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LEAN FOR LIBRARIANS: IN THEORY AND IN PRACTICE



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INTRODUCTION

LEAN FOR LIBRARIANS: IN THEORY AND IN PRACTICE

Developed by Toyota in the 1950s, Lean is a philosophy that is now more than 60 years old. It has been deployed by organisations around the world in industries of all shapes and sizes, from the multinational manufacturing corporations who first developed it to technology startups who have used it to fuel exponential growth.

Because Lean is all about making the most of existing resources, it can help organisations which are seeing revenue or customer numbers drop at least as much as those which are growing. Further, as it is not tied to a particular sector or business function it can help almost any area of a business, from the factory floor to the marketing department. Lastly, because Lean is not a “quick fix” or a one-time project it can help you to drive real, lasting change in the way things are done.

Academic libraries are today in a situation that sees them dealing with challenges from many different directions: digital discoverability, shrinking budgets, and increasing expectations each bring their own set of difficulties. Lean can help with all those problems. Yet, many librarians have not seen the opportunities that Lean can bring. Perhaps this is because it is seen as something that management do, rather than librarians; or something that will be big, difficult, and time-consuming to implement; or something that isn’t applicable to the world of the academic library.

The aim of this resource is to show you some of the principles behind Lean and how libraries in the UK are already seeing success with it. It outlines some of the core ideas and techniques needed for thinking Lean, following each new principle with a case study from a library at an institution in the UK.

Chapter 1 is all about reducing waste in time, energy, people, and spaces. Taken from the book *The Lean Six Sigma Black Belt Handbook*, it introduces the Lean view of waste and value, describing the different kinds of waste you might encounter and the problems they can cause. **Chapter 2** describes how the British Library identified and dealt with several different kinds of waste in one of their departments.

Chapter 3 continues our examination of waste, also adding in one of the key aspects of Lean problem solving: seeing the problem first-hand. Taken from *Value and Waste in Lean Construction* – showing just how universal the principles of Lean are – it describes how this technique can help you overcome challenges faster and determine the root causes of problems. **Chapter 4** then looks at how librarians at the University of Nottingham used the idea of problem solving on the library floor to improve the efficiency of their billing processes.



INTRODUCTION

LEAN FOR LIBRARIANS: IN THEORY AND IN PRACTICE

Having described how to identify waste and problems in **Chapter 5** we begin looking at tools to solve them. Taken from *Implementing Six Sigma and Lean*, this chapter outlines nine tools from the Lean toolbox that can be used to solve problems in your team. **Chapter 6** then looks at how the University of St. Andrews used some of these tools to make their reshelving process more efficient, freeing up librarians' time for other activities.

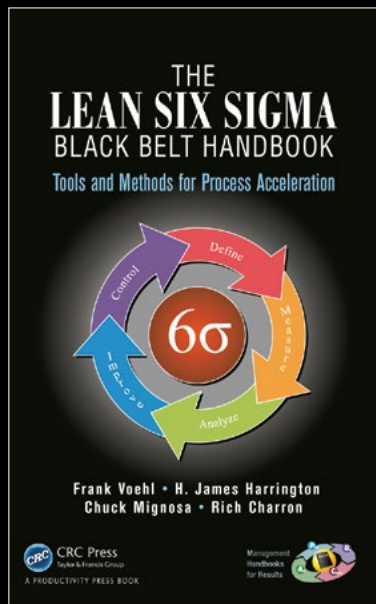
Chapter 7, taken from *Toyota by Toyota; Reflections from the Inside Leaders on the Techniques that Revolutionized the Industry* looks at the principle of continuous improvement and how small, regular changes can deliver big results in the long-term. **Chapter 8** goes on to describe how the science librarians at the University of Cambridge have used continuous improvement to increase library usage tenfold at a time when usage of physical libraries is generally declining.

Each of the case study chapters in this book ends in very much the same way: the library in question has improved efficiency, freeing up time for their hard-pressed staff, while also making patrons happier. While this may seem too good to be true, hopefully the fact that they come from real libraries shows that it is not.

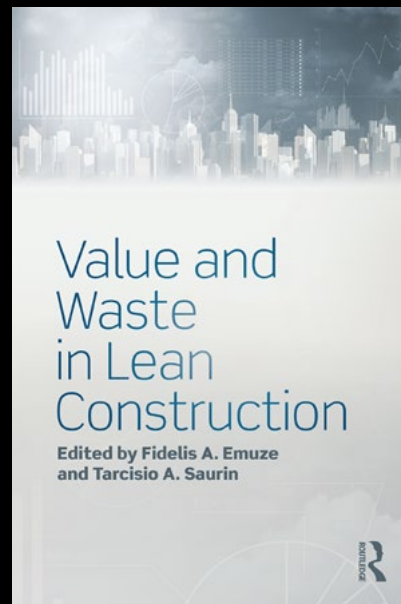
This FreeBook ends with a look to the future in **Chapter 9**. While implementing Lean techniques today can have many benefits, its real benefits can only be felt if Lean becomes a core part of your working practice. This chapter describes how we can learn from and teach others about Lean using the techniques through *gemba* walks, first introduced in Chapter 3. These are an important tool in ensuring Lean knowledge grows, is passed on to new colleagues, and becomes part of the library's culture.

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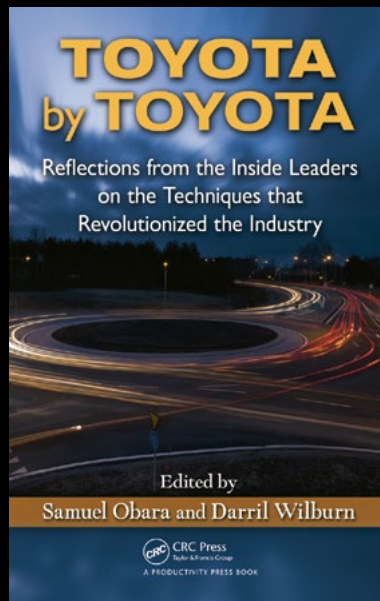
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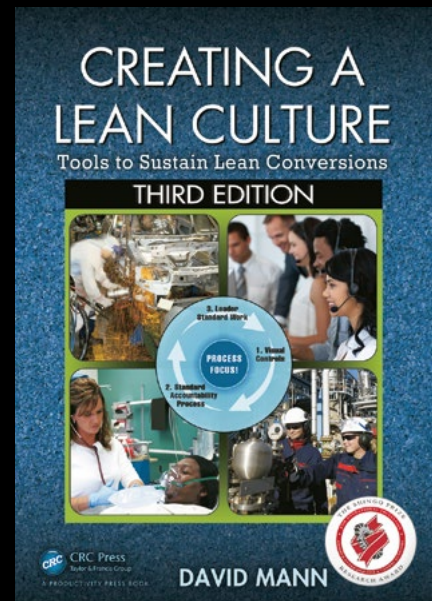
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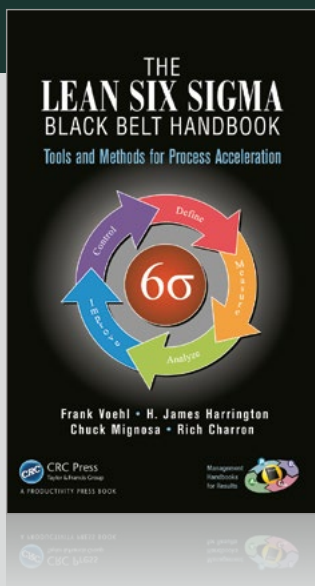


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CHAPTER

1

WASTE IDENTIFICATION



This chapter is excerpted from

*The Lean Six Sigma Black Belt Handbook:
Tools and Methods for Process Acceleration*

By Frank Voehl, H. James Harrington, Chuck Mignosa,
Rich Charron

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"There is nothing so useless as doing efficiently that which should not be done at all."

Peter F. Drucker

IN A NUTSHELL

Waste is generally composed of unnecessary activities that can be described either qualitatively or quantitatively. In its most basic form, Lean Six Sigma (LSS) encompasses both these descriptors. Waste identification is also called learning to see *muda*, which is a traditional Japanese term for an activity that is wasteful and doesn't add value or is unproductive, value-none, trivial, or unuseful¹. It is also one of three key concepts in the Toyota Production System (TPS). The other two are *mura*, which means irregularity, unevenness, or variability, and *muri*, which refers to overburden or strenuous work (Lean Enterprise Institute, 2008). These three terms describe the waste that infiltrates organizations and allows us to begin "learning to see" waste.

Waste identification and reduction is an effective way to increase profitability. Toyota merely picked up these three words beginning with the prefix *mu-*, which in Japan are widely recognized as a reference to a product improvement program or campaign. In this chapter, we present fundamentals on how to recognize *muda*, *mura*, and *muri* in the workplace. The chapter discusses the importance of looking at your organization in new ways, developing an inquisitive approach that encourages questioning of current beliefs and practices, and taking a look at everything you do from the customer viewpoint. One approach is to start at the end; that is, walk backward through your organization assessing process steps in reverse and asking questions. To this end, we include a series of checklists to get the LSS practitioner thinking in new ways.

OVERVIEW

Until recently, when we talk about learning to see waste, we are considering organizational wastes, not behavioural wastes. However, behavioural wastes can severely hinder Lean initiatives. This chapter describes what waste is and how to identify waste. It also discusses the mindsets that are the root causes of waste. These mindsets or belief systems are put into context here and described with terms like just-in-case logic. Almost all organizational wastes or process wastes are related to an employee in the organization that holds a traditional belief system.

1. Muda, 無駄; translation to English on Sanseido: "exceed." Japanese-English Dictionary

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Learning to see variation (*mura*) or waste (*muda*) requires a shift in how we view our organization. How do we view our processes? How do we measure our processes? What questions we ask about process performance, people performance, and equipment performance all indicate how we look at variation and waste. Throughout this chapter we present checklists that help you to begin to question everything you do in an effort to learn to see variation and waste in a new light.

WHAT IS VARIATION?

The way in which numbers differ is called variation (Harrington, Hoffher and Reid, 1998). Virtually everything that is measured is subject to variation. Our equipment is subject to variation. Our employees are subject to variation. The instrumentation that we often use to measure a process is subject to variation. How we measure our measures can be a key source of variation. There is variability inherent in many methods completed in our value-adding processes. For example, one of the most critical and prevalent tools used in every organization today is the computer and its software packages. How we gather information, analyse information, and report information can be subject to tremendous variation. Based upon the simple observations, one can see why the study and understanding of variation is a critical component to an LSS organization.

Variation can also be described as “a measure of the changes in the output from the process over a period of time.” (Harrington, Gupta and Voehl. 2009) As you collect data over time, you can measure and view the variation of process input variables, process methods, or process output variables. Understanding, controlling, and limiting process variation is a primary goal of any LSS practitioner.

As we begin our journey toward being an LSS organization, we must become proficient at measuring variation, analyzing root causes of this variation, and taking corrective actions to eliminate variation from all of our processes.

The entire study of variation is an endeavour to quantify and chart process behaviour. At the beginning of our value-added processes, we can quantify and chart our process input variables. These include the 5M's: materials, machines, manpower, methods, and measurements. The objective here is to minimize variation in our supply chain inputs to our value-added processes. For example, by measuring variation in material specifications, we are able to better control our value-adding process steps, thereby assuring a predictable outcome for product performance.

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HOW DO WE CHART VARIATION?

One of the most common process output variables in an LSS environment is process lead time. In many instances, customers are sensitive to the amount of time it takes us to add value for them. How we organize our materials, deploy our human resources, set up our equipment, and sequence our value-added steps has a tremendous influence on our process output lead time. The average lead time chart in **Figure 1.1** shows how the lead time varies over time, specifically, how month-to-month lead time varies during the year. It also shows the upper control limit (UCL) and lower control limit (LCL) for the data set.

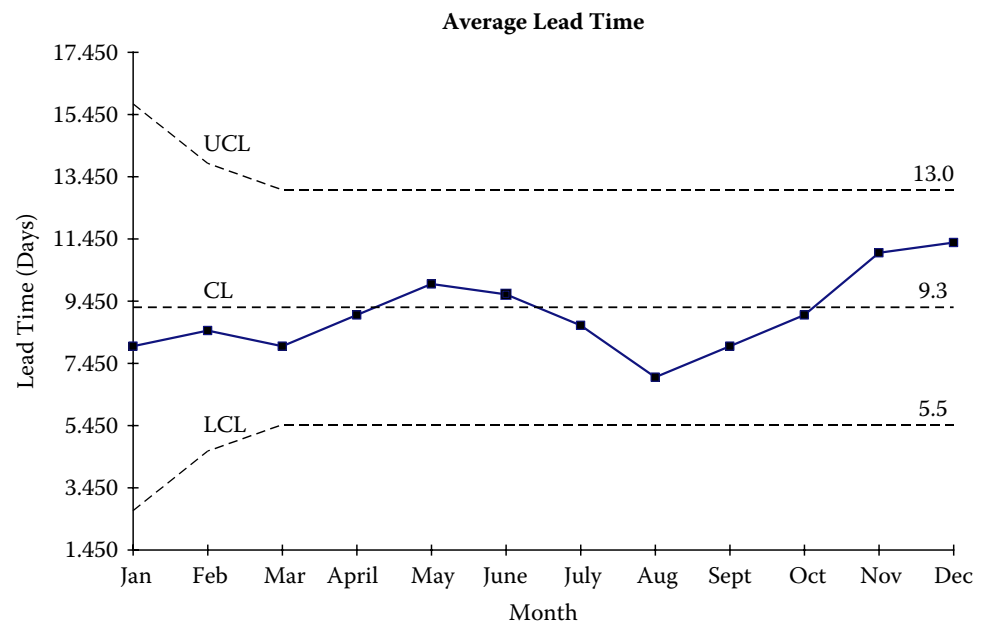


Figure 1.1 • Average lead time chart

WHY IS UNDERSTANDING AND CONTROLLING VARIATION SO IMPORTANT?

Simple charting like this can help us to understand, control, and improve lead time for our customers. The importance of understanding, charting, and controlling process variation cannot be overstated. Understanding variation and decreasing variation is the fundamental underlying foundation of all LSS organizations. First, it allows us to understand, control, and improve our entire supply chain, which includes many activities that are conducted outside of our physical facilities. Second, it allows us to uncover valuable insight concerning the interactions between materials and

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our processing equipment. Perhaps, more importantly, it provides a fundamental foundation for assessing our performance output behaviour that is critical for customer satisfaction. Virtually all of our outputs are key performance indicators and subject to variation. As a consequence, our ability to understand and chart variation is paramount for improved performance from a customer viewpoint. The remainder of this chapter and several chapters that follow in this handbook are dedicated to understanding waste identification and process variation and applying LSS tools for process improvement.

WHAT IS WASTE?

Describing waste is not as easy as one might think. Waste appears throughout organizations and is often mixed with nonwaste. There are times and conditions within our organizations where deciding what is waste versus non-waste can be somewhat of a moving target. For example, in today's organization, e-mail is virtually impossible to live without as a communication tool. In and of itself, it has great capacity to assist with many processes. Yet it can also be a significant source of extra processing waste. The telephone can produce a similar waste, but are all telephone calls wasteful? There are times when some organizations consider inventory an asset, that is, right up until the customer no longer wants to purchase the inventory. Clearly, one or more definitions describing just what is waste (all no-value-added activities) and what is not waste (value-added activities) are needed.

DEFINING THE VALUE-ADDED WORK COMPONENTS

LSS organizations are constantly searching for more effective ways to deliver value for the customer. How do we define value and distinguish it from activities that produce no value?

To better understand this term, we have provided you with a practical definition of value-added (VA), no-value-added (NVA), and novalue-added but necessary. (See **Figure 1.2.**) Value-added is an activity that transforms or shapes raw material or information to meet customer requirements.

Organizations that strive to eliminate NVA work while increasing their VA work are the ones that will be the most successful². There are a number of ways to accomplish this. One of the most effective ways is to first evaluate the practices used, so you can recognize any NVA work and then take steps to reduce it and be more efficient in your work. The basic characteristics include VA components such as customer

2. As a management technique, companies seek to provide additional value-added in their products as a way of distinguishing them from competitors; value-added in this sense is a means of avoiding commoditization and maintaining profit margins.

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VA and operational VA, as well as NVA components such as idle time, rework, and bureaucracy. Detailed analysis of these factors is a fundamental part of waste identification and the foundation of LSS initiatives.

- **Value-added** is an activity that transforms or shapes raw material or information to meet customer requirements.
- **No-value-added** is an activity that takes time, resources, or space, but does not add to the value of the product or service itself from the customer perspective.
- **No-value-added but necessary** is an activity that does not add value to the product or service but is required (e.g., accounting, health and safety, governmental regulations, etc.). In the business process management methodology this is called business value-added.

3. Many of the TPS/Lean techniques work in a similar way. By planning to reduce manpower, or reduce changeover times, or reduce campaign lengths, or reduce lot sizes, the question of waste comes immediately into focus upon those elements that prevent the plan being implemented. Often it is in the operations area rather than the process area that muda can be eliminated and remove the blockage to the plan. Tools of many types and methodologies can then be employed on these wastes to reduce or eliminate them.

4. Shigeo Shingo divides process-related activity into process and operation. He distinguishes process, the course of material that is transformed into product, from operation, which are the actions performed on the material by workers and machines. This distinction is not generally recognized because most people would view the operations performed on the raw materials of a product by workers and machines as the process by which those raw materials are transformed into the final product. He makes this distinction because value is added to the product by the process but not by most of the operations. He states that whereas many see process and operations in parallel, he sees them at right angles (orthogonal); this throws most of operations into the waste category. See value stream mapping for a further explanation.

Figure 1.2 • Definitions of VA, NVA, and NVA but necessary.

In the case of a manufacturing operation, VA means all those activities that turn raw materials into value (the product) for your customer. In the case of a service organization, VVA means all those activities that are required to deliver the intended service. In essence, the service is your product. Your VA product or service is what you end up with, or what the customer wanted. Conversely, NVA is anything that the customer is not willing to pay for. NVA entities can be employee activities, materials, information exchanges, and equipment. The difficulty comes in separating NVA from VA activities and still providing what the customer wanted. The remainder of this section is about identifying anything that is NVA in your organization³.

HOW DOES WASTE CREEP INTO A PROCESS?

Waste can creep into any process over time and usually does⁴. In the 1980s there was a popular story about a tire manufacturing plant in the Midwest. The story goes that they were conducting a continuous improvement effort when one of the observers posed a simple question to an operator "Why are we wrapping these tires in protective white plastic?" The operator was not sure; his reply was that they had done it for the 3 years that he had been with the company. So they went to the shift supervisor and posed the same question. His response was that the machine was there since he joined the company 7 years earlier. He said that Charlie

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in maintenance may know: “He’s been here for 25 years.” So they headed off to maintenance to find Charlie. When they posed the question to him, he replied that it is to protect the whitewall tires in shipping. They hadn’t made whitewall tires in the plant for years; however, they continued to wrap the newer all-black tires as if they had whitewalls. This is one example where a product change without a process change allows waste to creep in to your process.

THE POWER OF OBSERVATION

From the Renaissance period in the 1500s to the emergence of many of the pure and applied sciences in the 1700s to 1800s, there were limited technical tools compared to today. There were no computers, no Internet with instant information, no instant communication, no telephone, and no mass transportation. The sharing of knowledge was slow and difficult. In relative isolation, science was advanced by disciplined individuals committed to observation and experimentation.

It was during these times that the power of observation was the dominant tool for improvement. As mechanical scientific instruments were developed, these highly trained and skilled observers applied these tools, coupled with keen observation capabilities, to make astounding discoveries. However, in almost every organization that we go into, the power of observation is almost non-existent. Employees at all levels wander through the organization focused on their individual worlds and completely ignoring the blatantly obvious signs of waste that engulf their organization.

Some have called these organizational cataracts. These cataracts can grow and hinder our vision and render the power of observation an obsolete tool. Managers fail to see the waste of rework associated with the poor scheduling or haste with which they initially produced a product. Employees focused exclusively on a daily production deadline completely miss a multitude of opportunities to improve their environment in favour of producing the daily production quantity.

“The range of what we think and do is limited by what we fail to notice. And, because we fail to notice that we fail to notice, there is little we can do to change until we notice how our failing to notice shapes our thought and deeds.”

—R.D. Laing

This approach (observation and experimentation), which has been used by science for hundreds of years, is the key to advancing knowledge and improving our

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understanding of our surroundings. We must be able to accurately observe our surroundings, document what we see, investigate and analyse our observations to find out what is causing what we see, and ultimately take effective action to improve our environment.

Science is “the desire to know causes.”

—William Hazlitt (1778–1830), English essayist

This emergence of the power of observation is a key ingredient in the formation of a learning environment. The remainder of this chapter is about igniting the power of observation in our employees. More importantly, it's about learning to see waste and variation with new eyes, eyes that know what to look for.

SEEING WITH NEW EYES

Traditionally, Lean has classified waste into eight major categories. These categories were developed based upon visual symptoms in the organization. We have added a ninth waste, behaviour waste, which revolves around individual and collective belief systems and how they influence daily behaviour. The remainder of this chapter discusses each category in detail.

What types of waste are present? What are typical causes of each waste? How can waste be identified? Checklists are included to assist you with learning to see waste and variation. However, you are encouraged to expand these checklists by looking at each process step in your organization and developing your own questions. The nine waste categories are:

1. Overproduction
2. Excess inventory
3. Defects
4. Extra processing
5. Waiting
6. Motion
7. Transportation
8. Underutilized people
9. Employee behaviour

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5. Overproduction happens each time you engage more resources than needed to deliver to your customer. For instance, large batch production, because of long changeover time, exceeds the strict quantity ordered by the customer. For productivity improvement, operators are required to produce more than the customer needs. Extra parts will be stored and not sold. Overproduction is a critical muda because it hides or generates all others, especially inventory. Overproduction increases the amount of space needed for storing raw material as well as finished goods. It also requires a preservation system.

