - Value Stream Mapping.
  - Poka Yoke.
  - 5 Whys (Root Cause Analysis).
  - Total Preventive Maintenance.
  - Plan-Do-Check-Act (PDCA).
  - Single Minute Exchange of Die (SMED).
- *Selecting the most appropriate improvement tool to tackle a problem:*
  - Tools for improving quality and delivery.

GUIDANCE

This document is prepared to break the unit material down into bite size chunks. You will see the learning outcomes above treated in their own sections. Therein you will encounter the following structures;

Purpose

Explains *why* you need to study the current section of material. Quite often learners are put off by material which does not initially seem to be relevant to a topic or profession. Once you understand the importance of new learning or theory you will embrace the concepts more readily.

Theory

Conveys new material to you in a straightforward fashion. To support the treatments in this section you are strongly advised to follow the given hyperlinks, which may be useful documents or applications on the web.

Example

The examples/worked examples are presented in a knowledge-building order. Make sure you follow them all through. If you are feeling confident then you might like to treat an example as a question, in which case cover it up and have a go yourself. Many of the examples given resemble assignment questions which will come your way, so follow them through diligently.

Question

Questions should not be avoided if you are determined to learn. Please do take the time to tackle each of the given questions, in the order in which they are presented. The order is important, as further knowledge and confidence is built upon previous knowledge and confidence. As an Online Learner it is important that the answers to questions are immediately available to you. Contact your Unit Tutor if you need help.

Challenge

You can really cement your new knowledge by undertaking the challenges. A challenge could be to download software and perform an exercise. An alternative challenge might involve a practical activity or other form of research.

Video

Videos on the web can be very useful supplements to your distance learning efforts. Wherever an online video(s) will help you then it will be hyperlinked at the appropriate point.

1.1 Common Tools and Techniques

In order for a company to run as smoothly and efficiently as possible, it is necessary to know which tools to use. There are many different tools which can be applied company processes which can help to improve the efficiency of these processes. The improvements may be experienced incrementally or, alternatively there may be a breakthrough event which dramatically improves process(es). The processes which contribute, and drive customer satisfaction should be evaluated continually, and any improvements should be implemented accordingly. The overall aim and rationale for any company implementing these tools is to continually improve processes, to put it plainly, to get better all the time.

1.1.1 Seven Wastes

Waste, as discussed previously in this unit is any activity that does not add value from the customer's perspective. The 'Seven Wastes' of Lean Manufacturing are the different types of waste that can occur in a manufacturing company. These seven classes of waste are what any lean manufacturing methods aim to eliminate and, in the UK, these are often known as 'TIMWOOD'. The Seven Wastes are Transport, Inventory, Motion, Waiting, Over-production, Over-processing and Defects, as follows:

1. **Transport**

Transport is essentially the movement of inventory or products from place to another. This could be a small distance from stores to the machine shop or a larger distance such as from a production facility in Indonesia to a distribution centre in the U.K. The transportation provides no added value to the product, it does not change it in any way and a customer would have no interest in paying for this process. With the waste of transport, there are usually other associated costs such as safety procedures, storage space, operational staffing and handling machinery. Additionally, transportation can result in succeeding processes being delayed whilst waiting for the goods or materials to arrive. Transportation also presents another potential risk, when goods or materials are transported there is a danger that they may be damaged or even lost.

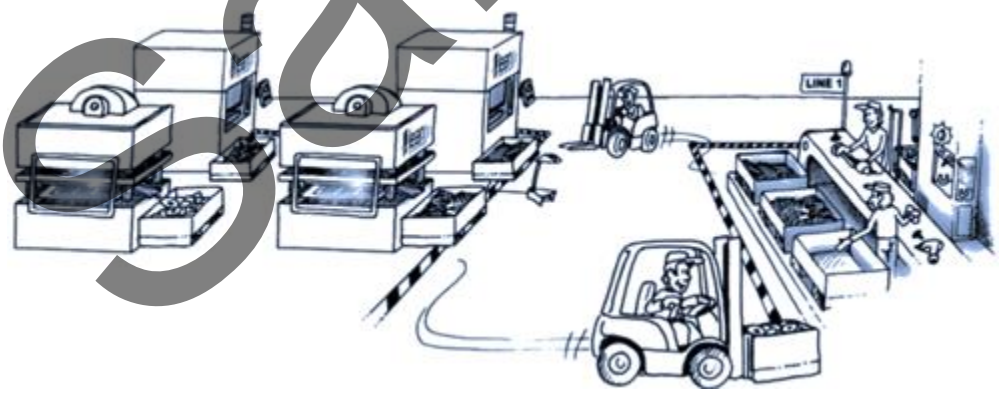

Figure 1.1: *Waste of Transport*

The waste of transport has several different causes and one of the major causes tends to be overproduction, which consequently may result in the waste of inventory, and that in turn may result in a further waste of transportation. Another cause of the waste of transportation is inefficient organisational layouts, companies

often layout their shop floor into distinct separate areas depending on the function being performed. For example, a part may be worked on using a milling machine and then be transported to be worked on using a lathe. There may be large gaps separating these two functional areas which requires additional actions to be performed such as the use of a forklift to move the piece being worked on.

Clearly in an example like this, it would be beneficial to change or develop the layout so that the spaces between operations are reduced and, in turn, delays are also reduced. The use of 'value stream mapping' may also be applied, which is discussed later in this workbook.

2. Inventory

Inventory is any parts or goods, whether these are parts or goods that are in progress or the finished article. Up until the point that the goods have been sold to the customer, they have a cost associated with them, a cost that the company must account for and shoulder. On top of the raw costs of the inventory, there are other linked costs which may not be immediately obvious. This inventory requires an area to be stored in, as well as packaging and possibly additional transportation, along with costs associated with the staff to actually carry out the management of the inventory and even insurance. Over-production is usually the main reason that leads to the waste of inventory and these two types of waste are intrinsically linked. Another factor that leads to the waste of inventory can be a poor layout and an in-balanced workflow, both of which can lead to a build-up of inventory either before or after processes.

