Introduction to Lean Thinking and Lean Tools

General Introduction

Welcome to this module on lean systems. If you have worked in manufacturing, chances are you will have heard of 'lean manufacturing' before now. In the past 20 years, the term lean manufacturing has become synonymous with efficiency in manufacturing and is the principle upon which companies such as Toyota and Honeywell have founded their competitiveness.

This module comprises 16 units which together take you through the history and development of lean thinking and the various tools and techniques that make up the 'lean toolbox'.

Lean systems are a suite of methods that can be applied in any manufacturing or service industry to identify value-add activities (VAs) and eliminate non-value-add activities (NVAs) from any system or process.

As customers worldwide are demanding ever higher levels of service and value for money, the marketplace is becoming increasingly competitive. In order to build upon successes and indeed to survive a challenging economic climate, organisations are seeking to understand what tools and techniques are available to them. Given that on average only 5% to 8% of the time a product spends in a factory is value-add, this represents a huge opportunity for any organisation (92% to 95%) to improve its performance. Lean systems offer a holistic and methodical set of tools that can be applied to eliminate waste and increase efficiency.

Lean thinking has been adopted in companies with as little as two people to globally managed companies employing tens of thousands. The techniques have been applied in industries as diverse as printed circuit board, PC, and aeronautical component manufacture. Due to the results of the application of lean tools, the methods have begun to be adopted by other industries including health, financial, and insurance services as well as government agencies.

This module will provide you with the knowledge of a set of tools that, when applied together and in context, will provide a significant opportunity to identify potential for the elimination of waste and increased productivity in any organisation.
Module Aims

The aims of this module are to:

- Describe what lean means and how it has developed
- Describe the tools and techniques included in the lean toolbox
- Explain the circumstances in which the different lean tools apply

The module will provide an overview of the Toyota Production System (TPS) and the 5 Lean Principles. It will also explain the main components of the TPS system including Just-in-Time (JIT) and cellular manufacturing. The module will dedicate one unit to each of the main lean tools including Value Stream Mapping, 5S, Kaizen, and Standard Work. The principles behind each of the tools and the various elements involved in effectively using these tools will be discussed.

Module Structure

The module has 16 units:

- Unit 1: History and Application of Lean Thinking
- Unit 2: Value Stream Mapping
- Unit 3: Cellular Manufacturing
- Unit 4: Work Standardisation and Standard Work
- Unit 5: Just-In-Time Manufacturing and Kanbans
- Unit 6: Single Minute Exchange of Dies (SMED)
- Unit 7: Creating and Sustaining an Orderly Work Environment with 5S
- Unit 8: Kaizen
- Unit 9: Visual Management and the Visual Factory
- Unit 10: Overall Equipment Effectiveness (OEE)
- Unit 11: Total Preventive Maintenance (TPM)
- Unit 12: Jidoka, Poke Yoke, and Quality
- Unit 13: Lean Supply Chains
- Unit 14: Lean Product Development and Quality Function Deployment
- Unit 15: Building a Lean Organisation
- Unit 16: Lean Systems: Case Studies

Module Content

Unit 1 introduces the concept of Lean Thinking. It summarises the history of the development of the Toyota Production System (TPS). The building blocks of the TPS are introduced and the 5 Lean Principles are defined in some detail. This unit introduces a number of key concepts that underpin much of the philosophy of lean thinking; for example, ‘value’, and ‘the elimination of waste’.
Unit 2 introduces Value Stream Mapping (VSM). The unit explores why VSM is such an important lean tool and discusses the benefits of the VSM process, particularly in identifying where improvement opportunities exist within the value stream. The unit identifies the steps involved in completing current and future state value stream maps.

Unit 3 introduces the concept of Cellular Manufacturing. The concept is explained and its implications are discussed, particularly in relation to its impact relative to traditional 'Batch and Queue' production. The unit explores the factors involved in successful cell design. It also identifies guidelines for successfully managing the development and implementation of manufacturing cells.

Unit 4 takes you through the concepts of Standard Work, Takt Time, and Cycle Time. You are shown how to calculate takt time and how to develop standard work. A range of tools and methods are introduced in this unit to enable you to analyse work elements and create standard work for processes.

Unit 5 looks at materials management within a lean environment. The JIT concept is discussed and its benefits explored. The methods required to support a Pull System are discussed and Kanbans and Load Levelling are explained with examples provided to demystify these mechanisms.

Unit 6 covers a key improvement tool in the lean toolkit, Single Minute Exchange of Dies (SMED). The importance of reducing set-up times is discussed in the context of achieving flow and pull. The SMED system and its ability to achieve dramatic reductions in changeover times are explained, as are the steps involved in implementing SMED.

Unit 7 discusses the 5S concept, its elements, and its benefits.

Unit 8 introduces the student to Kaizen, an extremely powerful tool for implementing change in pursuit of lean transformation. The unit explains the concepts of Kaizen and Kaizen Events. It then discusses the rationale for using Kaizen and the typical benefits that can be achieved by effectively deploying it. The main roles and responsibilities of Kaizen event participants are discussed, as are the necessary steps for planning and hosting successful events.

Unit 9 deals with visual management. The key objectives and benefits of visual management are outlined. The unit discusses how visual display and control build on an effective 5S implementation.

Unit 10 introduces Overall Equipment Effectiveness (OEE) and explains how it is calculated. The components of OEE are explained and two different methods are outlined for gathering OEE information.

Unit 11 introduces the concept of Total Preventive Maintenance (TPM). It discusses the advantages of implementing a TPM system. It also covers the typical causes of machine failure, the pillars of TPM, and the different categories of machine maintenance. Furthermore, it covers the typical stages in the lifecycle of a machine, from its installation to its decommissioning.
Unit 12 discusses the use of Jidoka and some of the quality tools and concepts deployed within Jidoka to ensure that quality is built into the product as it proceeds through the process. We look at Zero Quality Control (ZQC) and Shingo's analysis of inspection methodologies.

Unit 13 investigates how the concept of lean has developed in supply chains. The individual components that make up supply chains are discussed and standard supply chains are compared to lean supply chains. Finally, the characteristics of an advanced supply chain are discussed as well as the difficulties faced by an organisation when putting such a system in place.

Unit 14 focuses on the customer-driven aspect of lean and introduces Quality Function Deployment (QFD). The QFD process is explained. In addition, the unit discusses the benefits of using this team-based methodology to ensure that a customer focus drives the development process. The unit also explores some of the main tools and processes used by lean organisations in their quest to add value for customers.

Unit 15 looks at the cultural aspects of managing a lean transformation. The concept of culture is defined and the importance of addressing cultural issues as an integral part of lean is discussed. The unit also looks at the areas of empowerment and teamwork.

Unit 16 presents three different instances where lean tools have been applied in organisations. It explores the effects these tools had.

Assessment Procedures

During your study of Units 1 to 16, you will be able to judge your own progress by attempting the Self-Assessment Questions (SAQs) at the end of each unit.

The assessment of the module will be based on an end-of-semester exam and two short assignments. The weighting of the exam will be 60% and the weighting of the two assignments will be 20% each.

Reference Texts


Mike Rother and John Shook (2003) *Learning to See*, The Lean Enterprise Institute, Brookline, Massachusetts.