WASTE 1: OVERPRODUCTION

Overproduction means making more of a product than is needed by the next process or the end customer⁵. It can also be described as making the product earlier in time than is needed or making a product at a faster rate than is needed. Overproduction has been labelled by some as the worst waste because typically it creates many of the other wastes. For example, overproduction leads to excess inventory, which in turn leads to the wastes of motion and transportation. In addition, excess inventory requires more people, equipment, and facility space, all of which reduce company productivity and profitability. This is shown in **Figure 1.3**.

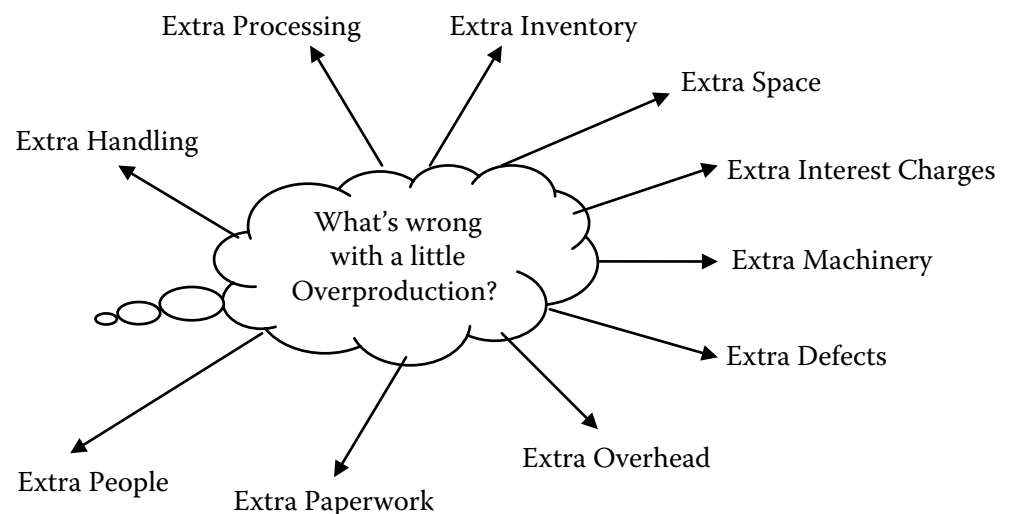


FIGURE 1.3 • Waste of overproduction.

What Causes Overproduction?

Overproduction can be traced to many management and employee behaviours. Some of the most common causes are:

- Just-in-case logic
- Unlevelled scheduling
- Unbalanced workloads
- Misuse of automation
- Long process setup times

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The Just-in-Case Logic Trap

Just-in-case logic is exactly what it sounds like. You make more product just-in-case—you fill in the blank. For example, just-in-case the machine breaks down, just-in-case our suppliers don't send enough raw materials, just-in-case our customer orders more than we can make or deliver on time, etc. There are many reasons for using just-in-case logic, and they are all bad!

Just-in-case logic is one of the most common non-Lean employee behaviours present in companies today. It is responsible for productivity losses in any type of organization by robbing employee time when working on NVA overproduction. It is commonly found in other waste categories, such as the waste of motion, transportation, inventory, waiting, and defects. Most importantly, it reveals an inherent weakness in your current process capability and reliability. Managers that practice just-in-case logic invariably have poorly understood processes and poor process control. Instead of fixing the process, they prefer to mask the system with just-in-case overproduction. They have fallen into the just-in-case logic trap. Don't do it!

Unlevelled Scheduling and Unbalanced Workloads

Unlevelled scheduling and unbalanced workloads can both lead to overproduction. When these conditions occur and employees continue to produce, even when there is no customer demand, overproduction occurs. In forecast-driven environments unlevelled scheduling frequently occurs. In areas where the workload is not balanced properly between two or more process steps, one step will have excess capacity while the next may have excess demand.

Misuse of Automation

Another common mistake is that owners, senior managers, and/or department managers want to see expensive equipment running, not sitting idle. This misuse of automation can cause severe overproduction. Not very often does customer demand exactly meet machine capacity. One of the most difficult challenges for LSS practitioners is to change the misconception that the machine must always be running. In environments where there is a combination of automated and manual production, the misuse of automation at one process step creates the unlevelled scheduling and unbalanced workloads at downstream process steps. In this case we have one cause of overproduction (misuse of automation) forcing overproduction at another process step.

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Long Process Setup Times

The length of time required to set up equipment has long been a primary justification for overproducing and carrying excess inventory. The traditional thought is that if your setup times are long, then you must build larger batches than are required. One traditional approach is to define an economic order quantity (EOQ) where the changeover cost + the inventory carrying cost are the lowest, and then you build a batch this size.

This concept is shown in **Figure 1.4**. Do these assumptions on batch size selection make sense if changeover time can be significantly reduced? The answer is no. As you reduce changeover time, you reduce both changeover cost and the inventory carrying cost, and the EOQ moves toward the left on the chart. In this case, instead of using EOQ, target your processes to build just what the customer wants. The most cost effective EOQ is always what the customer wanted.

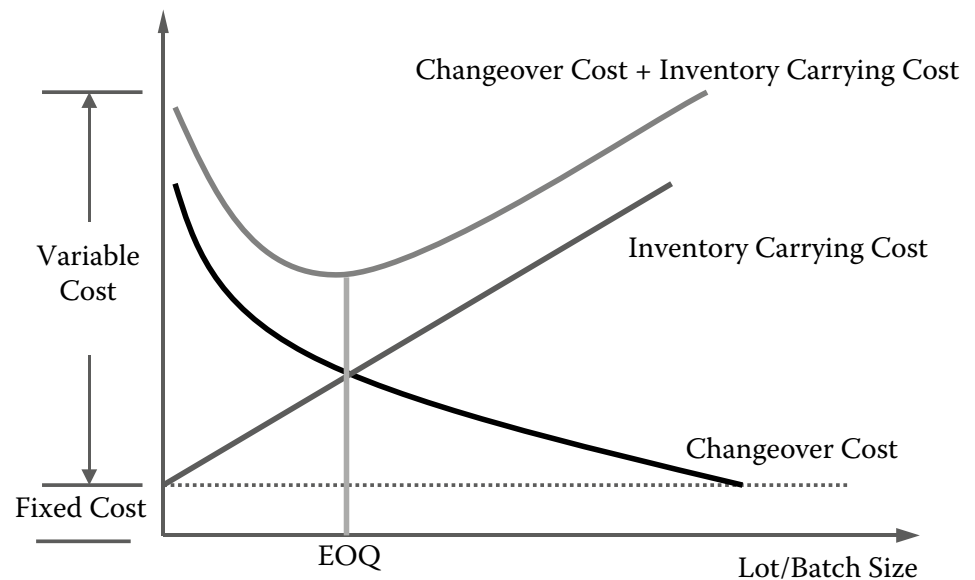


Figure 1.4 • Batch size selection based upon changeover cost and inventory carrying costs.

This is a classic example of bad measures driving bad behaviour. The primary assumption that you have to live with long changeovers and high inventory levels and inventory carrying costs, rather than try to eliminate them, was made based upon these two measures. In an LSS environment we focus on the process (long changeover time), identify the waste, and eliminate the waste by simplifying the setup process.

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How to Identify Overproduction

The learning to see overproduction checklist in **Figure 1.5** presents several questions designed to help you identify overproduction.

Waste of Overproduction Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Do we make more product than is required by the next process step?			
Do we make more product than is required by the customer?			
Do we make product faster than is required and store it for later use?			
Do we keep machinery running even when there is no demand?			
Do we create "busy work" for employees when demand falls?			
Are we producing more reports than needed?			
Are we making more copies than needed?			
Are we printing, faxing, and e-mailing more than what is needed?			
Are we entering repetitive information on multiple work documents or forms?			
Are we ordering more tests or services than what is required by the customer or patient?			

Figure 1.5 • Learning to see overproduction checklist.

WASTE 2: EXCESS INVENTORIES

Excess inventory is "any supply in excess of a one-piece flow through your manufacturing process."⁶ One-piece flow is often referred to as a make one-move one environment. Excess inventory could also refer to any finished goods inventory. Most organizations today run a mixed model of both "build to order" and "build to stock" products. Although some amount of raw materials and finished goods is required, many organizations use inventory to cover up poor process performance.

6. Inventory, be it in the form of raw materials, work-in-process (WIP), or finished goods, represents a capital outlay that has not yet produced an income either by the producer or for the consumer. Any of these three items not being actively processed to add value is waste.

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They keep raising the level of inventory until they cover process problems.

Like all of the nine wastes, living with excess inventory creates the “more syndrome.” For example, in an excess inventory environment, your company requires more people, more equipment, and more facility space. All the while you’re making more products (that you may or may not have customers for), more defects, more write-offs, etc. The “more syndrome” robs your company of productivity and profitability. In an LSS environment we reduce the sea of inventory and use the Lean or Six Sigma tools to identify the root causes of why the inventory was needed and then eliminate the root causes once and for all.

What Causes Excess Inventory?

- Poor market forecast
- Product complexity
- Unlevelled scheduling
- Unbalanced workloads
- Unreliable or poor-quality shipments by suppliers
- Misunderstood communications
- Reward system

Poor Market Forecast

Many organizations decide what they will build based upon a market forecast. Basically they take a sales and marketing forecast and convert it to a manufacturing forecast and then in turn set up a build schedule. Unfortunately, the only thing we can say about a forecast with a high degree of certainty is that it will be wrong. When this occurs, organizations are typically left with large amounts of inventory, much of which may be unsaleable.

Product Complexity

In a rush to get to market, many products are moved from the product development to full production before sufficient design for manufacturability has been completed. When product complexity is high, there are several issues that lead to excess inventory. These include raw materials performance issues, engineering changes that lead to supplier changes, production issues, and in-service performance, to name a few. In a competitive product cost environment, product complexity and high quality are often at odds with each other and are another source of excess inventory.

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Unlevelled Scheduling and Unbalanced Workloads

Similarly with overproduction, unlevelled scheduling and unbalanced workloads can both lead to excess inventory. These conditions typically occur in forecast-driven environments. In areas where the workload is not balanced properly between two or more process steps, one step will have excess capacity while the next may have excess demand. In the end, you wind up with excess inventory.

Unreliable or Poor-Quality Shipments by Suppliers

LSS organizations can only be sustained with an LSS supply chain. Inferior materials can, and often do, produce myriad troubles during your VA activities. Unreliable suppliers that deliver materials of poor quality or insufficient quantities only serve to help your competitors. To achieve LSS performance, focus on developing relationships with LSS suppliers.

Misunderstood Communications

Poor communication invariably leads to excess inventory. In the age of information overload, it is staggering how much bad information our employees are using and how much good information is being unused or misused. There are basically three fundamental areas in all organizations. (See **Figure 1.6**.) These are product development or service delivery, operations management, and information management. Most companies are good performers in one or two of these categories, but rarely all three. Depending on the nature and structure of the senior management team, more emphasis usually goes to one area. For example, companies with a perceived technology advantage tend to pay more attention to product or service development at the expense of the other two areas. When communication breakdowns occur, inventory increases, quality decreases, and profitability is hurt.

These are signs that you are in a poor communication environment:

- Poorly understood customer requirements
- Product or service is frequently delivered late
- Poor customer satisfaction
- Incomplete or inaccurate documentation
- Poor work instructions
- Inadequate information management system
- Barriers between departments
- Conflicting measurements system

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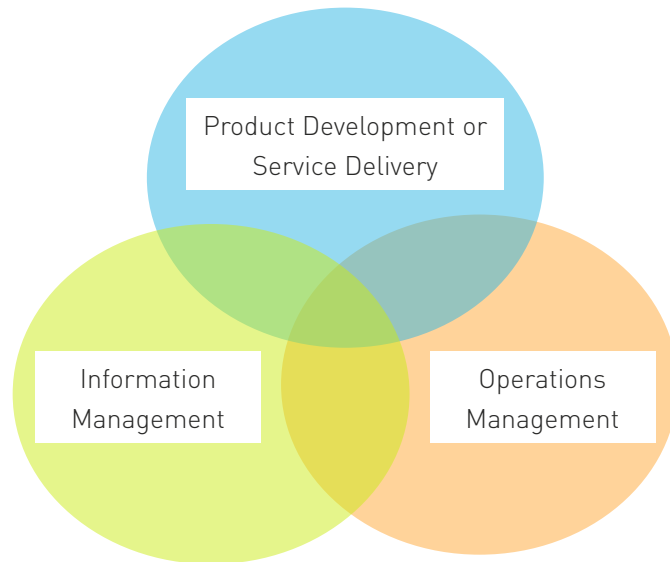


Figure 1.6 • The organizational universe.

Rewards System

There are several factors of company-wide rewards systems that can contribute to excess inventory. These factors can originate from senior management or from most departments. Since we know that measures drive behavior, poorly defined measures tied to rewards often result in excess inventory and many other wastes.

One example could be if an operations group has a measure of “on-time delivery” without regard for inventory levels. Another may be how the sales group gets compensation. Still another may arise from inadequate knowledge of the true cost of carrying inventory. Regardless of the reasons, if a large level of inventory exists in your facility, review the rewards program for an inadequate measurements system.

How to Identify Excess Inventory

The learning to see excess inventory checklist presents several questions designed to expose inventory waste. (See **Figure 1.7.**)

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Waste of inventory Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
What does the customer want?			
How much do they want and when?			
What are your purchasing signals— when, how much, how often?			
How do you structure your organization to meet these needs?			
How responsive is your inventory control and purchasing process to fluctuations in customer demand?			
Can you adequately describe the range of your customer demand for products or services?			

Figure 1.7 • Waste of inventory checklist.

WASTE 3: DEFECTS

Definition

A defect can be described as anything that the customer did not want. Defects include product or service attributes that require manual inspection and repair or rework at any point in the value stream. Defects can be detected and identified before your product or service reaches the customer or post-consumer in the form of warranty returns⁷.

What Causes Defects?

Defects can result from myriad causes. These causes can be classified into a few basic areas listed below. Each is followed by a brief description.

- Customer needs not understood
- Poor purchasing practices or quality materials
- Inadequate education/training/work instructions
- Poor product design
- Weak process control
- Deficient planned maintenance

7. Whenever defects occur, extra costs are incurred reworking the part, rescheduling production, etc. Defects cause scrap, repair, rework, backflow, and warranty/replacements; consume resources for inspection, correction, and replacement; cause opportunity loss (capacity and resources used to fix problems); cost 5% of sales for Six Sigma and 40% of sales for One Sigma processes; and reduce variability, lock gains, implement controls, and error proofing.

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Customer Needs Not Understood

Establishing comprehensive customer requirements is essential to defect-free products. More often than not we think we know what the customer wants or we make many assumptions about how he or she will use our product or service or what's important to him or her in terms of product or service performance. The more we can know in this area, the better we can develop our processes to respond to customer requirements.

Poor Purchasing Practices or Quality Materials

In the global marketplace, controlling the supply chain is an ever-increasing challenge. Purchasing departments typically have their own stand-alone measures based upon dead materials costs. Material costs are typically very visible in financial statements and a common target for cost reductions. This never-ending pressure for cost reduction frequently pushes product quality below levels expected by customers.

What's not present on most financial statements is the cost of quality, which includes repair and rework. Oh, it's present on the bottom line; however, there is no individual expense line item that can be targeted. Many defects can be traced to inferior quality materials. Repair and rework costs for these defective materials increase dramatically the further into the value stream your product gets before the defect is discovered. Numbers for how much this costs vary greatly across industries. Some of the components of this cost may include:

- Cost of communication with supplier
- Cost of storage until a disposition can be made
- Cost of employee time for physical moves or quarantine
- Cost of employee doing this NVA activity instead of a VA activity
- Cost of repair if required
- Cost of returns to suppliers
- Cost of re-engineering
- Cost of re-inspection
- Cost of productivity losses on new products due to staff re-assignment to complete rework

Inadequate Education/Training/Work Instructions

Here is an important rule of thumb: At any given point in time, you should have cross-training capacity at 150% of full production at each process step. To accomplish this, there needs to be a well-defined and executed cross-training program and effective

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work instructions to carry out the program. Often employees are asked to produce a quality product without adequate education, training, or visual work instructions to complete the task. One of the most effective means of defect reduction is the preparation of visual work instructions.

Poor Product Design

Many defects can be traced to poor product design. In examining product design failures, look for cost restrictions, poorly understood in-service product performance requirements, poor materials' selection, little or no product performance testing, and poor supplier performance. Regardless of the root cause of poor product design, the cost for a part design change increases dramatically the further into the value stream the product is before the defect is detected. The relative cost to mitigate a defect detected along the value stream using design engineering as a baseline of \$1 is:

- \$1 product design engineering
- \$2 product manufacturing engineering
- \$4 production
- \$5 to \$10 if the product reaches the customer

In some industries the cost could be significantly more. Many pharmaceuticals, for example, have limited shelf lives. If defect detection occurs at the customer, there may be insufficient time for return and repair or rework, requiring a complete write-off of the shipment. In this case, material/labor/facilities' costs plus profit are lost, not to mention the bad will created with the customer.

Weak Process Control

In all process environments either you control the process or the process controls you. Weak process control can stem from several sources, including deficiencies in materials, machines, manpower, methods, or measurements. It is easy for weak process control to creep into your processes.

The three telltale signs you need to work on process control are defects, rework, and high scrap rates.

Deficient Planned Maintenance

Poor equipment maintenance is often a cause for defective products. The justification for not completing planned maintenance can range from not enough time to do Total Productive Maintenance or autonomous maintenance, to can't afford to have production down, to equipment repairs are too expensive, to name a few. In the long run, effective equipment maintenance is always less expensive than equipment breakdowns due to

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poor maintenance, the cost of scrapping defective parts, or the added cost of rework.

How to Identify Defects

Defects are often only defined as something that an employee can tangibly see in the product. However, a defect is better described as anything that contributes to a product not meeting exactly what the customer wants. The list of questions in **Figure 1.8** should help you begin to expose a number of possible defects. This list could be greatly expanded; however, it should give you an idea of how to begin your search for anything that may possibly affect your product or service and be considered a defect.

Defect Detection Questions

- Materials
 - ☒ Are the proper materials being used?
 - ☒ Are the material specifications adequate?
 - ☒ How many materials are needed?
 - ☒ Are we purchasing excessive supplies of any kind?
 - ☒ When are they needed?
 - ☒ Where are they stored?
 - ☒ How are they handled?
 - ☒ How are they moved to where we create value for the customer?
- Machines
 - ☒ Is current machinery adequate? Optimal?
 - ☒ Where are they located?
 - ☒ Do we have obsolete equipment in the area?
 - ☒ Is there a defined maintenance program and schedule?
 - ☒ Is time allowed for proper equipment maintenance?
 - ☒ Do you have a daily 5S clean and inspect procedure?
- People
 - ☒ Are special personnel needed?
 - ☒ How many?
 - ☒ What specific skills are needed?
 - ☒ Do you have people cross-trained at each position?

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- Methods

- ☒ What methods do we use?
- ☒ Do you have visual work instructions for every operation?
- ☒ Are files (or work) awaiting excessive signatures or approvals?
- ☒ Are files awaiting task completion by others?
- ☒ Do we have any obsolete files in the area?
- ☒ Do we have data entry errors?
- ☒ Do we have standardized pricing, quoting, billing, or coding?
- ☒ Do we forward partial documentation to the next process?
- ☒ Do we ever lose files or records?
- ☒ Do we ever encounter incorrect information on a document?
- ☒ Are methods easy to understand, learn, and use?
- ☒ How do we train our staff?
- ☒ Does poor performance signal a requirement for retraining?

- Measurements

- ☒ What measures do we use?
- ☒ Are there clear strategic measures?
- ☒ Do all tactical process measures “roll up” to strategic measures?
- ☒ Are all of these measures performance based?
- ☒ Any dead cost measures?
- ☒ Do we have key process input (KPI) measures?
- ☒ Do we have key process output (KPO) measures?
- ☒ Do we have good in-process measures?

Figure 1.8 • Defect detection questions.

WASTE 4: EXTRA PROCESSING

Processing waste is described as any effort that adds no value to the product or service from the customers' viewpoint. These are steps that may not be necessary. Many examples of processing waste are present in any product or service delivery. For example, let's consider a product with 15 steps. If a sub-assembly at process step 3 is not assembled correctly, the product moves through the facility and the problem is initially detected at assembly step 13. Unfortunately, steps 5, 7, 9, and 11 may need to be disassembled and the correction made before step 13 can proceed. These

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repeated steps are rework and take valuable time away from employees who could be working on new products. This extra effort is called processing waste.

What Causes Processing Waste?

Processing waste can stem from many sources and is often present regardless of the activity type. Processing waste is predominantly waste that is found in front-office areas, such as order processing, information gathering and dissemination, and all accounting functions. It is also dominant in service industries where service-delivery requirements may be ill-defined or difficult to achieve. Industries like the medical field, janitorial, or food-service industries may have extensive processing waste from several apparent causes. These causes can be classified into a few basic areas listed below. Each is followed by a brief description.

- Product changes without process changes
- Just-in-case logic
- True customer requirements undefined
- Over-processing to accommodate downtime
- Poor communication
- Redundant approvals
- Extra copies/excessive information

Product Changes without Process Changes

When a product or service is changed, production staff or service personnel need to be properly informed. For example, visual work instructions or service-delivery instructions need to be modified and training conducted for the new process. In many growing companies, products or services are changed frequently, often with little or cursory regard for production or service-delivery personnel. This can be a major source of processing waste for a range of product or service quality issues.