In order to reduce the waste of inventory a company should adopt the lessons of lean manufacturing, making the value flow at the demand (pull) of the customer. Production must be balanced with assembly/finishing processes so that inventory does not accumulate in between these different processes.

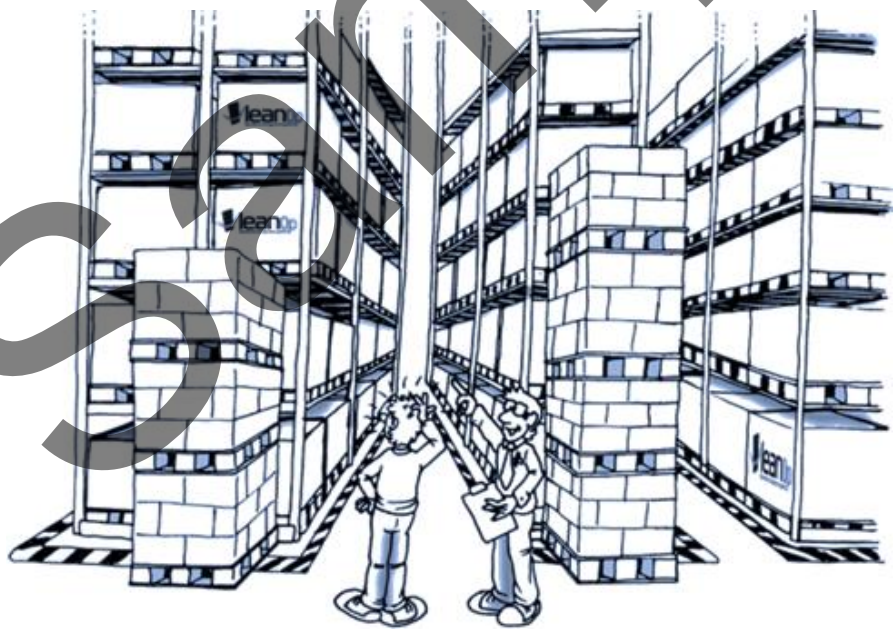

Figure 1.2: *Waste of Inventory*

3. Motion

Motions by either human workers or by machines which are not easy and simple to do are classed as unnecessary. A good example of this could be a worker having to reach up to a high shelf by their side in order to retrieve a part and then use it as part of an assembly. If the part could be supplied to the worker straight ahead of them at the midriff level, then this would significantly reduce the amount of time it takes to retrieve the part and would also reduce the stress on the worker. It is essentially a waste to move when you are not adding any value to the product you are working on.

The waste of motion has several main causes regarding layout, location of parts and tools and a lack of space. As well as these, the waste of motion may also be caused by working processes or part design which requires workers to re-orientate the work in progress regularly.

Motion clearly cannot be removed completely from a process, but the aim should be to minimise it as far as possible. This will always make working processes easier and less stressful to complete. A useful tool to eliminate motion is 5S which is another lean methodology used to organise workplaces. It is a highly effective tool for creating orderly storage areas for tools and parts, it will also help to create standard operating procedures for the best way to perform a particular process.

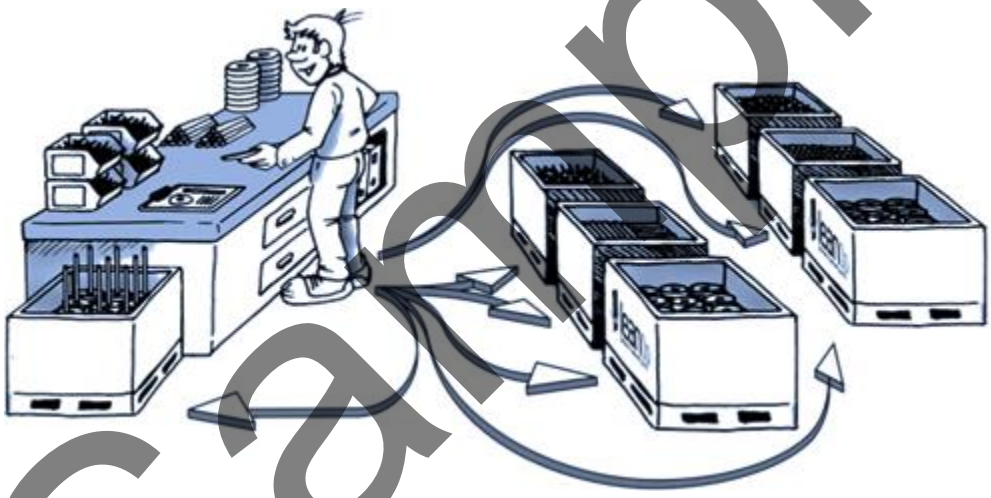

Figure 1.3: *Waste of Motion*

4. Waiting

Often in businesses, time is spent just waiting for an answer from other departments or other offices, waiting for machine maintenance, machines to finish processes or waiting for deliveries of parts or materials from suppliers. Workers may often work more slowly to disguise the fact that they are waiting for parts/materials to be delivered to move onto the next part of the process. This waiting causes a disruption to workflow and, as such, is a major debilitating factor affecting a company striving for lean manufacturing. Time spent waiting could be spent adding value to a product and often the time that has been wasted by waiting is made up for through overtime, which in turn costs the company more money.

Processes that are unbalanced result in the waste of waiting, if one task takes a longer period of time then the workers in the process immediately following will be waiting or performing processes slowly so as to