

Pearson BTEC Level 5 Higher Nationals in Engineering (RQF)

Unit 49: Lean Manufacturing

Unit Workbook 2

in a series of 4 for this unit

Learning Outcome 2

Toyota Production System

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Sample

INTRODUCTION

Evaluate the Toyota Production System against the now more widely adopted generic approaches to lean manufacturing.

- *Toyota Production System:*
 - Research the Toyota Production System (TPS) and identify the fundamental elements of the TPS as well as the motivation behind creating the TPS.
 - Compare TPS with the recognised theory and production systems publicised by other global manufacturers: how do they differ and how they are similar?
 - How the common principles are now being adopted outside manufacturing.

Sample

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 The Toyota Production System

1.1.1 What is the Toyota Production System (TPS)?

The Toyota Production System (TPS) is essentially a form of 'lean production' which has been developed by the Toyota company over many years. It was started as a step up from the mass production methods employed by American companies such as Ford. TPS eventually evolved and led to the term 'lean manufacturing' and gave rise to several other systems that have borrowed ideas and philosophies from this. The TPS method has advanced and grown beyond just the mass manufacture of cars, it has progressed to be used in all types of manufacturing such as aeronautical, nuclear, building construction and a vast number of other sectors. Its common principles have even gone on to influence other business types other than manufacturing, namely in the service industry.

The TPS is based on several fundamental principles and philosophies which were started by the founding Toyoda family and later developed by the company's executive, Taiichi Ohno. Toyota continues to be a market-leader thanks, in no small part, to the TPS which is continually being refined and improved in order to achieve large volume manufacturing along with high flexibility, all the while maintaining low inventory levels as well as minimal defects. The application of the TPS to its operation has allowed Toyota to get its products to market quicker than its competitors with fewer snags. As a consequence, Toyota creates satisfied customers who are more inclined to purchase their products over other competitors.



Figure 1.1: Toyota RAV4 Sports Concept

1.1.2 The Two Pillars of the TPS

There are two main conceptual 'pillars' of the TPS which are called Just-in-time and 'Jidoka'. Just-in-time means that the company 'makes only what is needed, only when it is needed and only in the amount that is needed' and 'Jidoka' means Autonomation, i.e. automation with a human touch. These two pillars are said to support the TPS 'house' and without either one of the pillars, the 'house' will collapse and result in inefficiencies.

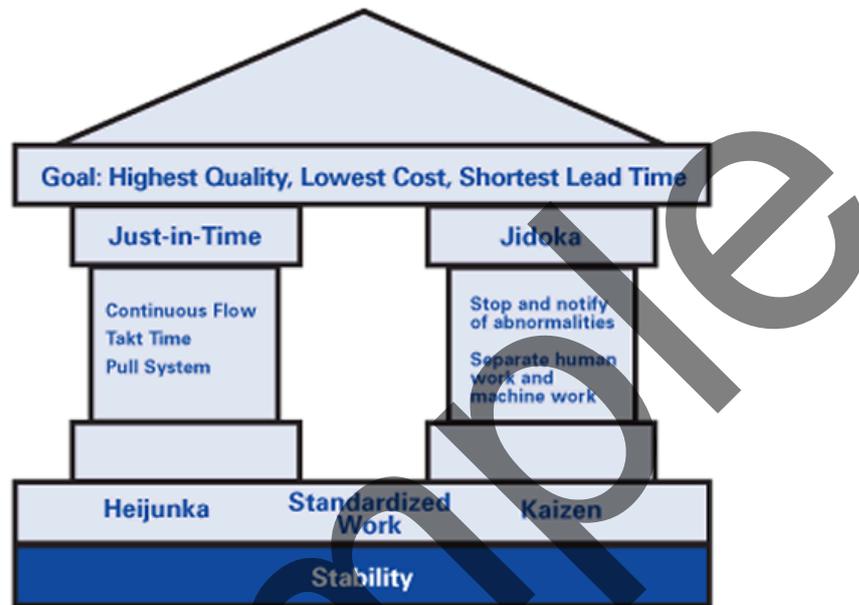


Figure 1.2: Toyota Production System 'House'

Just-in-time: 'make only what is needed, only when is it needed and only in the amount that is needed'.

The aim of the Just-in-time process is to efficiently produce goods within the shortest possible time period and in order to do this several methods are followed:

1. When a product is requested, the process must be started as soon as possible, therefore the workers at the beginning of the production line must also be informed as soon as possible.
2. The assembly line should be equipped with the exact number of all the parts required so that whichever type of product that is requested can be produced efficiently and speedily.
3. This assembly line must also replace the parts being used by taking the same number from the process that produces the parts. By doing this, over-stocking is reduced as only what is required is being replaced.
4. The prior process should be made up of low quantities of all parts and produce only the quantities of parts that are requested from the following process.



Figure 1.3: Just-In-Time Features

Jidoka: 'autonomation – automation with a human touch'.

In order for the Just-in-time process to work correctly, all the constituent parts being produced must comply with pre-existing standards of quality. This is accomplished using Jidoka:

1. Jidoka means that as soon as normal processing is finished, the machine stops in a safe and timely manner. In addition, it means that should a problem arise concerning quality or equipment, the machine is able to identify this issue independently and then stop its process, which avoids more faulty products being produced. Consequently, only products that pass these quality checks are progressed onto the next processes in the production line. This also avoids building of a number of faulty products.
2. A machine ceases production automatically when it has finished its process or if a defect is detected and then flagged immediately. As a result, the workers operating the machines are able to simply continue to work using another machine, whilst at the same time diagnose the cause of potential faults or defects. Overall, this results in each worker maintaining command of multiple machines, which leads to an increase in productivity, whilst solutions to faults and inefficiencies lead to continued improvements and better capacity for processing.