Just-in-Case Logic

Just-in-case logic is exactly what it sounds like. You make more product just-in-case—you fill in the blank, for example, just-in-case the machine breaks down, just-in-case your suppliers don't send enough raw materials, just-in-case your customer orders more than you can make or deliver on time, etc. There are many reasons for using just-in-case logic, and they all contribute to decreased company profitability! Just-in-case logic is a primary cause for over-processing waste.

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True Customer Requirements Undefined

When customer requirements are poorly understood or not documented properly and employees are not adequately trained on requirements, extra processing is bound to occur. AN LSS process starts with a clear fundamental understanding of customer requirements. This typically involves a critical to quality (CTQ) assessment and definition of all product or service requirements from the customer standpoint.

Over-processing to Accommodate Downtime

In traditional organizations, one belief is that people must be busy on production at all times. Consequently, managers order people to produce products even when none are required by a downstream customer. This results in over-processing and creates overproduction and excess inventory. Alternatively, this time should be used for additional LSS training, cross-training programs, or other continuous improvement activities.

Poor Communication

Poor communication is typically one of the top reasons that organizations lose effectiveness. Communicating information along the entire value stream is critical for a great customer experience. The earlier in any process that the communication breaks down, the worse is the resulting waste. A typical communication cycle includes:

- Identifying critical to quality (CTQ) customer requirements
- Transitioning customer requirements into product or service specifications
- Engineering the product or service
- Creating instructions for producing the product or service
- Product or service delivery to the customer

Redundant Approvals

Although there is a need to have some cost and quality control approvals in any process, it is easy to stifle the process by requiring redundant approvals that can dramatically increase lead time and increase total product cost. After reviewing many approval procedures over the years, this has been identified as a significant example of extra processing.

Extra Copies/Excessive Information

Information sharing can be a significant source waste. How many reports are printed and not read? If they are read, how many items are actions taken on? Then there are charts, graphs, memorandums, e-mail distributions, etc., leading to information overload for employees. One example is what can essentially be described as the e-mail soap opera. The saga begins with one controversial statement or aspect that

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8. Having a direct impact to the bottom line, quality defects resulting in rework or scrap are a tremendous cost to most organizations. Associated costs include quarantining inventory, re-inspecting, rescheduling, and capacity loss. In many organizations the total cost of defects is often a significant percentage of total manufacturing cost.

was sent to too many employees. It quickly evolves into long series of clarifications and reclarification e-mails, with each e-mail raising more questions than it answers. These types of e-mail dialogues rapidly consume significant employee time and energy of everyone involved.

How to Identify Processing Waste

The learning to see processing waste checklist presents some basic questions to uncover process waste⁸. (See [Figure 1.9](#).)

WASTE 5: WAITING

Waiting waste is often described as time waiting for something to happen or occur. This could be human waiting time, machine waiting, or materials waiting to be processed. When this waste occurs, ultimately it is the customer who is left waiting as lead times expand to accommodate the numerous waiting steps in your processes.

What Causes Waiting Waste?

Waiting time waste may be caused by several sources. Some examples include materials conveyance delays, machinery or equipment breakdowns, operators working too fast or too slow, and an insufficient number of employees, to name a few.

Waste of Extra Processing Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Is there visible rework being conducted?			
Do we measure the amount of rework?			
Do we collect data on labor and materials associated with rework?			
Are we duplicating reports or information?			
Are we entering repetitive data?			
Do we have many forms with duplicated data?			
Are we doing more work than is required for that process?			

Figure 1.9 • Waste of extra processing checklist.

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Causes of waiting waste include:

- Raw material outages
- Unbalanced scheduling or workloads
- Unplanned downtime for maintenance
- Poor equipment or facility layout
- Long process setup times
- Misuses of automation
- Upstream quality (flow) problems

Raw Material Outages

A prevalent root cause of waiting waste is raw material outages. Poor purchasing practices or purchasing measures can often lead to inadequate raw materials' inventories. Without raw materials you cannot add value for your customers and you bear all the material-related liability. For example, if you make a product that has 25 components and you are out of 2, you cannot build your product. However, you have the inventory carrying costs for the 23 components in stock. In addition, allowing outages to occur almost guarantees some of the other wastes, such as overproduction and extra processing. You cannot build the entire product, so you start building parts, and soon mountains of incomplete sub-assemblies begin to appear around the facility as work-in-process (WIP). Raw materials outages and management can be an LSS project focus topic.

Unlevelled Scheduling and Unbalanced Workloads

Similarly with overproduction, unlevelled scheduling and unbalanced workloads can both lead to the waste of waiting. These conditions typically occur in forecast-driven environments. In areas where the workload is not balanced properly between two or more process steps, one step will have excess capacity while the next may have excess demand. In the end, you wind up with equipment, materials, and/or manpower waiting.

Unplanned Downtime for Maintenance

When a machine breaks down unexpectedly, there is a significant opening for the waste of waiting. In addition, during the waiting period overproduction or extra processing can follow when management decides the result of finding things for employees to do until the equipment is back on-line. These extra activities are often viewed as steps that would be necessary to complete and not as waste. However, as shown in overproduction and extra processing, these are truly wastes and should be measured and subsequently eliminated.

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Poor Equipment or Facility Layout

Equipment placement and facility layout are primary sources of the waste of waiting. The position of equipment within a facility is frequently decided based upon (1) shortest run from electrical service, (2) currently open floor space, and (3) a position near similar equipment, or in an expansion location. None of these criteria are based upon a proper manufacturing sequence or limiting any of the nine wastes. Poor equipment and facility layout can result in significant motion, transportation, and waiting wastes.

Long Process Setup Times

When the time to change equipment over to a different product is long, this can be a contributor to the waste of waiting. Although long process setup times can vary depending on the equipment and complexity of the transition, process setups are necessary for most equipment. Every minute, hour, or day consumed by setup is time permanently lost to waiting and contributes to lower productivity and profitability.

Misuse of Automation

A common mistake that owners or managers often make is that they want to see expensive equipment running, not sitting idle. This misuse of automation can cause the waste of waiting. Not very often does customer demand exactly meet machine capacity. One of the most difficult challenges for LSS practitioners is to change the misconception that the machine must always be running. In environments where there is a combination of automated and manual production, the misuse of automation at one process step creates the unlevelled scheduling and unbalanced workloads at downstream process steps.

Upstream Quality (Flow) Problems

Product quality issues can lead to a number of wastes. Two prominent wastes are extra processing and waiting. In the case of many complex products that contain sub-assemblies, as soon as quality issues are uncovered upstream, remaining downstream steps are caught in a waiting game for completed quality sub-assemblies. Every process step should target 100% first-pass quality.

How to Identify Waiting Waste

Waiting waste can be present across the entire value stream. Regardless of the reason for the waste of waiting, the objective of learning to see is to identify where and when in the process waiting waste occurs. The checklist in **Figure 1.10** is an effective tool to identify where, when, and how the waiting waste is occurring in a process.

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Waste of Waiting Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Is work delayed from a previous process?			
Is there misuse of automation?			
Do you have unbalanced workload?			
Do you have unlevelled scheduling?			
Are there materials shortages?			
Do you have absenteeism—too few workers?			
How about too many workers?			
Are there frequent unexpected machine downtimes?			
Is your facility layout effective?			
Do you have upstream product quality issues?			
Do you have long process setups?			

Figure 1.10 • Waste of waiting checklist.

WASTE 6: MOTION

Waste of motion occurs when there is any movement of people or information that does not add value to the product or service⁹. The ultimate objective in an LSS organization is to properly connect materials, machines, man/woman power, and methods. When this is achieved, there is a state of continuous flow. Continuous flow is often credited with the highest levels of quality, productivity, and profitability. Wherever there are disconnects between two entities, for example, materials and people, the waste of motion is inevitable.

9. This waste is related to ergonomics and is seen in all instances of bending, stretching, walking, lifting, and reaching. These are also health and safety issues, which in today's litigious society are becoming more of a problem for organizations. Jobs with excessive motion should be analysed and redesigned for improvement with the involvement of plant personnel.

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What Causes Motion Waste?

There are many possible causes for the waste of motion. Some of the major sources are:

- Poor people, materials, and machine effectiveness
- Inconsistent work methods
- Poor information management
- Unfavorable facility or cell layout
- Poor workplace organization and housekeeping

Poor People or Machine Effectiveness

Employee interactions with materials and machinery may result in the waste of motion. This happens when employees have to walk distances to pick up or deliver materials by hand. It can also occur when information must be hand delivered from one process step to another. One example may be delivering a completed order back to accounting to complete the billing cycle. Another example may be delivering a completed order to shipping for scheduled delivery.

Inconsistent Work Methods

Whenever work methods are not documented properly, a number of inconsistent and poor practices slip into any process. The best counter to inconsistent work methods is the creation of standard operating procedures or visual work instructions. These become the foundation of all effective employee training programs. In their absence employee learning occurs through the passing down of “tribal knowledge” known only to “experts” in your organization. Learning that occurs under these conditions is open to interpretation by the employee on “what to do next” or “how to do” specific activities in the process. This frequently results in several employees doing the exact same activity differently. Inconsistent work methods not only result in the waste of motion, but also are frequently the root cause of product- or service-delivery quality issues.

Poor Information Management

The transition of information between employees, departments, and customers often leads to the waste of motion. Information management systems that are not set up to make required information available to employees when and where it’s needed often results in employees doing printouts and manual document transfers around the organization. As with many wastes, the waste of motion can also cause several other wastes. For example, when shipping instructions for a specific customer are not completely defined in the information management system, an employee in shipping must stop to track down the proper information, which can require going to order

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processing or customer service to obtain the information. This initial waste of motion produces the waste of waiting and the waste of extra processing before the order can be properly shipped.

Unfavourable Facility or Cell Layout

If the facility layout is weak, the waste of motion will be present. By facility we mean any department in an organization, wherever value is created for the customer. The layouts of administrative areas, such as order processing, customer service, accounting, and warranty claims departments, are seldom considered as areas where waste can occur, but often are significant sources for the waste of motion. This is due to the frequent manual transportation of documents necessary in these areas, as well as an inordinate amount of information exchange required to produce your product or service.

In a production environment poor facility layout results in excess waste of motion regarding moving raw materials in a position to add value, securing tools and fixtures, or delivering materials to the “next process step.”

Poor Workplace Organization and Housekeeping

It never ceases to amaze me how little attention is paid to workplace organization and housekeeping. Managers would rather employees spend hours searching for tools, materials, documentation, etc., than allow 30 minutes/day to maintain an organized work area. This philosophical fixation that every employee activity must be producing product is responsible for many of the wastes observed in organizations today. Every day managers can walk by piles of obsolete materials, in-process rework, and mountains of defective warranty returns, while continuing to allow no time for employees to correct the conditions that produced these results. All process improvement programs begin with workplace organization and housekeeping.

How to Identify Motion Waste

Motion waste can be present across the entire value stream. Regardless of the reason for the waste of motion, the objective of learning to see is to identify where and when in the process motion waste occurs. The checklist in **Figure 1.11** is an effective tool to identify where, when, and how the motion waste is occurring in the process.

WASTE 7: TRANSPORTATION

Transportation waste is any activity that requires transporting parts and materials around the facility. Unlike motion waste that typically involves only people,

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Waste of Motion Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Are all materials where needed?			
Do you have the proper material quantities?			
Are materials specifications correct?			
Are tools in good working order?			
Are all tools available?			
Is order documentation complete?			
Is shipping information complete?			
Do you have to search for files on the computer?			
Are you searching for documents in file cabinets or drawers?			
Are you hand-carrying paperwork to another process or department regularly?			
Are you constantly reviewing the same manuals for information?			

Figure 1.11 • Waste of motion checklist.

10. Transporting product between processes is a cost incursion that adds no value to the product. Excessive movement and handling cause damage and are an opportunity for quality to deteriorate. Material handlers must be used to transport the materials, resulting in another organizational cost that adds no customer value. Transportation can be difficult to reduce due to the perceived costs of moving equipment and processes closer together. Furthermore, it is often hard to determine which processes should be next to each other. Mapping product flows can make this easier to visualize.

transportation waste is usually reserved for action involving equipment to move materials or parts¹⁰. This equipment comes in many forms, such as carts, rolling racks, forklifts, golf carts, and bicycles, to name a few.

What Causes Transportation Waste?

Transportation waste can be caused by a number of factors. The major causes are:

- Poor purchasing practices
- Large batch sizes and storage areas
- Inadequate facility layout
- Limited understanding of the process flow

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Poor Purchasing Practices

The largest contributor to transportation waste is poor purchasing practices. Many organizations measure their purchasing effectiveness on the dead cost/piece for raw materials purchased. This can lead to incredible waste throughout the organization, not just transportation waste but also the waste of overproduction, inventory, extra processing, and defects.

Let's consider a real-world example to demonstrate how non-Lean measures can drive non-Lean behaviour within an organization. Let's say your organisation has a program in place to drive the cost of raw materials down and John's, the purchasing department manager, bonus is dependent on a 10% reduction in raw materials costs. He has his heart set on that 60-inch plasma TV with surround sound installed before football season, so consequently he sees little else except achieving the dead materials cost reduction.

John begins to think: How can he achieve this predefined material cost reduction? Two actions immediately come to mind; both are non-Lean. First, he can go to current suppliers and try to get price decreases. These decreases usually require that the organization buy in larger volumes, which he does immediately. In fact, at the next manager's meeting John is eager to get a pat on the back from the boss and reports that he has secured a 3% material cost reduction in the first month of the program; the unnecessary raw materials, along with the corresponding inventory and transportation waste, begin to show up in receiving the very next week.

Second, he can search for secondary suppliers that are willing to provide supposedly equal raw materials. At first glance they appear to be equal in every way—specification, function, and quality. He begins to substitute some of these raw materials and again achieves more raw materials cost reductions that are, of course, well received by management. John achieves his bonus and spends Sunday afternoons in bliss with his favourite beverage and gridiron action—an apparent happy ending. Not so fast. In the next few weeks during production, some inconveniences arise because the new materials aren't exactly like the original parts. This leads to some in-process defects that require rework or the waste of extra processing. In addition, weeks later returns begin from customers for poor product service in the field.

Because the sales price is based upon typical labour standards, these extra production costs and warranty return costs don't appear on management's radar and consequently don't exist. Only after months, when management realizes the

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shrinking profit margins, does another costly search for the reasons begin. This is a classic non-Lean example of how non-Lean traditional measures can drive non-Lean behaviour. In this case, what did John learn to see? Certainly not the waste! His behaviour was being completely driven by his measurement system.

Large Batch Sizes and Storage Areas

The waste of transportation can also occur when you process large batches of product or set up large storage areas. Both of these decisions require that the materials be moved at some time. These moves invariably require people (materials handlers) and equipment (forklifts, carts, pallet jacks, flatbeds, etc.). This situation is almost always the symptom of a poor purchasing decision that was based upon a non-Lean traditional management belief that organizations save money when they buy large batches of materials.

Inadequate Facility Layout

One of the primary causes of transportation waste is poor facility layout. Where you place equipment, how and where your materials storage areas are set up and regularly accessed, and your organization's purchasing philosophy all affect productivity and profitability. Proper facility layout can reduce lead time by up to 40%, and dramatically reduce the waste of waiting, transportation, and motion.

Limited Understanding of Process Flow

In every process there needs to be a thorough understanding of the materials, machines, man/woman power, or methods required to add value for the customer. A primary component of Lean—and a constant goal for LSS practitioners—is continued process development and deeper understanding of process knowledge. It is important to understand the best sequence of process steps to meet customer demand, such as: How are activities conducted? How fast is product needed? Where do materials get consumed? What are the fluctuations in manpower requirements? Is the correct type of equipment available? Is the equipment in working order? Having well-defined answers for these factors contributes to improved process understanding.

How to Identify Transportation Waste

The learning to see transportation waste checklist presents some specific questions that can help you uncover transportation waste. (See [Figure 1.12.](#))

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Waste of Transportation Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Are materials moved between buildings?			
Do you make large batches?			
Do you buy bulk raw materials?			
Do you have lots of forklifts?			
Do you have many other types of transportation equipment?			
Are materials stored long distances from where they are used?			
Are there multiple temporary storage areas?			

Figure 1.12 • Waste of transportation checklist.

WASTE 8: UNDERUTILIZED EMPLOYEES

The waste of underutilized employees often occurs when we fail to recognize and harness people's mental, creative, innovative, and physical skills or abilities. This is present to some extent in almost every company, even organizations that have been practicing Lean behaviours for some time. Much of this employee misuse stems from the management concepts previously discussed regarding traditional organization belief systems.

Although many Western managers pay lip service to "our employees are our most valuable asset," they are the first to philosophically look at employees as a liability, not an asset. Many are often quick to practice management by head count—this is the practice of stating that we will operate with a specific number of employees regardless of the number required to provide good performance for the customer.

What Causes Underutilized Employees Waste?

There are a number of causes of underutilized employees or people waste. Each of these stems from some aspect of traditional belief systems.

- Old guard thinking, politics, the business culture
- Poor hiring practices
- Low or no investment in training
- Low-pay, high-turnover strategy

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Old Guard Thinking, Politics, and Business Culture

Old guard thinking, politics, and general business culture often stifle using employees' creative skills or producing innovative assignments that could result in significant process improvements. Unfortunately, in many organizations an employee's perceived importance to the organization is generally directly proportional to his or her salary or directly linked to his or her title. This is common in the United States and seldom seen in Japanese companies.

Poor Hiring Practices

Most human resource departments are faced with the difficult task of how to attract and retain skilled employees. Poor hiring practices usually stem from the structure of the department and management's mandate for critical components of the hiring process, such as pay level, required skills, or required experience. All of these could hinder getting the best candidate for the position.

There are many factors that can go into poor hiring practices. A few common mistakes include:

- Inadequate job advertisements
- Position definition
- Nepotism
- Not matching skills to position requirements
- Not understanding the technical aspects of job requirements
- Inability to identify the skills necessary to add value to a position

Low or No Investment in Training

Good data on training time, although readily available from many sources, is often difficult to translate to an organization. The American Society for Training and Development (ASTD) puts the dollars per year per employee at about \$1,400. For a \$40,000/year employee, this equates to about 3.5% of annual salary. It has been cited in the literature that top-performing companies spend approximately 4 to 6% of annual salary on training. It has also been reported that average American companies spend less than 5% on employee training. LSS organizations often approach 10%, with 3 to 4% of annual salary direct spending on new training and 6% employee time committed to improvement activities.

All companies tend to view training differently. One observation is unavoidable—poor-performing companies tend to invest little or nothing in training, while higher-performing organizations invest in training and focus on process improvement.

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Low-Pay, High-Turnover Strategy

Another common trait of traditional organizations is the “low-pay, high turnover rate” philosophy. This is characterized by hiring to a specific hourly or salary level regardless of skills, and living with the performance that pay rate returns. Because the conditions are poor, employees either leave to pursue a better opportunity or are let go by the company for myriad reasons. This is an internally focused philosophy and completely ignores the voice of the customer.

How to Identify Underutilized Employees Waste

The learning to see underutilized people checklist in **Figure 1.13** points out some questions you can use to assess your current employee utilization and expose some apparent causes for lack of effective employee use.

Waste of Underutilized Employees Checklist			
Process:	Date:		
Description	Yes	No	Apparent Cause
Do we know the true experiences and capabilities of our employees?			
How easy is it to move employees to special assignments?			
Is your process so fragile that employees cannot be assigned to special projects?			
Are employees in positions they were trained to do?			
Is there active improvement-idea generation from all employees?			
Are employees allowed to experiment with process improvements?			
Can employees assist in other areas as needed?			
Do managers place obstacles or restrictions on employees?			
Are employees empowered to take action in their area?			
Is there a “can’t do” atmosphere?			
In there a “can do” atmosphere?			

Figure 1.13 • Waste of underutilized people.

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WASTE 9: BEHAVIOUR

Behaviour waste is any waste that results from human interactions. It is present to some extent in all organizations. It can be minimal in truly LSS organizations; however, it can be pervasive and devastating in traditional organizations. Behaviour waste naturally flows from an individual's or a company's inherent beliefs. "The concept of waste has not yet been effectively extended to the self-defeating behaviours of individuals and groups of people in the workplace." (Emiliani, 1998)

Behaviour waste is a root cause of the other eight common wastes. Many of the previously described wastes alluded to employee beliefs and behaviours as causes for waste generation. The identification and elimination of behaviour waste is critical to any successful LSS initiative.

How to Identify Behaviour Waste

Behaviour waste is classified as either personal (yourself) or people (between two or more employees). Identifying these behaviour wastes in your organization is the first step to elimination of this disruptive waste.

Personal Behaviour Waste

Personal waste is waste that comes from within oneself. It stems from the way you view yourself, your goals and objectives, or possibly your position in the organization. Oftentimes personnel who prefer a Theory Y organization (empowered-employee environment) and are working in a Theory X organization (command and control environment) feel underappreciated. As a consequence, they become an underutilized employee and can exhibit low morale. The personal waste they generate comes directly from their individual belief system. Gossip, self-imposed barriers, deceptions, and ego are a few of the many examples of personal waste.

Personal waste has been described as the little voice inside your head that provides constant running (negative) commentary. It can control an employee's inability to suspend judgment and projects unresolved internal conflicts of the employee. It does not take much personal waste to bring continuous improvement to a screeching halt. In fact, personal waste will restrict process improvement and Lean deployment at any process step that touches this employee, which is basically your entire value stream.

People Behavior Waste

People waste has to do with relationships between fellow employees. This includes between department managers and senior managers, as well as the manager-

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employee relationship. Some categories of people waste include turf wars, fiefdoms, or politics. Some specific examples of what people say when they are exhibiting people waste are:

- “Bill’s initiative is so stupid!”
- “Forget about what Jane says!”
- “John is impossible to work with!”

One can see how personal waste, when coupled with people waste, can stifle all process improvement.

SUMMARY

Learning to see variation and waste is a critical first step to improving quality, productivity, and profitability. Only after employees begin to learn to see waste and variation with new eyes can they identify previously unnoticed waste in the organization and effectively begin to eliminate the sources of waste and variation.

Processes add either value or waste to the creation of goods or services. The seven wastes originated in Japan, where waste is known as *muda*. The eighth waste is a concept tool to further categorize *muda* and was originally developed by Toyota’s chief engineer Taiichi Ohno as the core of the Toyota Production System, which also became known as Lean Manufacturing. The ninth waste—behaviour waste—is by far the most damaging of all the wastes. The reason is simple: *Everything we think, everything we say, and everything we do* shape the behaviour of all employees in our organization and gets them going in a direction of either creating value for the customer or creating waste.

To eliminate variation or waste in a process, it is important to understand exactly what waste is and where it exists, and to clearly view, measure, and limit variation. While activities can significantly differ between factories and the office workplace may seem to be a different world, or in service organizations where the product is actually a service, the typical wastes found in all these environments, and in fact in all business environments, are actually quite similar. All forms of the nine wastes are highly costly to an organization because waste prohibits the smooth flow of materials and actually degrades quality and productivity. The Toyota Production System mentioned in this chapter is also referred to as just-in-time (JIT) because every item is made just as it is needed. Conversely, overproduction is referred to as just-in-case. This creates excessive lead times, results in high storage costs, and makes

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it difficult to detect defects. The simple solution to overproduction is turning off the tap; this requires a lot of courage because the problems that overproduction or behaviour wastes are hiding will be revealed. The concept is to schedule and produce only what can be immediately sold and shipped and improve machine changeover/setup capability.

For each waste, there is a strategy to reduce or eliminate its effect on an organization, thereby improving overall performance and quality, while at the same time lowering costs. Learning to see is all about learning to use these strategies and tools in a productive manner.

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CHAPTER

2

REDUCING COSTS, NOT SERVICES, BY ELIMINATING WASTE AT THE BRITISH LIBRARY

REDUCING COSTS, NOT SERVICES, BY ELIMINATING WASTE AT THE BRITISH LIBRARY

In the early 2000's the British Library realised that it faced a challenge. The world was turning to online information sources, so fewer people had need of its Document Supply services. However, the Library's legal obligations and the expectation of its existing customers meant the service needed to continue, meaning a fundamental review was needed to balance the Library's financial position and account for the reduction in demand. A Lean project was initiated to improve efficiency and put in place a sustainable business model, starting with an unusual step: employing somebody from a Japanese car parts manufacturing company.

Andrew Appleyard had worked for a member of the Toyota Group for thirteen years before being appointed by the British Library. His experience was in managing production operations and his appointment signalled a change in the types of skills that the librarians and support staff would need. The Library's Document Supply and Digitisation processes were just that: processes. This meant that they—along with much of the other work the Library team were doing—could be optimised in exactly the same way as a manufacturing process. One of the most important ways of optimising those processes was removing waste. Working with the teams in the Library's Boston Spa facility Appleyard, began identifying and eliminating a whole range of different forms of waste, covering *muda*, *mura*, and *muri*.

TACKLING DIFFERENT KINDS OF *MUDA*

One of their first projects was a reduction in a type of excess inventory, one of the nine categories of *muda* introduced in Chapter 1. Further, it was a type of inventory that definitely fell under the "Non-Value Add" heading: cardboard boxes. Six store rooms at the library had to be set aside permanently just for the packaging materials required to ship collection items. Bespoke boxes were brought in from Eastern Europe two or three times a year and each shipment had to last all the way through until the next. Appleyard and his colleagues converted to standard box sizes supplied by an organisation in Wakefield, just down the road in Yorkshire from the British Library's Boston Spa base. They could deliver new boxes as soon as the team were about to run out, a concept known in Lean as Just in Time supply, so much less packaging needed to be stored at any one time and it could all be kept by the side of the production line in what is known as a *Kanban*¹¹. This freed up 500m² of much-needed warehouse space, reduced packaging costs, and had an additional environmental benefit.

11. For more information on Kanban systems Just in Time see Chapters 4 and 7 respectively of *The Lean Six Sigma Black Book Handbook*

REDUCING COSTS, NOT SERVICES, BY ELIMINATING WASTE AT THE BRITISH LIBRARY

The *Kanban* system was also applied to other consumable inventory, including stationery. Appleyard and his team realised that more space than necessary was being taken up at the Boston Spa building by stationery, as large orders were being placed “just in case” things ran out. *Kanban* works on the principle that where you have repeat orders and can dedicate a location to each individual item, then complex ordering systems and duplicated stores can be removed by a simple “top up” approach. Implementing a *Kanban* system has moved the British Library from “just in case” inventory holding to “just in time” restocking, because they now know exactly when any item is about to run out and can replenish the *Kanban* before that happens.

Reviewing the efficiency of existing processes also helped the Boston Spa team to tackle another form of *muda*, excess motion. As is the case with many service providers the Document Supply team constantly strove to reduce the time it took to satisfy an individual customer’s requests. This meant that each request was processed when it arrived, so when demand was high the same part of the Document Supply process was repeated many times over in a single day. By designing a process that allowed requests to be batched together Appleyard and the team reduced the number of retrievals workers had to make from the shelves—an efficiency they demonstrated with pedometers. Not only did batching up requests like this save time, it also saved workers’ energy in an easy-to-demonstrate way. And because they were spending less time on walking for each order the team discovered that during busy periods they were able to process more requests per day than before, hitting their delivery targets and keeping their costs down and customers happy.

However, one of the most successful cost reduction projects was the mothballing of the building that previously housed their Cataloguing team. Staff from that team were co-located alongside related operational teams in another building, eliminating some over-processing—another form of *muda*. When faced with having to close a building most companies would do the same thing: shuffle teams around to make space for the people moving and keep all those people together because they used to sit together. The British Library took a different approach. Rather than moving the Cataloguing team wholesale they worked out exactly where each person fitted into the flow of their process, locating them next to the people before and after them in that process. This eliminated disconnects in the library’s cataloguing process while saving around £56,000 in building maintenance and utility costs. It also improved the overall flow of the library’s processes, bringing benefits to the whole team.



REDUCING COSTS, NOT SERVICES, BY ELIMINATING WASTE AT THE BRITISH LIBRARY

TACKLING *MURA*

Another major project for the British Library aimed to eliminate *mura*, waste due to unevenness in operations. As mentioned before, their Boston Spa facility is spread over seven floors in one building. Like in many companies, demand varies throughout the year in different ways for each team, who are based on different floors. Previously, this meant that while one floor was a hive of activity with teams working overtime another might be quiet, with people who have little to do. This was compounded by the fact that different processes were used on each floor and each had a different layout, making it difficult for people to transfer and to find their way around. Appleyard's team standardised every aspect of the building that they could: equipment, layout, furniture, and processes. They then—after much careful conversation with the relevant trade unions—retrained some staff so that they were multi-skilled. This meant that as demand shifted between teams the people in those teams could move to match that demand profile. As people had the skills to work in multiple roles and as they were in a familiar environment even when they had to move to a different floor they could execute their demand-filling roles easily and with little delay.

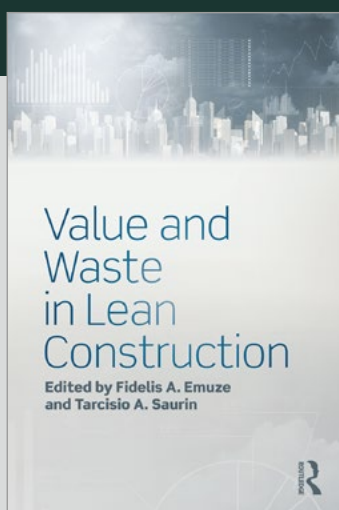
SUMMARY

All this waste identification and elimination has helped Appleyard and the rest of the team at the British Library reduce costs without reducing the service levels they offer or customer satisfaction. Indeed, they have even managed to deploy these improvements into other areas, scaling up the Digitisation operation enough to start offering the service to other organisations. All of which goes to show that while the ideas of *muda*, *mura*, and *muri* were originally conceived to describe wastes experienced in manufacturing, all three are very much applicable to libraries, and that eliminating each of them can help to reduce costs without reducing value to patrons.

CHAPTER

3

WASTES AND *GENCHI GENBUTSU*: THE IMPORTANCE OF 'GO AND SEE FOR YOURSELF' TO PROJECT VALUE



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Value and Waste in Lean Construction

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WASTES AND GENCHI GENBUTSU

THE IMPORTANCE OF 'GO AND SEE FOR YOURSELF' TO PROJECT VALUE

Bolivar A. Senior and Brad Hyatt

Excerpted from *Value and Waste in Lean Construction*

An essential element of lean management is the insight that the best way to get a meaningful understanding of a problem is personally going to the place where action is taking place to observe the situation. This principle is called *genchi genbutsu* in lean management, and the management tool of deliberately observing the situation at hand is a *gemba* walk. This chapter discusses the origin, purpose and implementation of *genchi genbutsu* and *gemba* walks.

3.1 BACKGROUND

General Dwight Eisenhower said that 'Farming looks mighty easy when your plough is a pencil, and you're a thousand miles from the corn field' (Eisenhower Presidential Library, n.d.). In other words, be there if you want to truly understand your project. Lean construction (LC) recognises the wisdom of this adage. The Last Planner System (LPS) (Ballard, 2000), for example, is centred on the input of field personnel who are in the best position to understand the problems and opportunities of the project. LC, in turn, aligns with the principles of the Toyota System and lean management in general, which also acknowledges the importance of personal presence to assess and provide solutions to management problems.

3.1.1 CONCEPTS AND VOCABULARY: *GENCHI GENBUTSU*, *GEMBA* AND GOING TO *GEMBA*

Jeffrey Liker recounts in his pivotal book, *The Toyota Way* (2004), that when he asked Toyota employees who he interviewed what distinguished the Toyota Way from other management approaches, 'the most common first response was *genchi genbutsu*', regardless of the employee's position in the company. Toyota Motors identifies *genchi genbutsu* as one of the four high level principles in the internal document used for employee training. In Japanese, *genchi* means 'actual place' and *genbutsu* means 'actual thing'. The combination of the two words is frequently translated as 'going to the place to see the actual situation for understanding' (Liker, 2004). The term *genchi genbutsu* is, thus, richer than the two words in isolation.

Gemba is another key word for lean management. It can be translated from the Japanese as 'the real place' or 'the actual place'. It is a relatively common word in Japan. After an earthquake, for example, an on-site TV crew may say that they are 'reporting from the *gemba*', meaning to be reporting from where the action is (Imai, 1997). In lean management, *gemba* refers to the place where value is actually created, such as the shop floor in a car manufacturing assembly. The *gemba* of a

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construction project from its owner's perspective are the points at which the project is actually built, all other places and steps being of importance to the contractor.

Gemba is increasingly used as synonymous to *genchi genbutsu*, especially when used as 'going to *gemba*'. This chapter uses 'going to *gemba*' and '*genchi genbutsu*' interchangeably, both referring to going to the source to find the facts to make correct decisions, build consensus and achieve goals (Toyota Material Handling Europe, n.d.). These and other Japanese words and expressions are used throughout the rest of this chapter, instead of their translations. As in other areas concerning lean management, keeping the original Japanese terms conveys more accurately the concepts originated in the Toyota Production System (TPS) than do their translated versions.

10.2 ORIGINS AND CURRENT USE

Firsthand observation has been part of lean management from its origin, especially as viewed by Taiichi Ohno, a pivotal figure for the TPS. An anecdote attributed to Mr Ohno (Wakamatsu, 2009) recounts that he asked a young engineer to draw a circle with chalk at a spot on the Toyota shop floor and to stand in the circle. The engineer stood for hours in the circle until the end of the day (Ohno scolded the engineer for briefly leaving the circle to go to the restroom). At the end of the day, Ohno asked the engineer: 'Have you figured it yet?' to which the baffled engineer answered: 'I have no idea.' Ohno made the engineer stand in the circle again the next day. At lunch, Ohno asked him again: 'Have you figured it yet?' The engineer responded: 'Yes, there's a problem.' Ohno was not indulgent with the engineer: 'You told me that you had continuously improved the shop floor but it has gotten worse because of your instructions! If you know what the real problem is now, go and fix it right away.'

The anecdote encapsulates the essence of going to *gemba*. The engineer had to see the shop floor with his own eyes and from close up. The problem was discovered and the answer was figured out by the engineer. The understanding of the problem and the proposed solution were part of the same thought process. In addition, the engineer learned many lessons, not only about the shop operation, but also about the self-directed essence of true problem solving – and Ohno's famed propensity for unadorned speech. Examples of *genchi genbutsu* go further than Ohno's practical lesson. A frequently cited example from Toyota (e.g. Padgett-Russin, 2003; The *Economist*, 2009) concerns the redesign of the 2004 Toyota Sienna. Yuji Yokoya, the engineer charged with the redesign, went to the *gemba*. He drove 53,000 miles across North America and figured insights that would be difficult to obtain if not by direct

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experience. Among other issues, he realised that Canadian roads have higher crowns in the mid-section than in Japan, probably to deal better with the large amounts of snow in Canada; that winds in Mississippi were very strong and demanded special attention to car stability; and that eating and drinking while driving is common in North America. Each discovery provided an opportunity for improvements in issues such as the minivan's drive handling, geometric proportions and 14 cup holders and a food mini-tray, among others. It is doubtful whether Mr. Yokoya would have been able to detect these issues by indirect information means alone. It is also arguable that he might have not appreciated their significance if someone had simply told him about them.

The usefulness of 'going to *gemba*' is manifested in many other circumstances. For example, New York Police Department Commissioner William J. Bratton used the concept to turn around the New York Transit Police in 1990. As reported by Abilla (2007), Bratton discovered that none of the senior staff officers rode the subway. To make officers aware of the safety concerns at the time, he required them to ride the subway to work, meetings and at night. The firsthand 'go to *gemba*' experience has been credited with helping to improve the approach to policing the subway and the substantial improvement in riders' safety that the city has enjoyed since the 1990s.

10.3 HOW TO GO TO GEMBA

A *gemba* walk is not a stroll by the project, and not even a project walkthrough to assess its status. It has the basic objective of understanding reality through direct observation and checking information first-hand. Going to *gemba* requires an understanding of the operation being observed and the skill to meaningfully observe it. There is no single, cut-and-dried way to perform a *gemba* walk. Toyota Chairman Fujio Cho summarised the process of going to *gemba* most concisely by three principles: '(1) go see, (2) ask why and (3) show respect' (Shook, 2011). These principles have been interpreted and applied with different emphases, depending on the industry context. The following steps have been discerned from Mr. Cho's principles and successfully applied (Shook, 2011). Despite the subjectivity of a *gemba* walk, there are best practices that can be summarised as follows (Flinchbaugh, 2011):

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- *Identify your purpose.* A *gemba* walk is performed to learn something about the situation at hand. If these two basic questions cannot be answered, the walk should not start in the first place: (1) Why are you observing the *gemba*? (2) What are you trying to learn from your walk?
- *Know your gemba.* The typical construction customer realises value at the project, and there is a natural tendency to equate *gemba* with project. But, the *gemba* of a particular situation can be elsewhere. Physical, direct observation is the key, for example, to understanding the interaction among subcontractors or the dynamics underlying a problematic material supplier.
- *Observe with a framework.* Now that you are at the *gemba*, are you capable of visualising the operations and their flow? Can you see the flow of the activities and interactions? Performing a *gemba* walk requires a baseline of technical understanding, management proficiency and ability to process the results of the *gemba* walk. In other words, there must be a framework to observe and not only look at the situation.
- *Validate what you see.* According to Wakamatsu (2009), Taiichi Ohno liked to share the story of a company's president who did not have a strong technical background and yet made a rule of visiting the company's shop floor to check the documents discussed in company meetings. He 'often discovered that what had been told in the[company] meetings were false assumptions'. Lean management relies on trust and reliability, which makes even more relevant the Russian adage that Ronald Reagan often used: trust, but verify (Watson, 2011).

10.4 MANAGEMENT BY WALKING AROUND

A management technique known as 'management by walking around' (MBWA) is sometimes confused with *gemba* walks. MBWA in its current form is attributed to the Hewlett Packard Corporation in the 1970s, and was popularised by T. Peters and R. Waterman in their 1982 book, *In Search of Excellence* (Peters & Waterman, 1982). The Business Dictionary summarises key aspects of MBWA as

"Unstructured approach to hands-on, direct participation by the managers in the work-related affairs of their subordinates, in contrast to rigid and distant management. In MBWA practice, managers spend a significant amount of their time making informal visits to work area and listening to the employees. The purpose of this exercise is to collect qualitative information, listen to suggestions and complaints, and keep a finger on the pulse of the organization. It is also called management by wandering around."
– Business Dictionary, n.d.

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From this definition, it can be seen that a key difference between *gemba* walks and MBWA is their purpose. While both involve the personal presence of the decision maker, a *gemba* walk is more purposeful than MBWA. *Gemba* and *genchi genbutsu* gather information as part of a problem-solving strategy. MBWA attempts to find the problem and improve a manager's accessibility and company morale.

10.5 SUMMARY

The practice of *genchi genbutsu* provides the basis for effective problem solving on any project. It effectively allows the project team to identify the root cause of the problem in the specific context of the issue. This ensures that the team leaders do not try to present solutions that are generic in nature, and that may not solve the actual problem. The power of this approach comes in the leader's ability to view the issue at the site (*gemba*), identify the problem and work with the team to determine a solution that addresses the root cause.

It is extremely difficult to determine a solution if you do not see the problem firsthand. Once you have gone to *gemba* and observed, it becomes much easier to determine the root cause of the issue. At this point, true problem solving can begin.

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CHAPTER

4

IMPROVING BILLING EFFICIENCY

BY GOING TO THE *GEMBA* AT
THE UNIVERSITY OF
NOTTINGHAM

IMPROVING BILLING EFFICIENCY

BY GOING TO THE GEMBA AT THE UNIVERSITY OF NOTTINGHAM

Lynn Brown is Senior Librarian of Customer Services, at the University of Nottingham and has helped to run sixteen Lean projects since 2011. One of the most successful has been a review and overhaul of their billing system for overdue items that has reduced their workload, made returns easier for their customers, and improved patron satisfaction. Both the identification of the problems in the billing process and the solutions to those problems came when Brown and her team of Lean experts applied the principle of *genchi genbutsu*.

IDENTIFY PROBLEMS AT THEIR SOURCE

The team knew that both the time it took staff to process return reminders and the number of late returns were a problem area but weren't sure exactly where the issues lay. To find this out, Brown and her team spent time with staff at the *gemba*. Sitting at the lending desk they watched notices being created and sent out and the students who had received them come in. The team then sat down with the frontline staff and discussed the largest problems that were taking the greatest length of time out of staff members' days.

Several problems with the process were identified:

- Bills for overdue items took too long to be processed
- Processes were not standard across libraries
- Those students who did receive emails did not react to them

One of the first things that Brown and her team noticed was that frontline staff were not confident with the systems and processes involved in sending out bills. Collating and checking all the information needed for billing was a time-consuming process. In particular, gathering pricing information took longer than it might have as this was a skill outside the frontline team's expertise.

STREAMLINE SIMPLE PROCESSES

To start cutting the time taken on bill preparation, the team at University of Nottingham used two simple fixes: they introduced a quick to prepare pre-bill reminder and they automated the pricing calculations on the actual bill.

Rather than spending time calculating the price of each item on the pre-bill reminder Brown and her team realised that they only needed to show patrons an approximate amount to convince them to return books before the billing stage. The reminder

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replaced the specific item price with an average price of a standard textbook at the university. In many cases these 'approximate bills' – created in a matter of moments rather than made perfect over hours – were all that were needed to convince patrons to bring their books back. At one library site, 74% of items where a pre-bill reminder has been sent are now returned before the billing stage.

When patrons did not respond to these reminders, meaning that tailored bills were required, the library team automated pricing on these bills using data stored on the item record in the LMS wherever this was available. Now, approximately 81% of item prices are automatically priced with the other 19% being priced by collection librarians, the experts in the books under their charge.

With their new free time the library team set about streamlining their processes, saving themselves more time. They decided to stop shelf checking for overdue items before sending out a bill as those items were almost never found. This removed one of the most time-consuming and least value-adding steps in the billing process. They also realised that around 94% of the addresses they had on their system for patrons were correct, meaning that checking that address only added value to the process 6% of the time. Removing address checking further shortened the process.

GET PEOPLE IN THE *GEMBA* TO WRITE THEIR OWN DOCUMENTATION

Brown and her team also addressed the system's familiarity problem by making sure that the billing process made sense to the people who were now using it. Instead of relying on the old documentation, two members of the Lean team used their experience to rewrite the bill-creation process. Because this documentation was created by their peers, rather than by management or another team, staff felt confident in admitting which parts of the system they struggled with the most, meaning it was refined and made clearer for everyone who needed to use it.

This new, tighter process and thorough documentation has helped to reduce the time spent on frontline billing. Further, removing or automating so many steps has reduced the elapsed time taken for a bill to be received by a patron, so notifications are more timely. As a bonus, because pricing is calculated more consistently across sites the librarians can be more transparent with their patrons.

This documentation also enabled University of Nottingham to standardise processes across library sites. Before this project was run each of their eight sites had slight differences in process and procedure, so librarians working across different sites had

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to adapt. The creation of a single process standardised late return billing across all sites, removing that inefficiency caused by variation.

MAKE SURE YOUR SOLUTIONS ADD VALUE TO PATRONS

For all the improvements the team made to the billing process, none of them would have been of any use if the process did not produce any value. The team could make as many improvements behind-the-scenes as they liked but that would not solve one of the major problems: books were not always being returned so other students needing those texts were unable to get access to them. Despite the reminders being sent out and the time it took to create those reminders and any subsequent bills, the books due were not coming in as expected. Again, discovering the reason for this came from sitting at the *gemba*.

Brown and her team started to hear the same complaint regularly. The emails that the team had sent out for years didn't make sense to their recipients. Students were deleting them because the subject line didn't make it obvious what the email was about and didn't stand out in any way from all the other emails they were receiving every day. A deleted email was, in patrons' eyes at least, the same as not receiving notice. More than that, those students who did open the email were confused by what Brown describes as "archaic language"; many didn't understand why they had received the email in the first place. Again, this meant they ignored or deleted it. A trip to the *gemba*, then, gave the library team a relatively quick, easy-to-implement solution to the problem of getting books back on shelves so other students could use them.

Working from these results the library team changed the emails, moving away from what had always been done before and towards what their customers needed. They wrote new subject lines that they knew would stand out in patrons' busy inboxes, so people started opening the emails. They made the language in the emails simple, so that even those patrons whose first language wasn't English had no difficulty in understanding why they were being communicated with. Combined with the simplification in the creation of overdue notice emails that came from using average textbook prices, these simple changes resulted in both an increase in books being returned and a reduction in the time staff spent working on late returns.

Finally, it was clear from listening to patrons' conversations at the frontline services desk that had they received a reminder on the day their books were due they would have brought them in that day, removing the need for any processing of overdue



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items at all. As well as the pre-bill reminder, then, the library team added an “on the day” reminder which has further helped to reduce the number of overdue items the librarians have to deal with.

Getting into the *gemba* was crucial in realising all these results for the University of Nottingham. If they had tried to identify the problems in the billing system on a strategy away day or while shut up in a room together, Brown and her team may have come up with many good ideas. But none would have cut to the heart of why the frontline team and the customers were behaving as they did better than spending a few hours at the frontline desk.

CHAPTER

5

TOOLS FOR IMPROVEMENT



This chapter is excerpted from
*Implementing Six Sigma and Lean:
A Practical Guide to Tools and Techniques*

Ron Basu

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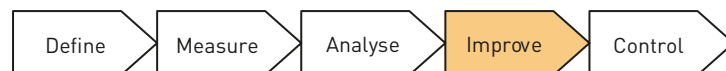
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Invention, strictly speaking, is little more than a new combination of those images which have been previously gathered and deposited in the memory; nothing can come of nothing.

— Joshua Reynolds, circa 1780



The earlier stages of the project, in particular the Analyse stage, have pinpointed the areas for improvement. During the Improve phase, the ideas and solutions are put to work. Various options are then compared with each other to determine the most promising solution. Some experiments and trials may be required to validate the best solution. Finally, this solution is usually piloted on a small scale in the business environment.

The objectives of the tools of the Improve phase are to help the team to develop a solution for improving process performance and to confirm that the proposed solution will meet or exceed the quality improvement goals of the project.

The key deliverables of the Improve phase are:

1. *Proposed solution*: A solution for reducing variation or eliminating the special causes of the problem in the process.
2. *Validate solution*: Process improvement that has been piloted in a real business environment.

The important tools for improvement should include:

- I1: Affinity Diagram
- I2: Nominal Group Technique
- I3: SMED
- I4: Five S
- I5: Mistake Proofing
- I6: Value Stream Mapping
- I7: Brainstorming
- I8: Mind Mapping
- I9: Force Field Diagram

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The Improvement stage also depends on techniques including Brainstorming, Design of Experiments (DOE), Quality Function Deployment (QFD) and Failure Mode and Effect Analysis (FMEA).

I1: AFFINITY DIAGRAM

DEFINITION

An Affinity Diagram is an improvement tool to generate creatively a number of ideas and then summarise logical groupings among them to understand the problem and then to lead to a solution.

This is also known as the KJ method, identified with Kawakita Jiro, the Japanese scientist who first applied it in the 1950s.

APPLICATION

An Affinity Diagram is used to categorise verbal information into an organised visual pattern. It is used in conjunction with brainstorming when problems are uncertain, large and complex, thereby enabling the user to create a discipline out of chaos.

It is a tool to overcome 'team paralysis' which is created by the generation of a large number of options and a lack of consensus. As part of brainstorming all ideas are recorded on sticky notes or index cards. The ideas on the notes are then clustered into major categories. It aims to be a creative, rather than a logical process. Hence the Affinity Diagram is regarded more as an improvement tool rather than an analytical one.

BASIC STEPS

1. Clarify the chosen problem or opportunity in a full sentence.
2. Collect the current data available on the problem or opportunity. This is usually done by brainstorming within a group.
3. Record each piece of data or idea onto a card or Post-It™ note and place them at random onto a board.
4. Sort ideas simultaneously into related groups.
5. Arrange the group affinity cards, usually less than 10 in each group, in a logical order.
6. For each grouping, label header cards and draw broad lines around the group affinity cards.

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WORKED-OUT EXAMPLE

The following example is adapted from Schmidt et al. (1999, p. 125).

Consider the problem as clearly stated below:

What are the barriers to a quality improvement programme?

Figure 5.1 shows an example of an Affinity Diagram related to the above problem.

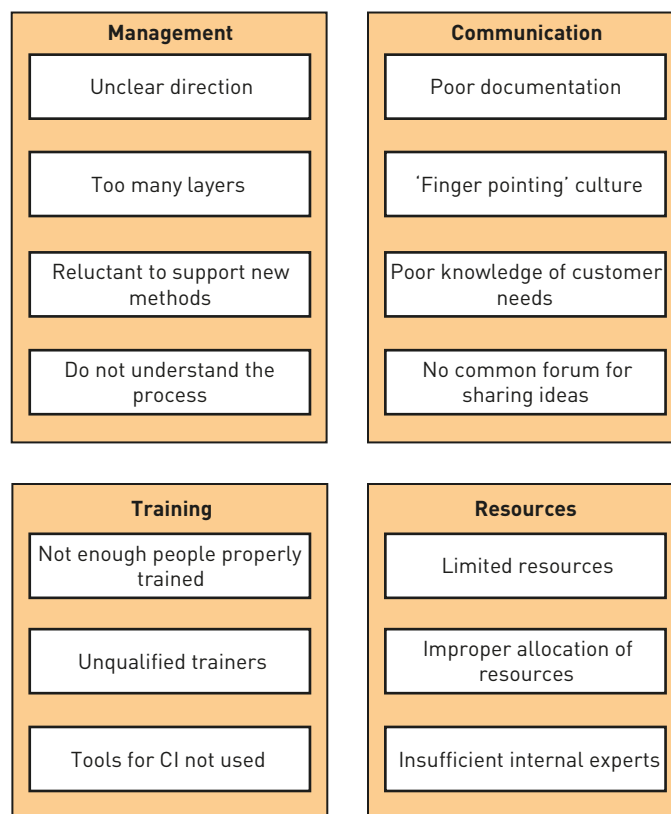


Figure 5.1 • An Affinity Diagram

TRAINING REQUIREMENTS

The knowledge and application of an Affinity Diagram are best derived by 'on-the-job' training during a brainstorming exercise on an actual problem. The facilitator should have experience in applying a number of Affinity Diagrams to direct the team and gain a consensus of grouping.

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FINAL THOUGHTS

It is important to note that an Affinity Diagram is an improvement tool used in conjunction with a brainstorming exercise. It should not be confused with CEDAC, a hybrid of the Cause and Effect Diagram, which also uses cards or Post-It™ notes.

12: NOMINAL GROUP TECHNIQUE

DEFINITION

Nominal Group Technique (NGT) is an improvement tool to derive an importance ranking in a team's list of ideas arising from a brainstorming exercise. This is also known as the Weighted Multi-voting Technique.

APPLICATION

NGT is widely used to arrive quickly at a consensus on the relative importance of ideas or issues in a group working environment. It allows every team member to rank issues without any pressure from others. Thus the quieter individuals exercise the same power as the more dominant team members.

The application of NGT usually follows a brainstorming session. Incidentally, you may have recognised a similar process being applied during the voting procedure for the Eurovision Song Contest! (Now you have a good reason for watching it next time.)

BASIC STEPS

1. Assemble the team and generate a list of issues, problems or ideas to be prioritised. This could be done either by a brainstorming session or each member may be asked to write down their ideas.
2. Write the list on a flip chart or board. Refine the list by eliminating duplicate or similar statements.
3. Assign labels (A, B, C, etc.) to the final list of statements and record them on a flip chart or board.
4. Each member records the labels of each statement in a rank order with the highest number allocated to the most important statement. For example, if there are five statements then '5' is the most important and '1' is the least important ranking.
5. Aggregate the rankings of all team members and the statement with the highest point would have the highest priority.

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WORKED-OUT EXAMPLE

Consider the case of a private school where several complaints have been made about the low morale of staff, but they are of an informal and unstructured nature and the Board of Governors have little to work with. **Table 5.1** shows the team's list of complaints.

Five members of the team have allocated a rank order to each problem listed in **Table 5.1** and the results are shown in **Table 5.2**.

Table 5.1 • List of Problems

A	Not enough teamwork and consultation
B	Information coming from an 'in crowd'
C	No consistent procedures
D	Dogmatic approach of the Head
E	Lack of feedback from reports made to parents and pupils
F	Strong hierarchy and work demarcation
G	Lack of training for support staff
H	More focus on fees than education
I	Lack of credit or recognition for support staff
J	Inadequate workspace except for the Head and 'cronies'

Table 5.2 • Nominal Group Technique

Problem	Team members					Total	Priority
	1	2	3	4	5		
A	7	9	9	6	6	37	High
B	10	7	7	9	8	41	
C	6	10	8	6	7	37	
D	9	8	10	8	10	45	High
E	5	3	6	7	9	30	
F	8	5	4	5	3	25	
G	3	4	5	4	2	18	
H	1	2	1	3	1	8	
I	4	5	2	2	5	18	
J	2	1	3	1	4	11	

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TRAINING REQUIREMENTS

Similar to the 'Affinity Diagram', the knowledge and application of NGT can be best derived by 'on-the-job' training in an actual group exercise. The facilitator should have the experience of directing a team and gaining a consensus.

FINAL THOUGHTS

NGT is not a 'scientific' approach but it is simple and builds commitment to the team's choice through equal participation. It generates an atmosphere of fun and individual inclusion, building 'team spirit'. We recommend the application of NGT for solving in particular problems related to cultural and 'softer' issues.

I3: SMED

SMED or Single Minute Exchange of Dies is name of the approach used for reducing output and quality losses due to changeovers and setups. 'Single Minute' means that necessary setup time is counted on a single digit.

APPLICATION

This method has been developed in Japan by Shigeo Shingo (1985) and has proven its effectiveness in many manufacturing operations by reducing the changeover times of packaging machines from hours to minutes.

The primary application area of SMED is the reduction of setup times in production lines. This process enables operators to analyse and find out themselves why the changeovers take so long and how this time can be reduced. In many cases, changeover and setup times can be condensed to less than 10 minutes, so that the changeover time can be expressed with one single digit, and it is therefore called 'SMED'.

SMED is considered as an essential tool in Lean Manufacturing and it is instrumental in the reduction of non-value added activities in process times. Changeover loss is one of the six big losses that have been defined within the Total Productive Maintenance (TPM). It is important to note that SMED is directly linked with the analytical process of OEE (Overall Equipment Effectiveness).

With due respect to the success of the SMED method, it is fair to point out that the basic principles are fundamentally the application of classical industrial engineering or work study.

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BASIC STEPS

1. Study and measure the operations of the production line to discriminate:
 - a. Internal setup, the operation that must be done while machine is stopped.
 - b. External setup, the operation that possibly can be done while the machine is still running.
2. Suppress non-value added operations and convert internal setup operating into external setup. The data from OEE and the preparations of prerequisites (e.g. tools, changeover parts, pre-assemblies, pre-heating, mobile storage, etc.) are reviewed to achieve results. Some internal setups are converted to external setups.
3. The next stage is to simplify the design of the machine, especially fillings and tightening mechanisms. Some examples of the design simplification are U-shaped washers, quarter turn screws and cam and lever tighters.
4. Balance the work content of the line and ensure teamwork. For example, in one automatic insertion machine, one operator sets up on the machine front while the other operator feeds components on the other side.
5. Minimise trials and controls. Use of Mistake Proofing or *Poka-Yoke* enables the standard way to be carried out each time.

WORKED-OUT EXAMPLE

The following example is taken from Basu and Wright (1997, p. 97).

Consider the setup time reduction of a packing machine.

The internal and external setup times have been measured. As shown in **Figure 5.2**, the total setup time is reduced by overlapping external setup times on the internal setup time.

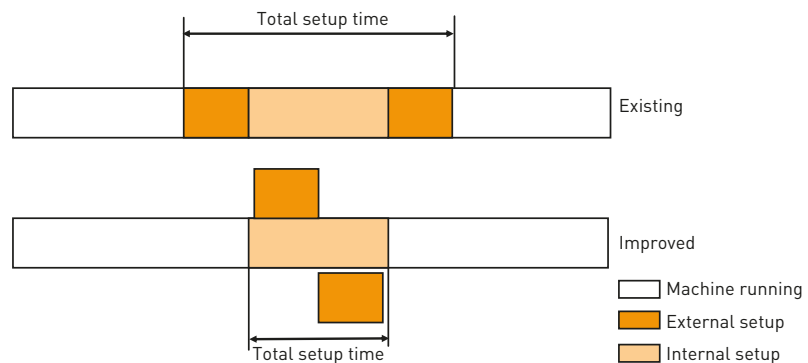


Figure 5.2 • SMED: Setup time reduction [Source: Basu and Wright, 1997].

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TRAINING REQUIREMENTS

The training of SMED is likely to be more effective on team members with a good understanding of work study or industrial engineering. The basic principles should be explained to members with hands-on exercises being carried out in a room. This should be supplemented by a production line study in a factory environment. It is also important that the basics of OEE are covered during an SMED training session.

FINAL THOUGHTS

SMED can produce excellent results in achieving the reduction of setup times but admittedly it is resource intensive. It should therefore be restricted to bottleneck operations.

14: FIVE S

DEFINITION

Five S is a tool for improving the housekeeping of an operation, developed in Japan, where the five Ss represent five Japanese words all beginning with 's':

- *Seiri (Organisation)*: Separate what is essential from what is not.
- *Seiton (Neatness)*: Sort and arrange the required items in an orderly manner and in a clearly marked space.
- *Seiso (Cleaning)*: Keep the workstation and the surrounding area clean and tidy.
- *Seiketsu (Standardisation)*: Clean the equipment according to laid down standards.
- *Shitsuke (Discipline)*: Follow the established procedure.

In order to retain the name 'Five S', a number of English language versions have evolved. These include:

- Seiri: Sort
- Seiton: Set in order/Stabilise
- Seiso: Shine
- Seiketsu: Standardise
- Shitsuki: Sustain.

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APPLICATION

The Five S method is a structured sequential programme to improve workplace organisation and standardisation. Five S improves the safety, efficiency and the orderliness of the process and establishes a sense of ownership within the team.

Five S is used in organisations engaged in Lean Sigma, Just-in-Time (JIT), Total Productive Maintenance (TPM) and Total Quality Management (TQM). This principle is widely applicable not just for the shop floor, but for the office too. As an additional bonus there are benefits to be found in environmental and safety factors due to the resulting reduced clutter. Quality is improved by better organisation and productivity is increased due to the decreased time spent in searching for the right tool or material at the workstation. Consider the basic principle of a parent tidying a small child's room which is overflowing with clutter and sorting together various types of toys. The end product should be a neater, warmer, brighter and more civilised play environment which will encourage the child to utilise all toys and equipment more productively because all relevant pieces are together, space is enhanced and mess is reduced.

It is useful to note that the quality gurus of Japan like numbered lists, e.g. the Seven *Mudas*, the Five Whys, the Five Ss. However, the exact number of Ss is less important than observing the simple doctrine of achieving the elimination of wastes.

As the Five S programme focuses on attaining visual order and visual control, it is a key component of Visual Factory Management.

BASIC STEPS

1. *Sort*: The initial step in the Five S programme is to eliminate excess materials and equipment lying around in the workplace. These non-essential items are clearly identified by 'red-tagging'.
2. *Set in order*: The second step is to organise, arrange and identify useful items in a work area to ensure their effective retrieval. The storage area, cabinets and shelves are all labelled properly. The objective of this step is, as the old mantra says, 'a place for everything and everything in its place'.
3. *Shine*: This third action point is sometimes known as 'sweep' or 'scrub'. It includes down-to-basics activities such as painting equipment after cleaning, painting walls and floors in bright colours and carrying out a regular cleaning programme.
4. *Standardise*: The fourth point encourages workers to simplify and standardise the process to ensure that the first three steps continue to be effective. Some of the

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related activities include establishing cleaning procedures, colour coding containers, assigning responsibilities and using posters.

5. *Sustain*: The fifth step is to make Five S a way of life. Spreading the message and enhancing the practice naturally involves people and cultural issues. The key activities leading to the success of Five S include:
 - Recognise and reward the effort of members
 - Top management awareness and support
 - Publicise the benefits.
6. The final step is to continue training and maintaining the standards of Five S.

WORKED-OUT EXAMPLES

As Five S is primarily a visual process, a good example of promoting its message would be to display pictures of a workplace with photographs showing both 'before' and 'after' depictions of the implementation of Five S.

The following example is taken from Skinner (2001) to illustrate the benefits of a Five S programme.

Northrop Grumman Inc. in the United States first deployed Five S on a part delivery process. The work area assembled a variety of components into a single product.

Before Five S, the area was not well organised, and the process was inefficient. With Five S implementations, the area saw a huge 93% reduction in the space employees travel to complete tasks as well as a 42% reduction in the overall floor space.

The system has become a one-piece flow operation between assembly and mechanics, enabling everyone involved to know what the station has and what it needs.

TRAINING REQUIREMENTS

Five S is a conceptually simple process, but it requires both initial and follow-up training to inculcate the methodology to all employees. The classroom training sessions should be followed by, as far as practicable, a visit to a site where visual changes due to Five S could be observed. A second best option is to show the members photography or videos illustrating the 'before and after' status of the workplace involved in a Five S programme.

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FINAL THOUGHTS

Five S is a simple tool and should be considered for the housekeeping and visual control of all types of work area, whether they are in manufacturing or service.

15: MISTAKE PROOFING

DEFINITION

Mistake Proofing is an improvement tool to prevent errors being converted into defects. It comprises two main activities: preventing the occurrence of a defect and detecting the defect itself. Mistake Proofing is also known as *Poka-Yoke*. The concept was developed by Shigeo Shingo and the term '*poka-yoke*' comes from the Japanese words '*poka*' (inadvertent mistake) and '*yoke*' (prevent).

APPLICATION

Mistake Proofing is applied in fundamental areas. Although *Poka-Yoke* was devised as a component of Shingo's 'Zero Quality Control' for Toyota production lines, it is very easy to understand and grounded in basic common sense. The process of Mistake Proofing is simply paying careful attention to every activity in the process and then placing appropriate checks at each step of the process. Mistake Proofing emphasises the detection and correction of mistakes at the Design stage before they become defects. This is then followed by checking. It is achieved by 100% inspection while the work is in progress by the operator and not by the quality inspectors. This inspection is an integral part of the work process.

There are abundance of examples of simple devices related to Mistake Proofing in our everyday surroundings including limit switches, colour coding of cables, error detection alarms, a level crossing gate and many more.

BASIC STEPS

1. Perform Shingo's 'source inspection' at the Design stage. In other words, identify possible errors that might occur in spite of preventive actions. For example, there may be some limit switches that provide some degree of regulatory control to stop the machine automatically.
2. Ensure 100% inspection by the operator to detect that an error is either taking place or is imminent.

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3. Provide immediate feedback for corrective action. There are three basic actions in order of preference:
 - i. Control: An action that self-corrects the error, e.g. spell checker.
 - ii. Shutdown: A device that shuts down the process when an error occurs, e.g. a limit switch.
 - iii. Warning: Alerts the operator that some error is imminent, e.g. alarm.

WORKED-OUT EXAMPLE

Consider the situation leading to the development of a level crossing. This is a place where cars and trains are crossing paths and the chances of accidents are very high.

The possible errors that might occur would relate to car drivers, who might be thinking one thing or another or distracted while driving (source inspection).

Both the level crossing operator and the car driver should ensure safety features while the work is in progress (judgement inspection).

In order to prevent drivers from making mistakes when a train is approaching, traffic lights were installed to alert the driver to stop (warning). The lights might not be completely effective, so a gate was installed when a train was coming (shutdown or regulatory function).

The operation of the gate was controlled automatically as the train was approaching (control).

With the above Mistake Proofing devices in place, an accident can only occur if either the control and regulatory measures are malfunctioning or the driver drives around the gate.

TRAINING REQUIREMENTS

There is no 'rocket science' involved in Mistake Proofing and it may be perceived in a dismissive fashion: 'that's only common sense'. However, it is critical that there should be some basic training in the principles and applications of Mistake Proofing. Furthermore, the employees need to be empowered to make improvements in the process by using Mistake Proofing. A half-day workshop should meet these training requirements.

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FINAL THOUGHTS

Mistake Proofing is a simple tool in principle, but its execution is the difficult part. The contrast between Mistake Proofing and 'fool-proofing' however is critical. The essential difference is that in Mistake Proofing, operators are respected and treated as partners in solving problems.

16: VALUE STREAM MAPPING

DEFINITION

Value Stream Mapping (VSM) is a visual illustration of all activities required to bring a product through the main flow, from raw material to the stage of reaching the customer.

Mapping out the activities in a production process with cycle times, down times, in-process inventory and information flow paths helps us to visualise the current state of the process and guides us to the future improved state.

APPLICATION

VSM is an essential tool of Lean Manufacturing in identifying non-value added activities at a high level of the total process. According to Womack and Jones (1996), the initial objective of creating a Value Stream Map is to identify every action required to make a specific product. Thus the initial step is to group these activities into three categories:

1. Those which actually create value for the customer.
2. Those which do not create value but are currently necessary (type one Muda).
3. Those which create no value as perceived by the customer (type two Muda).

Once the third set has been eliminated, attention is focused on the remaining non-value creating activities. This is achieved through making the value flow at the pull of the customer.

VSM is closely linked with the analytical tool of Process Mapping. Having established improvement opportunities at a high level by VSM, a detailed analysis of the specific areas of the process is effective with Process Mapping.

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BASIC STEPS

1. The first step of VSM is to select the product or process for improvement.
2. Each component of production from the source to the point of delivery is then identified.
3. The entire supply chain of the product or process (e.g. through order entry, purchasing, manufacturing, packaging and shipping) is mapped sequentially.
4. The quantitative data of each activity (e.g. storage time, delay, distance travelled, process time and process rate) are then recorded.
5. Each component (i.e. activity) of production or process is evaluated to determine the extent to which it adds value to product quality and production efficiency.
6. These activities are then categorised as:
 - a. Value added
 - b. Necessary non-value added
 - c. Unnecessary non-value added.
7. Areas of further analysis and improvement are then identified clearly.

WORKED-OUT EXAMPLE

The following example is adapted from Womack and Jones (1996, pp. 38–43).

Consider a case containing eight cans of cola at a Tesco store. **Figure 5.3** shows a Value Stream Map of cola, from the mining of Bauxite (the source of aluminium of the cans) to the user's home.

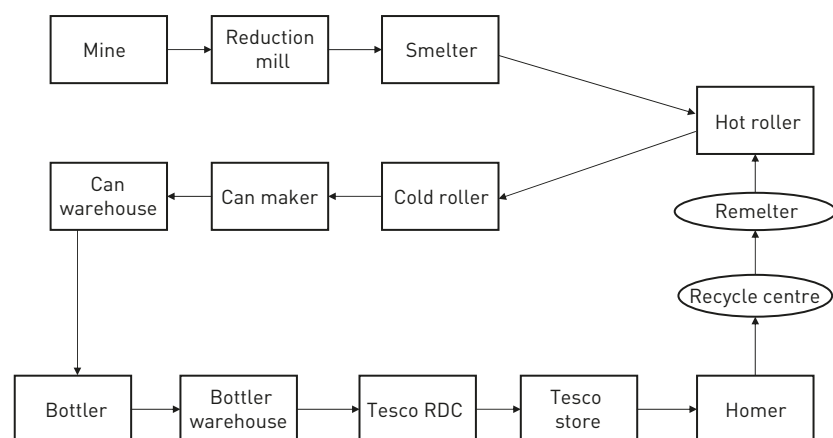


Figure 5.3 • Value Stream for Cola Cans (© Ron Basu)

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The quantitative data related to the activities in the value stream are summarised in **Table 5.3**.

Table 5.3 • Quantitative data of Cola Can

	Incoming storage	Process time	Finished storage	Process rate	Cumulative days
Mine	0	20 minutes	2 weeks	1000 tonnes/hour	319
Reduction mill	2 weeks	30 minutes	2 weeks	-	305
Smelter	3 months	2 hours	2 weeks	-	277
Hot rolling mill	2 weeks	1 minute	4 weeks	10 feet/minute	173
Cold rolling mill	2 weeks	<1 minute	4 weeks	2100 feet/minute	131
Can maker	2 weeks	1 minute	4 weeks	2000 feet/minute	89
Bottler	4 days	1 minute	5 weeks	1500 feet/minute	47
Tesco RDC	0	0	3 days	-	8
Tesco store	0	0	2 days	-	3
Home storage	3 days	5 minutes	-	-	3
Totals	5 months	3 hours	6 months	-	319

It is evident from the details in **Table 5.3** that value added activities take only 3 hours compared to the total time (319 days) from the mine to the recycling bin. This proportion is surprisingly small when one considers the overall duration of the process.

TRAINING REQUIREMENTS

The basic principles of VSM are not new, but making sense of these ideas and applying them to practical problems clearly require some training. There is no shortage of training consultants offering workshops and courses in the tools of Lean Manufacturing including VSM.

We recommend that the team members should undergo a training workshop of at least half a day's duration for VSM. This training programme should be combined with other relevant tools like Process Mapping.

FINAL THOUGHTS

A complete Value Stream Map quickly provides the visibility of the total process and is very effective in identifying non-value added activities at a macro level.

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SUMMARY

Arguably the most difficult and certainly the most creative part of the Six Sigma and Operational Excellence initiatives is the Improvement stage. It is not rational to expect that the improvement tools described in this section will point out the obvious way forward. The solutions depend on the knowledge, innovative ideas and teamwork of the members. The tools and techniques are there to channel the ideas and analytical data towards improvement.

17: BRAINSTORMING

DEFINITION

Brainstorming is an improvement tool for a team to generate, creatively and efficiently, a high volume of ideas on any topic by encouraging free thinking. There are a few variations on the brainstorming process, of which two methods are more frequently used. First is the structured method (known as the 'round robin') where each member is asked to put forward an idea. The other technique is unstructured and is known as 'free-wheeling', in which ideas are produced and expressed by anyone at any time.

APPLICATION

Brainstorming is employed when the solution to a problem cannot be found by quantitative or logical tools. It works best by stimulating the synergy of a group. One member's thoughts trigger the idea of another participant, and so on. It is often used as a first step to open up ideas and explore options, and these are then followed up by appropriate quality management tools and techniques.

It has the advantage of getting every member involved, avoiding a possible scenario where just a few people dominate the whole group.

There are some simple ground rules or codes of conduct to observe:

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- Agree to a time limit with the group
- Accept all ideas as given and do not interpret or abbreviate
- Do not evaluate ideas during the brainstorming process.
- Encourage quantity rather than quality of ideas.
- Discourage the role of an expert
- Keep ideas expressed in just a few words
- Emphasise causes and symptoms as opposed to solutions
- Write clearly and ensure the ideas are visible to everyone
- Have fun!

BASIC STEPS

1. Clearly state the focused problem selected for the brainstorming session.
2. Form a group and select a facilitator, agree on a time limit and remind members of the ground rules.
3. Decide whether a structured approach or a free-wheeling basis will be used. For a larger group, a structured approach will allow everyone to get a turn and subsequently this could be switched to the free-wheeling method.
4. Write clearly on a flip chart or a board any ideas as they are suggested. The facilitator will motivate and encourage participants by prompting them, 'What else?'
5. Review the clarity of the written list of ideas, allow them to settle and discard any duplication.
6. Apply filters to reduce the list. Typical filters could include cost, quality, time and risk.
7. Ensure that everyone concurs with the shortlist of ideas.

WORKED-OUT EXAMPLE

Consider the following focused statement for brainstorming.

"What are the key selection criteria of a family holiday?"

The five members of a family generated 26 ideas or issues. These were then filtered by a budgeted cost of £4000 for the whole family and the following key criteria were derived:

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- Two weeks in August
- Seaside resort
- Indoor and outdoor recreational facilities
- Not near a nightclub
- Rich local culture
- Opportunities for sightseeing.

TRAINING REQUIREMENTS

The application of brainstorming does not require any formal training in a classroom. A facilitator with some previous experience in the process can conduct a successful brainstorming session after briefing the team with the ground rules.

FINAL THOUGHTS

Brainstorming is a very useful tool for generating ideas in a group. Follow the ground rules with particular emphasis on two points:

1. Do not dominate the group
2. Set a time limit of, say, half an hour for the entire session.

18: MIND MAPPING

DEFINITION

Mind Mapping is a learning tool for ordering and structuring the thinking process of an individual or team working on a focused theme.

According to Buzan (1995), the Mind Map 'harnesses the full range of cortical skills – word, image, number, logic, rhythm, colour and spatial awareness – in a single, uniquely powerful technique'.

It is a graphic tool to express 'radiant thinking' comprising four key characteristics:

1. The subject or theme is presented as a central image or key word.
2. The main components of the subject root out from the central image as branches.
3. Each branch contains a key word printed on an associated line.
4. The sub-components of each branch are also represented as branches attached to higher level branches.

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Mind Map is arguably comparable to the Cause and Effect Diagram where the effect represents the central image of the Mind Map. Each of the branches of the Mind Map are the causes in the Cause and Effect Diagram.

APPLICATION

Mind Maps have been applied for both individual and group objectives.

The applications in individual areas included:

- Note taking
- Multi-dimensional memory device
- Creative thinking.

Buzan (1995) claims that the mode of note taking involved in making a Mind Map saves more than 90% of the total time required for the conventional linear method of making notes. Instead, the Mind Map version involves noting, reading and reviewing only relevant key words.

Another way of thinking, the mnemonic device, involves the use of the imagination and association in order to produce multi-dimensional memorable images. The use of the memory Mind Map activates the brain to become mnemonically alert and thus increases the memory skill level.

The Mind Map is suited to creative thinking because it uses all the cortical skills commonly associated with creativity, especially imagination, association of ideas and flexibility.

The Group Mind Map becomes a powerful tool during a group brainstorming exercise. The Mind Map becomes a 'hard copy' of the emerging group consensus and at the same time reflects the evolution of ideas through the branches and sub-branches radiating from the central image or theme.

In recent years, Group Mind Maps have been successfully used by universities (including Oxford and Cambridge) and multi-national companies like Boeing Aircraft Corporation, EDS, Digital Computers and British Petroleum.

BASIC STEPS

The Mind Map is intended to increase mental freedom and thus it is important not to introduce rigid disciplines. However there is a need for a structured approach, otherwise freedom may be mistaken for chaos.

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Buzan (1995) suggests six 'Mind Map laws' and offers three recommendations to supplement these 'laws'. The 'laws' are:

1. Use a central image and emphasise that image by using variations in size of printing and colour.
2. Use arrows when you want to make connections within and across branch patterns.
3. Be clear and use only one key word per line.
4. Develop a personal style, while maintaining the Mind Map 'laws'.
5. Use hierarchy and categorisation in the form of basic ordering of ideas.
6. Use a numerical order simply by numbering the branches in the desired order.

The three recommendations are designed to help you implement the 'laws'. The recommendations are:

- a. Break mental blocks
 - i. Add blank lines to your ongoing Mind Map
 - ii. Ask questions to stimulate a block-breaking response
 - iii. Add images to your Mind Map
 - iv. Maintain awareness of your associational capacity.
- b. Reinforce your Mind Map
- c. Review your Mind Maps
- d. Do quick Mind Map checks.
- e. Tools for improvement 129
- f. Prepare
 - i. Your mental attitude
 - ii. Your materials
 - iii. Your workplace/environments.

The above 'laws' and recommendations are applicable to both individual and Group Mind Maps. It is important to designate a facilitator to process a Group Mind Map starting with a central image.

WORKED-OUT EXAMPLE

An example of a Mind Map for Late Delivery is illustrated in [Figure 5.4](#).

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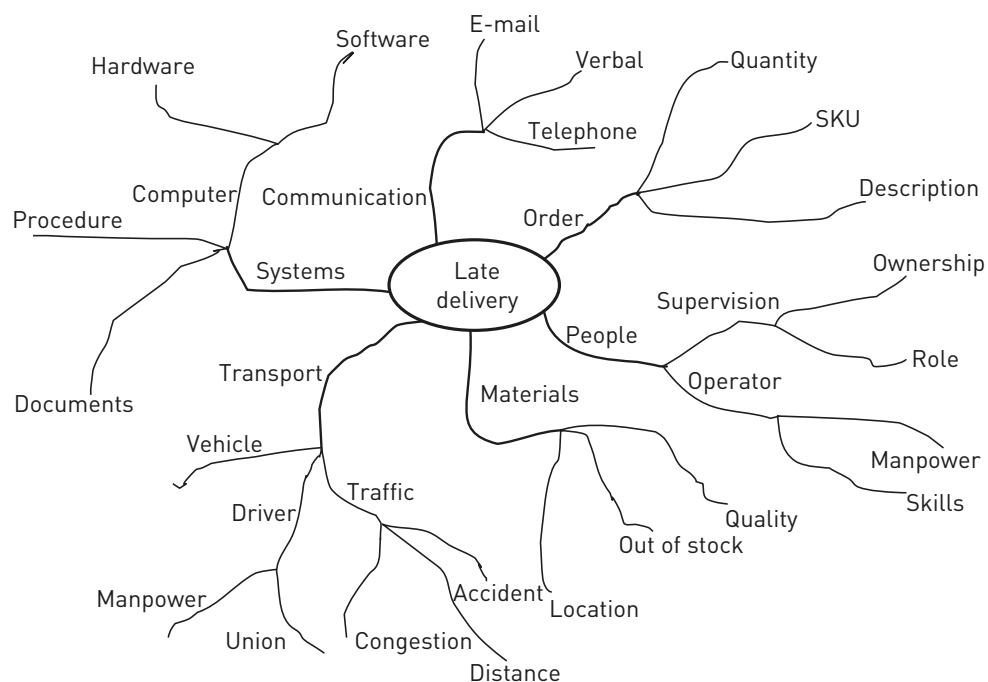


Figure 5.4 • A Mind Map (© Ron Basu).

In this Mind Map, Late Delivery is the central image. The main causes are noted by key words on radial lines and sub-causes are shown on branches emerging from these radial lines.

If after the completion of the Mind Map, the importance of root causes can be weighted by assigning a number 1–100 according to its importance.

TRAINING REQUIREMENTS

The basics of Mind Mapping can be grasped by reading Tony Buzan's 'The Mind Map Book' (1995). However it would be useful if a facilitator with previous experience in Mind Mapping conducts a number of trial exercises before applying it to a real life problem.

FINAL THOUGHTS

Mind Mapping has various individual and group applications. It is particularly useful as a mnemonic or analytical tool for developing personal choices. It gives the brain a wider range of information on which to base its decision.

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19. FORCE FIELD ANALYSIS DIAGRAM

DEFINITION

The Force Field Analysis Diagram or simply Force Field Diagram is a model built on the concept by Kurt Lewin (1951) that change is characterised by as a state of equilibrium between driving forces (e.g. new technology) and opposing or restraining forces (e.g. fear of failure).

In order for any change to happen the driving forces must exceed the restraining forces, thus shifting the equilibrium.

APPLICATION

Force Field Diagram is a useful tool at the early stage of change management leading to improvement. It is often used to

- investigate the balance of power involved in an issue or obstacle at any level (personnel, project, organisation, network);
- identify important players or stakeholders – both allies and opponents;
- identify possible causes and solutions to the problem.

BASIC STEPS

According to Lewin (1951) three key steps are involved in the concept of change management by Force Field Diagram:

1. First, an organisation has to unfreeze the driving and restraining forces that hold it in a state of apparent equilibrium.
2. Second, an imbalance is introduced to the forces, by increasing the drivers or reducing the restrainers or both, to enable the change to take place.
3. Third, once the change is complete and stable, the forces are brought back to equilibrium and refrozen.

Force Field Diagram is constructed by a team and the following basic steps are suggested:

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1. Agree on the current problem or issue under investigation and the desired situation.
2. List all forces driving changes towards the desired situation.
3. List all forces resisting changes towards the desired situation.
4. Review all forces and validate their importance.
5. Allocate score to each of the forces using a numeric scale (e.g. 5 = most important and 1 = least important).
6. Chart the forces by listing the driving forces on the left and restraining forces to the right.
7. Decide how to minimise or eliminate the restraining forces and increase the driving force.
8. Agree on an action plan.

WORKED-OUT EXAMPLE

The issue identified is how to increase the usage of purchase orders in a pharmaceutical company. The driving and restraining forces were identified by the team and also rated in a scale 1–5 (1 = low, 5 = high) and represented in a Force Field Diagram as shown in **Figure 5.5**.

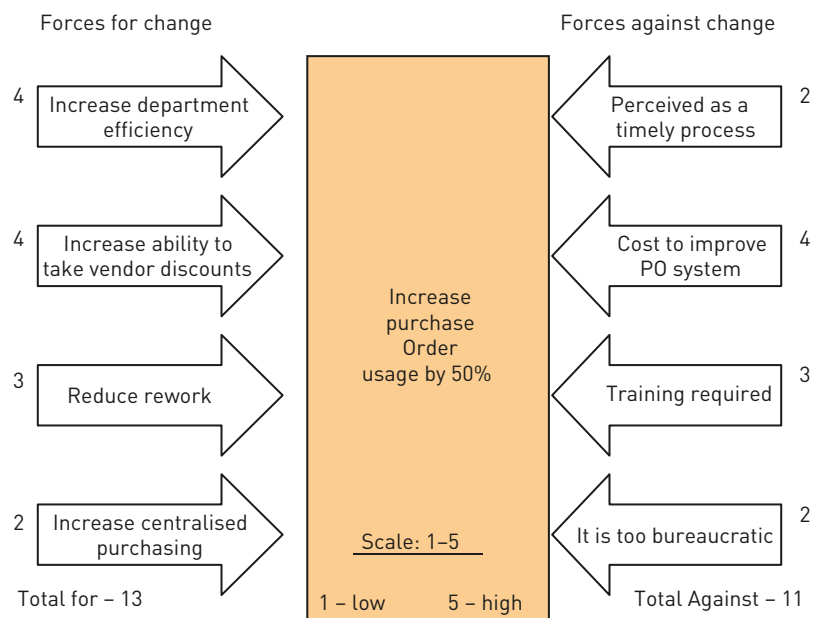


Figure 5.5 • Force Field Analysis Diagram



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The driving forces show a total score of 13 against a total score of 11 shown by the restraining forces.

TRAINING REQUIREMENTS

The knowledge and application of a Force Field Diagram are best derived by 'on-the-job' training during a brainstorming exercise on an actual problem.

The facilitator should have experience change management in applying a number of Force Field Diagrams to direct the team and gain a consensus of identifying forces and allocating scores.

FINAL THOUGHTS

Force Field Diagram is a powerful tool in the Improvement stage of Six Sigma and also in tempering the mindset in any change management projects. It could also provide new insights into the evaluation and implementation of corporate strategies.



CHAPTER

6

REDUCING RESHELVING TIME WITH LEAN TOOLS AT THE UNIVERSITY OF ST. ANDREWS

REDUCING RESHELVING TIME

WITH LEAN TOOLS AT THE UNIVERSITY OF ST. ANDREWS

In 2008 the library at the University of St. Andrews in Scotland realised that they had a problem with reshelving. The Library Reshelving Team knew that it was taking too long to get books onto shelves and with a growing collection meaning more crowded shelves that situation was only going to get worse. Fortunately, the University has its own team of Lean consultants, St. Andrews Lean Consultants headed by Mark Robinson, that the library could call on for help.

Mark and the Reshelving Team ran a *kaizen* event over the course of three days to benchmark their problems, define their aims, describe their current process, and redesign the process to meet their goals.

BENCHMARK PERFORMANCE AND PROBLEMS

The first step for the library was to benchmark current performance. Mark and the Reshelving Team worked together to establish the key metrics they would use to measure progress. Crucially they didn't just opt for the obvious or easy-to-measure metrics but chose those which had a real impact in the library's service levels.

For example, they noted that on average the team reshelved around two short loan books per minute which over a year meant they spent around 1,083 hours each year just returning short loan books to their proper places. They also noted that on average 20 full sprite loads of long loan books were reshelved each day across two levels of the library building.

But averages don't take into account seasonal variation. In particular, they don't describe what happens at peak times when a team is under most pressure. So, the Reshelving Team also created a *control chart* (see Chapter 5 of *Implementing Six Sigma and Lean*) from two years of monthly shelving data, shown in Figure 6.1, that allowed them to see just what that variation looked like and meant.

Mark and the Reshelving Team also looked at the specific problems that inefficient reshelving caused, determining that it meant:

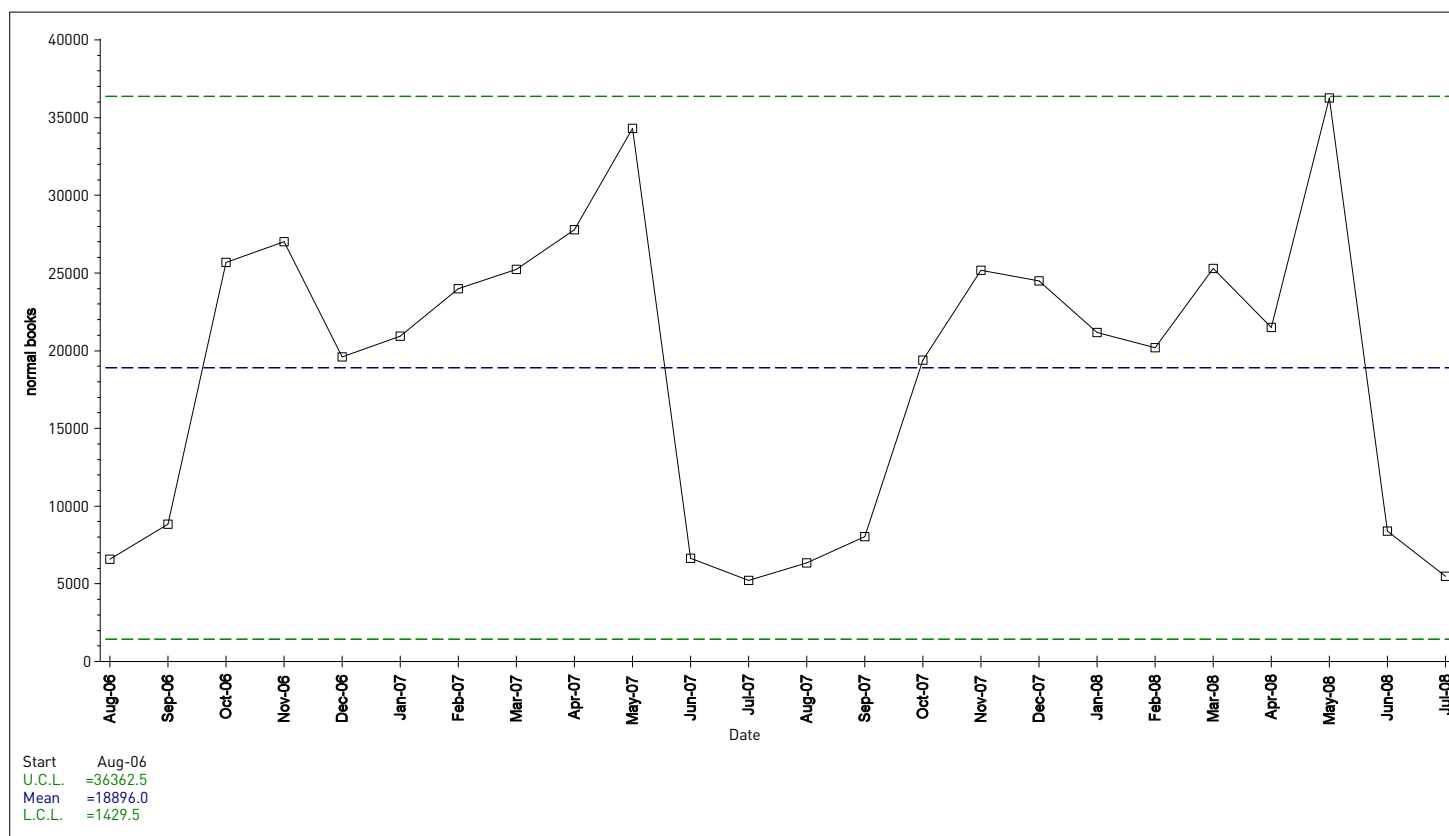
- There weren't enough trollies during peak times to cope with demand
- Shelves became messier as term progress
- Reduced access to collection for patrons

They also noted that a lack of student helpers at peak times lead to further issues with the process, forcing the team to modify it on an *ad hoc* basis at times when they were already busy.

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Figure 6.1 • Control Chart – Books Shelved by Month



LEAD WITH SUCCESS CRITERIA

Having determined where they were, the Reshelving Team next decided where they wanted to be. To do this they used a *quad of aims*, sometimes called *3W+1H*, which outlines:

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- Why the improvements are being made; its purpose
- Who the stakeholders are and who benefits from those improvements
- What needs to be done for the benefits to be felt; the deliverables
- How success will be measured; the success criteria

For the team at St. Andrews, quad looked like this:

- Purpose;
 - o “To develop a shelving process where books and DVDs are returned to the right space on the right shelf, and in the most efficient and timely manner”.
- Stakeholders and beneficiaries;
 - o Stakeholders: library staff
 - o Beneficiaries: library users
- Deliverables – to be complete by the start of the academic year;
 - o Books being returned to shelves within four hours
 - o A consistent ‘return to shelved’ processes is to be in use
 - o High quality standards
 - o A Staff resourcing plan
 - o Activity reporting
- Success criteria;
 - o Books being returned to shelves within four hours
 - o A consistent ‘return to shelved’ processes is to be in use
 - o Adequate staff resources are to be available
 - o Weekly reports on activity are to be produced

Before the *kaizen* event it could take anywhere between two and seven hours for a book to be reshelfed, so not only were the team looking at improving the time it took reshelve items but a single goal meant they also had to try and reduce variation.

Having worked out where they were and where they wanted to be, Mark and the Reshelving Team moved onto the next, and in many ways the most difficult, step: working out how to get there. To do this they called on several Lean tools.

LEAN TOOL: BRAINSTORM

Although not unique to Lean, brainstorming is an important part of the improvement process. It allows many ideas to be put forward for improvements by all members of

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the team and as long as the rules outlined in Chapter 5, section I7 are followed many of these can turn out to be new, individual, and useful. This is especially true if all ideas put forward are focused on achieving a specific set of goals.

In the case of the team at St Andrews, ideas were put forward on various ways to improve the process and on how to reduce the amount of time items spent waiting on sprites and in reshelving bays. Some of these ideas were quick to implement, such as putting a short loan trolley next to the lifts so patrons could return those books easily to a single place, while others, such as improving the library's signage, would take more planning.

LEAN TOOL: AFFINITY DIAGRAM

Having generated a number of ideas the team used an *affinity diagram* – described in Chapter 5, section I1 – to group them and find connections. Ideas were written on Post-It notes and placed on a board at random then sorted by the team into themes. Four themes were identified for the ideas generated in the brainstorming session:

- Solving problems that have arisen over time
- Improving customer service
- Working better with other library departments
- Improving the Reshelving Team's working area

By grouping their ideas into themes the Reshelving Team were able to identify the broader issues that faced them and problems to solve, so could prioritise them effectively.

LEAN TOOL: VALUE STREAM MAP

Crucial to improving the efficiency of the process at St. Andrews was the ability to describe it. A value stream map – described in Chapter 5, section I6 – was created that followed a book around as it was reshelved, all the way through from being returned by a patron to hitting the shelf. This let the team identify which parts of the process were valuable and which created waste through over-processing and unnecessary handling. In doing this they identified that each book was handled ten times before it was reshelved and sorted four times, giving an indication of the inefficiency of their current process.

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The Reshelving Team were then able to map out a new process, combining or cutting those wasteful steps. At the same time the steps which added value were described thoroughly so they could be carried out consistently and regularly. In the new process, regular intervals were set out for emptying book return bins – every 15 minutes – and trollies – when full or at every three hours. Further, steps which had previously been implicit in the process but were not always followed – such as returning trollies to the office – were documented so they could be stuck to. All this helped to reduce the variation waste – *mura* – that had previously caused reshelving to be so inefficient before.

The new process was also put into a value map, revealing that it required books to be handled only six times and sorted four times, a clear improvement on the original.

Value stream mapping also helped the Reshelving Team to identify bottlenecks and other areas for improvement. For example, as part of the work to improve their area of the library ergonomic trollies and categorised sprites were introduced, while space was made available near the returns desk for sorting. This both reduced *muda* arising from transportation – as discussed in Chapter 1 of this freebook – and widened a bottleneck early in the process.

THE RESULT: CLEAR PATH TO IMPROVEMENT

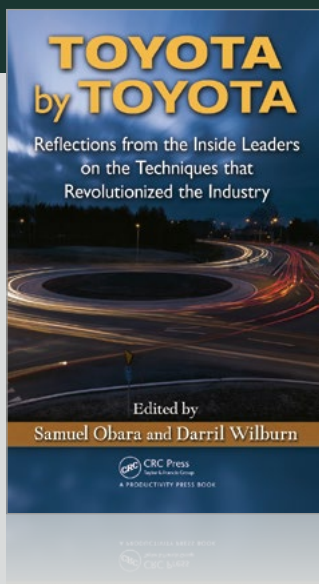
By using a range of Lean improvement tools – including the quad of aims, brainstorming, affinity diagrams and value stream mapping – the Library Reshelving Team at University of St. Andrews reduced both the time it takes to get a book back on the shelf and the variation in that length of time. They hit their goals within the time they allotted themselves, allowing them to say both to themselves and to library administrators that they had been successful with their *kaizen* event. Because they were successful, service levels improved throughout the year and patrons at the university library were happier. The team themselves were also happier in their work, as they don't have times of the year when they are bored and don't have times when they are overwhelmed.

As a bonus, the “working better with other library departments” category of improvements described in the team's affinity diagram has increased communication between the Reshelving Team and other library staff and volunteers.

CHAPTER

7

TOYOTA KAIZEN METHODS



This chapter is excerpted from

Toyota by Toyota; Reflections from the Inside Leaders on the Techniques that Revolutionized the Industry

Edited by Samuel Obara and Darril Wilburn

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TOYOTA KAIZEN METHODS

Art Smalley

Excerpted from *Toyota by Toyota*

The topic of Kaizen is not new or unique to Toyota Motor Corporation. The term “Kaizen” roughly translates to “change for better” and is normally equated with Continuous Improvement in English. The concept of Kaizen inside Toyota has various roots that should be mentioned for reasons of clarification. Also unlike the Western world where Kaizen is typically a big event over a fixed period of time (e.g., five days), Kaizen in Toyota is more a process consisting of six basic steps that anyone or any team can do over any period of time. In this chapter I briefly introduce the background of Kaizen methods inside Toyota, some of the origins, key concepts, and the six basic steps of the process.

The word “Kaizen” in Japanese is written with two kanji characters meaning to change and for the better. Unfortunately, the origins of the term are not exactly clear in terms of etymology. The word “Kaizen” is Chinese in origin and has roots as far back as the Qing Dynastic period in China from 1644 to 1911. The term has always meant improvement although it was not used exactly as in the specific sense we use it today in Lean manufacturing, business, or process improvement.

In the early part of the twentieth century, the term “Kaizen” gradually started to appear in published Japanese works. However, it was not a word widely used by the general population. “Kaizen” was mainly used as a technical term in books and did not cross over into the modern spoken vernacular. Starting around the early twentieth century, the industrial engineering movement in the United States and other countries made methods-based improvement a priority. Works by Fredrick Taylor Frank, Lillian Gilbreth, and others in the field became popular topics. Translations of these books into Japanese no doubt spurred the need for a specific word to mean improvement in this sense and adaptation of the Chinese characters representing “Kaizen” likely occurred. Indirectly, all these works affected Toyota and other companies inside Japan.

In terms of specific direct influences, there were several particular items that influenced the development of Kaizen inside Toyota. Kaizen methods inside Toyota are chiefly a logical extension of Sakichi Toyoda’s founding precepts, the Training Within Industry (TWI) Job Methods course, and several classroom lectures known as the P-Courses taught by Shigeo Shingo from 1955 to 1981 inside Toyota. The Kaizen course borrows elements from each of the preceding training courses and also adds unique Toyota elements.

Before diving into the basic steps of Kaizen at Toyota, there are some related topics that are worth highlighting in terms of general positioning that affect thinking

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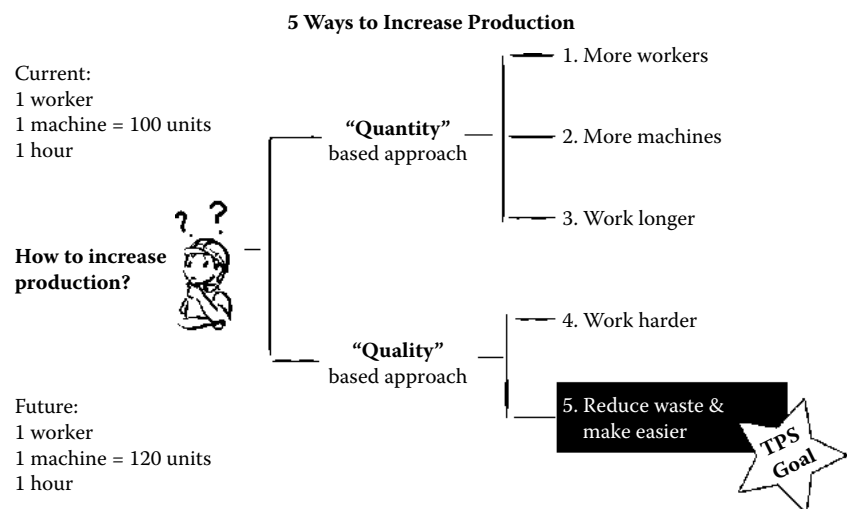
Art Smalley

Excerpted from *Toyota by Toyota*

patterns concerning this topic. Kaizen training at Toyota identified some specific beliefs about how improvement should be carried out. For example, a typical question posed for discussion was, “How do you increase productivity?” Participants normally responded with typical answers such as increasing the number or workers, adding machines, working overtime, or working harder. From a sheer numbers point of view, those answers might deliver more units of production but they do not qualify as true Kaizen. In an ideal case, Kaizen seeks to produce greater quantities of quality product that can be sold using existing manpower, machines, and time constraints. None of the first three typical answers accomplishes that goal and the fourth one—working harder—is neither sustainable nor desirable.

In Kaizen, Toyota wanted leaders to be able to separate work quantity input-based improvements (more machines, more time, more people, etc.) from work quality or method-related improvements, for example, change the nature of the work to be easier and better. In other words, leaders driving Kaizen needed to eliminate waste or unnecessary details in the existing process.

It is possible to make more items by increasing equipment or personnel, but those come at an obvious drawback—increased cost! There are two ways to improve production that do not add cost to the equation but only one of those ways is desirable from a Toyota point of view. By improving the quality of their work, teams can in fact produce greater quantities of quality product using existing resources. In modern-day terms, this is of course often referred to as “working smarter” and not “harder.”



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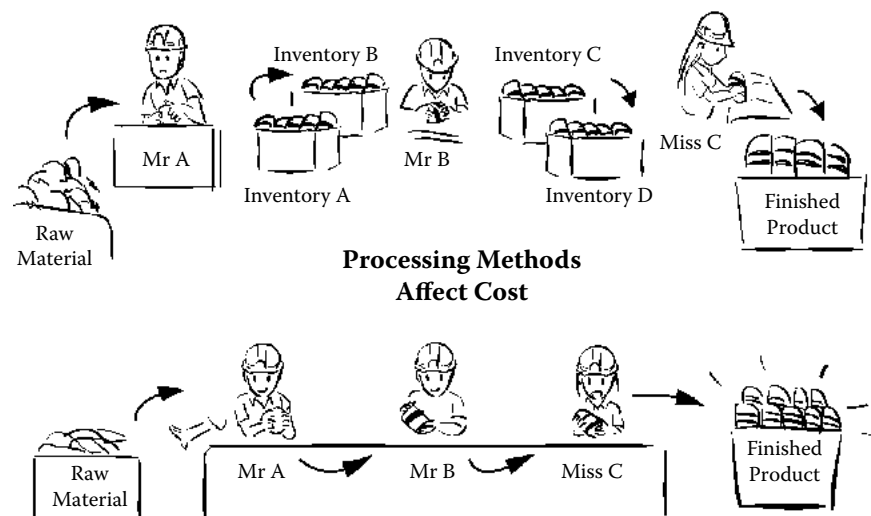
Excerpted from *Toyota by Toyota*

A second preliminary concept discussed in the Kaizen skills course was the notion that how you performed work eventually affected cost. The previous discussion point often drives this point home, but for confirmation the following content was also discussed.

At the time this course was developed, the intended audience was almost exclusively from the manufacturing ranks. As such, the typical graphic used was a manufacturing flow sequence that highlights contrasting styles. Whether or not you are in manufacturing today is not of any consequence. There are ways of doing work that involve inefficiency in your current style of operations. That inefficiency might be rework, downtime of machines, delays in response times, waiting by personnel, or other problems. It is a leader's task to identify more efficient ways of doing things that involve a better sequence and quality of result.

Sometimes, discussion of these previous concepts caused some concern on the part of employees. For example, "I work hard for the company," "I do my best all the time," and "I am very efficient in my day-to-day work routine" are commonly held beliefs. To help reconcile this subjective self-held viewpoint versus reality, Toyota developed the following concepts over the years of the Kaizen course and Toyota Production System (TPS).

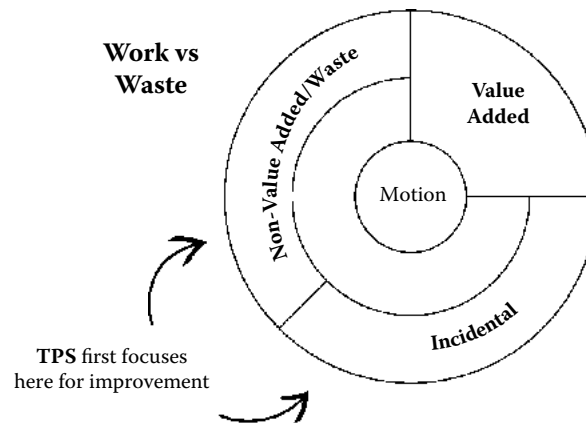
Most people feel they are very busy at work and sometimes overwhelmed during peak work hours or rush periods. The reality is that most of what people consider "work" is not value added from the customer point of view. Toyota taught leaders to think of work as true value-added operations to the customer, incidental items required in the current state of operations, and pure waste in the operation.



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In reality, true value-added work is quite a small part of our normal jobs. Customer requirements spell out the form, fit, content, function, etc., of what they desire. The intermediate steps we use to get that end result are usually not specified. A machine such as a lathe, for example, might remove metal to a certain final dimension and surface finish required by the customer. Which exact type of lathe, the tool, the holder, the storage location of materials, or the exact program used to make the part, is normally not specified. Only making the required final dimensions and specifications as indicated in print in this case are value added to the customer. The rest of the operation is not entirely value added and can be studied for improvement. In reality of course, the value-added portion can be analysed for improvement as well but that is usually not the initial starting point for Kaizen.

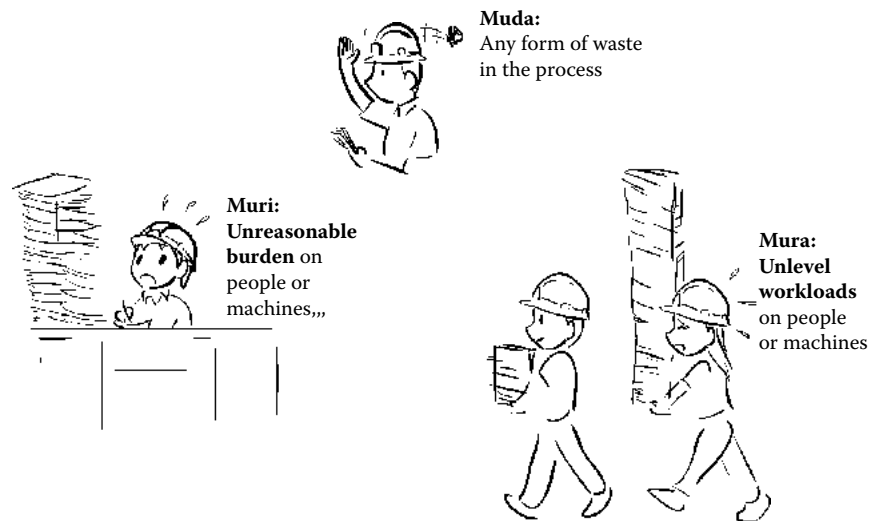
Incidental waste pertains to work that is required in the current state of the operation that is not valued added but still must be done in the current process. For example, the movement of material is not value added to the customer but still some minimal amount must be done in order to get parts from the delivery truck to the process and back again to the shipping dock. Pure waste, on the other hand, is excessively moving materials from one storage location to another location multiple times.

To help leaders and employees see that not all work is value added, Taiichi Ohno coined the terms Muda, Mura, and Muri to explain the concept he was articulating. Muda is waste, Mura is un-levelness, and Muri is overburdening the person or process. All three of these different phenomena are disruptive to efficient production operations.

TOYOTA KAIZEN METHODS

Art Smalley

Excerpted from *Toyota by Toyota*



Even more specifically, Taiichi Oho codified seven typical types of wastes in the mid-1960s:

1. Over-production
2. Excess inventory
3. Scrap and rework
4. Wait time
5. Conveyance
6. Excess motion
7. Over-processing

As the original list of seven wastes was created inside Toyota, many companies have altered the list and added their own forms of waste as well. Failures to utilize human potential, inefficient systems, wasted energy, etc., are frequent additions to the list. The original list is not perfect and was intended to serve as a way to highlight examples for employees to identify areas for improvement. For parties outside of manufacturing, the list requires translation into relevant examples. For example, waiting for material might instead relate to waiting for documents to arrive or be processed. Scrap and rework might pertain to mistakes in documents or transactions.

The final critical concept that relates to the introduction of Kaizen is the principle of cost *reduction*. Kaizen can be conducted for a variety of reasons, including quality, lead-time, productivity, safety, and other items. Ultimately, however, in Toyota we were also crystal clear about the need for cost reduction.

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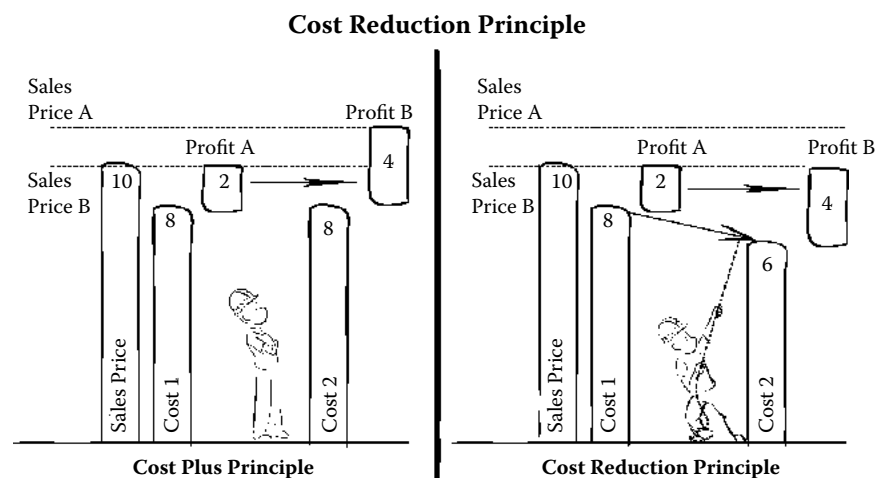
Art Smalley

Excerpted from *Toyota by Toyota*

As mentioned earlier, the automotive industry is a highly competitive industry with many complementary products. Establishing a reputation for quality is critical for any industry. In the long run, companies must also make a profit. A former president of Toyota Motor Corporation, Taizo Ishida, used to remark frequently about the need “to defend your castle by yourself.” By this comment he meant that it was proactive and helpful to take your destiny into your own hands and not leave your personal fate up to others. One of Toyota’s methods of embracing this concept was the principle of cost reduction.

In the simplest sense, profits are determined for a company by three factors: sales price, cost, and volume. For general discussion purposes, these three elements can be represented by the following equation:

$$\text{Profits} = (\text{Sales Price} - \text{Cost}) \times \text{Volume}$$



Given this simple equation, how can a company earn greater profits? There are only three levers for the equation: increase the sales price, increase the number of units sold, or reduce the cost. In general in competitive industries, raising prices is difficult and customers may simply turn to alternative offerings from competitors. Simply making more products is no guarantee of making money either...the result may just be excess inventory or waste. The only sustainable way to increase profits is to focus on cost reduction.

Importantly, reducing cost does not mean simply cutting costs or jobs. Reducing costs means eliminating waste in any process that does not add value to the customer. Less inventory, fewer defects, less waiting time, etc., all lead to greater

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productivity of the factors involved in production. This is the true spirit of Kaizen—establish more efficient uses of existing resources by taking out the waste or unnecessary details that do not add value. Companies that can accomplish this goal will reduce costs and help improve profits. By emphasizing this formula, Toyota made sure that everyone realized they had a direct hand in the success of the company.

In general, there were six main steps to Kaizen inside Toyota and the steps are related to other methodologies, such as the scientific method and general problem solving. The big difference is that in Kaizen, as we will observe going forward, there are more degrees of freedom and greater emphasis on generating original ideas. In general, all improvement methodologies follow the pattern of Plan-Do-Check-Act (PDCA) in some basic fashion and in this sense Kaizen is fundamentally the same.

STEP 1: DISCOVER IMPROVEMENT POTENTIAL

The first basic step of Kaizen at Toyota is to discover improvement potential. There is a slight technical difference between problem solving and Kaizen that is worth emphasizing. In problem solving you are typically trying to close a gap to a known standard. The root cause for this gap is pursued until the gap is closed. In Kaizen there does not technically have to be a problem or a gap from standard. Process performance might be fine or at standard, however you still need to improve for some reason. For example, you might be at 100% on-time delivery but with a lead-time of five days. A good example of Kaizen would be to maintain 100% on-time delivery with a lead-time of two days or less.

Discovering improvement potential is sometimes obvious but helps to embody certain attributes when pursuing improvement. Negative defeatist thinking will never lead you to any gains. Here are some basic things to keep in mind when searching for improvement opportunities.

Always keep the spirit of inquiry alive when you are conducting Kaizen. Do not settle for simply understanding “what” is going on in any process. Seek to understand “why” it is the way it is and exactly “how” it works. Often this process of investigation takes some time in the beginning, but in the end it always pays rewards.

Practice the Toyota concept of “Genchi Genbutsu” at every opportunity. That is, go and see the actual objects in question at the actual workplace. Don’t accept second-hand information or reports, as these often will mislead you or fail to ask all the right

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questions. Just as detectives visit their crime scenes for investigations, you need to visit your worksites for detailed observation as well.

I also suggest that you throw away all preconceived notions about the process or situation you are facing. There is nothing wrong with having opinions or hypotheses when you start out. However, be careful that these do not function as blinders that limit your ability to obtain better ideas or different points of view. Sometimes the best ideas are not always the first ones you come across.

When assessing improvement potential, always practice thorough observation of the work site. This is related to the concept of Genchi Genbutsu but do not fall into the trap of seeing things once at a high level and thinking that you understand all the details. It often takes multiple observations to understand the details of any process, so plan on spending some time “getting under the hood” of the process and learning what makes it tick.

The final point regarding attitude and posture toward discovering improvement potential is to strictly adhere to the concept of “AQD.” By this acronym I mean that you should strive to be *analytical*, *quantitative*, and *detailed*. The term “analytical” means, roughly, to break things down into smaller pieces for study. This helps tremendously in Kaizen if you can break things down into understandable, interrelated components. Second, strive to be quantitative and measure things accurately. Do not accept verbal qualitative statements such as “good,” or “long,” or “hard,” for example. Learn to measure things and be precise. Finally, I also suggest being as detailed as possible. Practice the technique of peeling back the layers of the onion until you are very clear and close to something that can be improved.

If you embody all these attributes, they will make it easier to conduct Kaizen in general and also easier to identify improvement opportunities. Of course these attributes do not generate ideas or answers for you but they help stimulate the mind in a positive direction that will be of benefit during the entire process. In addition, there are also some traditional techniques that Toyota often employed during Kaizen activities to help generate improvement areas. I will outline several of the more common ways to find improvement opportunities.

One of the simplest ways is to compare performance or any process or area to the existing standards and look for opportunities to improve. Technically, if you are short of the standard, you are in problem-solving mode but that is okay if you are looking to improve. If you are meeting all or many of your standards, then you have to question

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if the standards are now too low in terms of difficulty and need to be raised. This is an excellent way to create the need for Kaizen in many instances.

Additionally, a great way to find opportunities for improvement is to create something we called a “production analysis board” at Toyota. Write down the expected production rate for the shift in small increments, such as every fifteen minutes or at least every hour. Then for one day collect data about how well the process is able to meet the expected rate in terms of actual output. Also note the reasons why the process falls behind, moves ahead, speeds up, slows down, etc. These details will always provide great insights for Kaizen opportunities.

Another proven technique is to visit the work site and spend time identifying all the forms of waste that exist in the area. The seven waste categories are an excellent starting point and exist in every operation in some fashion or other. Take these points and list all the examples of them that you find, and that should lead to many areas of Kaizen opportunity.

The final avenue that I will mention in this discovery-related step is to practice the concept of 5S. In Japanese the words Seiri, Seiton, Seiso, Seiketsu, and Shitsukei relate to a disciplined method of organizing and cleaning an area. In English they roughly mean to put, sort and arrange things into proper positions. Once items are properly stored, then properly clean the items, label them, etc., and ensure they remain in a state of cleanliness. Finally, the last S refers to the Japanese word for discipline. Practice discipline to ensure that the gains you have made in terms of organization are sustained.

Any of these methods should work in terms of identifying improvement opportunities. Often you might know right away what you need to improve due to demands from the customer or senior management. When that is not the case, simply looking to improve any of these methods should help you identify multiple areas for improvement.

STEP 2: ANALYZE THE CURRENT METHOD

The second basic step of Kaizen is to analyze the current methods in place for the process or processes you are observing. There is no one magical way to analyze processes. Your goals should drive what you look at in detail and how you study the process. I will list some of the more common types of analysis that have been of use over the years at Toyota. You will have to use other methods as well, depending on the nature of your situation.

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The most elemental form of analysis is something called “work element analysis.” This is a fancy way of saying that you should write out all the steps of an operation in sufficient detail and then begin the step-by-step process of questioning each step. First ask exactly what this step is and what its fundamental purpose is. Then ask why that step is necessary. Look for steps that you can eliminate. Additionally ask, “where” the step is done, “when” it is done, “who” is doing it, and, of course, “how” it is being done. This method is referred to as the 5W 1H technique for investigation. Repeat it over and over as needed until all the steps in the process are covered and sufficiently examined.

In an ideal case, you are looking for steps to eliminate; however, that is not always possible for every step. Because we are looking for improvement, be sure to also consider what can be combined, what can be rearranged, or finally, what can be simplified. This step-by-step process is referred to as ECRS, the acronym for *eliminate, combine, rearrange, and simplify*. Each of these letters represents a different analysis and improvement angle for consideration. Often, this simple technique is all you need to generate valuable improvement opportunities.

A second common technique inside Toyota for analyzing processes is time study. Many critical elements of Toyota’s system are founded upon time-based concepts. Takt time, Just-In-Time, and cycle times are just a few well-known examples. Time studies have their associated strengths and weaknesses but almost always the time required to complete a task is one aspect of productivity. Measuring times for an operation on a step-by-step basis is a valuable way to analyze processes and factually find out how long different tasks are taking to complete. Steps that take a long time to complete or vary considerably are often excellent candidates for Kaizen.

A technique that is similar to time study is that of motion study. Normally we use the phrase “time and motion study” as if it was a single technique, but the roots and methods are quite different. Time studies, as mentioned above, merely look at how long some step or process takes to complete. It says nothing about the fundamental motions required to complete that step. For time studies to have any meaning, however, the times must be related back to either work elements or discrete motions for identification purposes. Time merely reflects the action being taken; however, it is not the motion or action in and of itself.

There are special symbols that can be used in motion analysis when this sort of detailed observation is required. The symbols are quite old and were formed by the husband and wife team of Frank and Lillian Gilbreth. Eighteen basic symbols can be

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used to depict most human motions and they are quite detailed in nature (e.g., extend hand, grasp, remove, etc.). There is not enough space in this chapter to explain the symbols but they are easily found in old Industrial Engineering textbooks or on the Internet for interested parties. When motion study is combined with time study, it can become a powerful technique for generating many small improvements that can add up to something very big in the end.

If you combine work elements, time, and motion study in a particular way, you will arrive at a form of analysis known as *standardized work* at Toyota. Standardized work is a chapter or book all by itself in terms of difficulty and precision. If you are familiar with the concept, however, it can be a tremendous way to analyze certain types of operations. In a general sense, what you seek to do is establish a takt time or rate for a process and then align work elements for a given operator or set of operators up to that rate. In other words, you are attempting to balance the work to the rate of customer demand. When this analysis and activity is put into place, work rates are more closely aligned with customer demand and the practice of overbuilding is usually stopped. In addition to stopping this overbuilding, there is normally a large gain in terms of productivity and quality as well.

When machines are the focus of improvement of work instead of human operations, then a different lens is normally needed to spot improvement angles. For machines in most production shops, the areas of mechanical breakdown, changeover time, minor stops, speed losses, scrap, and rework, for example, represent excellent areas for improvement. Normally, one or two of these areas predominate in terms of impact on production. It is good practice to measure the extent of these losses and then pick the largest one or two for deeper study and analysis.

One more uniquely Toyota style of analysis is that of Material and Information Flow Analysis (MIFA). In the world outside Toyota, this practice is known as *value stream mapping* due to the success of a well-known workbook published on this topic. The basic concept of the analysis is to measure the lead-time throughout the facility for a given product or component. Normally, the actual value-added time for any item is measured in minutes, whereas the lead-time is measured in days. Analyzing scheduling patterns, process flow, inventory amounts, and other angles often highlights many areas of improvement.

As I cautioned at the beginning of this step, there is no single way to analyze a process. Your goal will determine what you will look at in reality. For example, if you are strictly looking to improve quality, then none of the items alone mentioned above

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will likely be sufficient. Other techniques related to improving process capability then make more sense to employ. Normally, however, some form of work element analysis, time and/or motion study, standardized work, machine loss analysis, or material and information flow analysis is a great way to look more deeply into a process and generate ideas for improvement.

STEP 3: GENERATE ORIGINAL IDEAS

The third step in Toyota's Kaizen method is to generate original ideas for improvement. Just as there is no one magical way to analyze a process, there is no one magical way to generate ideas. We can, however, provide some basic advice regarding the idea generation process and highlight some methods that have been used in the past to help spur thinking.

Often there are roadblocks that stifle our creative thinking process and we need to be mindful of these pitfalls. Otherwise, even the best of teams can become sidetracked and fail to generate improvement ideas. One common problem is simply force of habit. We repeat something over and over again until it becomes second nature. That habit is healthy in many respects but it does not always help in implementing Kaizen. Be prepared to always challenge the current status quo and be open to experimenting with new methods in Kaizen.

As set of related roadblocks are those of preconceptions or common sense. Often we unintentionally have mental roadblocks that hinder our thinking. For example, in the area of machine setups, it was common sense to run large batch sizes on equipment that ran multiple part numbers and were difficult to change over. Common sense said to run fewer changeovers because they took away from valuable production time. Uncommon sense challenged the assumption behind this idea that changeover time was fixed and set out to reduce that time component until it was negligible.

Emotion can also be a powerful force that limits our creative thinking power. We need both logic and emotion to form opinions and drive actions. However, the emotion of fear of failure, for example, can force us to become hesitant or overly cautious. In Kaizen we need to remind ourselves from time to time that it is okay to fail as long as no one is injured and the damage is not irreversible. Some of our best learning comes from failing and learning why something does not work. Often it requires a second or third time to get things right, and we need the patience and persistence to follow through on these sorts of items. Be careful so that you don't allow emotions to stifle trial and error and the associated learning process.

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In terms of practical advice, there are several things I suggest that you attempt when generating ideas. One very important rule is to separate idea generation from that of judgment. Often we are quick to judge and dismiss ideas that are new or different. In generating original ideas, I suggest that you strive for quantity of improvement ideas first and then whittle those down later to select the most promising few. If you apply the lens of judgment too often or too early, you will inadvertently stifle the creative thinking process as idea generation and judgment utilize different parts of the brain.

Other points of practical advice include thinking from different angles and combining ideas with others. For example, if a task like fastening a bolt takes too long or is difficult, the right approach might not be to do this task faster or make it easier using the same mechanism. The best idea might be to eliminate the need for the fastener in the first place and secure it via another method. This alternative way might link in with someone else's idea about how to apply a new method for fastening the items in question.

Over the years there have been a variety of documents created to help people generate ideas, and I suggest that you research and apply these techniques as needed. Some of the methods are simple, such as mental checklists. Alex Osborn was regarded as the "father of classical brainstorming." He created several checklists that asked a series of questions pertaining to reusing, borrowing, changing, enlarging, reducing, substituting, rearranging, reversing, and combining items. Often, these thought-provoking questions can be used to stimulate idea generation.

Industrial engineers also have created various rules for motion economy. These rules can apply to use of the human body, arrangement of the workplace, or the design of tools and equipment. Reviewing these checklists and—more importantly—creating your own for your respective situation is a great way to encourage the thinking process and to make sure you are considering multiple angles.

Another fundamental piece of advice is to encourage the practice of asking questions and clarifying the purpose of various items. The fundamental 5W 1H technique for asking Why, What, Where, When, Who, and How is very useful for analysis as well as idea generation. After asking the 5W 1H questions, review everything in the context of can we eliminate it, can we combine it, can we rearrange it, or can we simplify it for improvement? This questioning process is always useful for generating new ideas.

The final and most famous method for idea generation is that of brainstorming. Almost everyone is familiar with this process and it needs no introduction. When applied correctly, it is a very useful technique for idea generation. Be sure to keep

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the group to a reasonable size so that participation is manageable. The four basic rules for brainstorming are to suspend criticizing during the idea generation phase, encourage speaking freely, seek quantity, and encourage thinking collaboratively. Employing an assigned facilitator and scribe are also useful techniques for running an effective meeting.

STEP 4: MAKE A KAIZEN PLAN

In Kaizen we normally try to implement improvement ideas as soon as possible. Sometimes that ideal can be done right away but at other times it takes a while to implement some items. In either case, it is important to have a plan in place to guide the actions that need to be carried out. The plan does not need to be elaborate or overly complicated. However, it does need to contain several key elements for it to be a viable plan.

First, the plan must make clear *what* is going to be done in terms of either corrective actions or altered methods to improve the current state. The action items should be as specific as possible and detailed enough to be clear. If the *what* part of the plan is not clear, then people are left to their own interpretations of the task and confusion might be the result. Take time to draft what is going to be done in a clear fashion and review it with all necessary parties.

Second, the plan should also contain *who* is going to do the task and by *when*. Plans that do not assign either responsible parties or a due date are rarely completed. In order to get things done, a person or someone representing a group of people needs to own action items for clarity. This person may in reality coordinate the completion of the work but there needs to be a single point of ownership for clarity and accountability. Likewise, without a due date, tasks will drag on for an extended period of time and not ever be completed. In Kaizen we have to make clear who is responsible for action items, along with a due date.

Additionally, in some plans it is also useful to include *how* the action item will be done if that is not self-evident. In other cases, the *what* and *how* are often mixed into one statement regarding the purpose of the proposed action items. In either case, it is also useful to make it clear where the work will be done and *what the expected result is* for the item in question. For example, if changing the assembly technique at station six is implemented in hopes of reducing difficulty and saving time, what is expected? Just expecting “better” is not always a clear indication of what to expect. If you expect to cut the cycle time in half, then include in the plan that the expected

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result is to reduce the time required from sixty seconds to less than thirty seconds, for example. This will give you something more specific to check later on when you are evaluating the success of your action items.

STEP 5: IMPLEMENT THE PLAN

Implementing your Kaizen plan is essentially the “Do” phase of the Plan-Do-Check-Act (PDCA) management cycle. Creating a good plan as outlined in Step 4 is a healthy step toward implementing your plan. Implementation normally involves a mix of short-, medium-, and longer-term items to complete. Here are a few things to keep in mind.

During implementation it is very important to communicate with all affected parties about what is being done. Often, Kaizen breaks down due to failures to explain and coordinate with affected parties. Part of being a good Kaizen leader is skill in both leadership and communication. Be sure to conduct updates and review the plan as needed during implementation phases.

Second, do not forget to provide proper training and instruction as needed. The act of Kaizen implies change, and therefore various standards and ways of doing things in the process are altered. Take the time during implementation to make sure that training, when required, is adequately conducted for anyone affected by the change. Having a good job instruction training plan in place as part of the Kaizen implementation is always a good idea to increase the chances of success.

Another key point during implementation is to remain positive and enthusiastic about the change. It is always likely that you will run into unforeseen problems during implementation. Take the time to address those items, revise plans, and alter methods as needed. Success is often a matter of sticking to the Kaizen process and repeating it as needed. If at first you don't succeed, try and try again.

STEP 6: VERIFY THE RESULTS

The final important step of Kaizen is to check and verify your results. Unless you produce results that generate measured improvement, you have not done true Kaizen. In other words, activity alone does not ensure achievement. There are several key points in this step to keep in mind. One key point is the importance of using standards as a method for measurement. Another is honestly assessing if you have met your goal. If you did meet the goal, then measure by “how much?” Was it as in

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the amount as expected? If not, then by how much did you miss and why not? These are critical actions to complete during the final step of Kaizen.

The other unstated part of this final phase is deciding what to do next. If you are satisfied with your results, can you replicate this elsewhere? What needs to be done in order to sustain the gains you have made? These questions and others should be considered during the completion of your Kaizen implementation. One useful way to help facilitate this discussion is by holding a brief Kaizen presentation report at the conclusion of the activity. Have the team explain their task and identify the improvement opportunity they were seeking. In addition, have the team explain the analysis methods they used and what improvement ideas they identified. Also, have them explain the implementation sequence and the results obtained from the project. As part of the closing discussion, review what was learned, how this can be shared and sustained, and what else might be done.

SUMMARY

This chapter attempted to explain some of the history, concepts, and basic steps associated with Toyota's Kaizen method. I always remind people to think of Kaizen as a process and not an event or activity. The process of Kaizen can be practiced by individuals, teams, or special groups brought together for a particular purpose. The goal of Kaizen is to generate improvement results for the organization and to develop the skill of the participants involved in the activity. The opportunity for Kaizen is endless, and the process is always rewarding for those willing to undertake the journey.

Note: For further details on this topic, including specific worksheets, examples, and more in-depth explanations, please refer to the book titled *Toyota Kaizen Methods: Six Steps to Improvement* authored by Art Smalley and Isao Kato, and published by Productivity Press in 2010.



CHAPTER

8

INCREASING LIBRARY USAGE

THROUGH CONTINUOUS
IMPROVEMENT AT
UNIVERSITY OF CAMBRIDGE

INCREASING LIBRARY USAGE

THROUGH CONTINUOUS IMPROVEMENT AT UNIVERSITY OF CAMBRIDGE

University of Cambridge has a large and complex library structure, with more than 140 libraries including a central library, college libraries, department and faculty libraries, and affiliated libraries. In 2015 two of the university's science libraries were merged: the collections at the Central Science Library (CSL) – which as its name implies was in the city centre – were merged into the Moore Library– sited around 15 minutes away from most colleges and departments. So, not only did librarians at the Moore Library have to contend with factors that have caused so many to face declining usage, such as increased resource discovery outside the university library, they also had to persuade patrons to make a journey they didn't previously have to. Further, they had to do this with a third fewer staff than before the libraries combined and with reduced shelving space as the two libraries now occupied one building.

To overcome these challenges, Yvonne Nobis, Head of Science Information Services for the University, made growth in usage a key objective for the library. Thanks to the initiatives she and her team have run, usage of the Moore Library is now ten times what it was directly after the merger. While Nobis and her team did not set out to be Lean, their approach to continually improving services and the library environment has been a key factor in this growth.

CHOOSING CHANGES THAT BENEFIT THE CUSTOMER

Merging two libraries into one building meant a large reduction in available shelf space. As well as the circulating book collection that has been moved to the Moore Library, the Central Science Library held a journals and archive collection that took up almost six miles of shelving space. This was destined for temporary storage in North London, around 60 miles away, while a new archive facility was built nearby that would make content retrievable again, albeit with a wait for patrons.

This meant that as much value as possible had to be found from every inch of space in the Moore Library. One way Nobis and her team considered finding this value was moving to an ebook-only purchasing strategy wherever content was available electronically. As long as patrons valued ebooks about as much as physical copies this would limit the growth of their physical collection, saving them space for years to come.

To find out whether it would really be a good idea the team placed a survey form inside every book in the building, asking whether patrons would prefer the library to stock e-books, print books, or both. Patrons' overwhelming preference was for print.

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If the librarians at the Moore Library had made the transition to e-books, then, they would have made space savings – a non-value adding activity – but the library would not have had resources in the format that patrons wanted to use – reducing library's value those patrons. They may well have seen a reduction in usage, taking them away from their goal.

On the other hand, a use of space which has added value has been the introduction of blackboards. While they may be an optional extra for humanities students they are a key tool in maths and the sciences. Think of Matt Damon's problem-solving scene in *Good Will Hunting*; Sheldon and Leonard's flat in *The Big Bang Theory*; or Eddie Redmayne's portrayal of the discovery of Hawking radiation in *The Theory of Everything*. Blackboards and whiteboards are the best collaboration and problem-solving tools for science and mathematics students and those students engage with these tools regularly. After discussions with students Nobis and her team initially bought two blackboards; these have been so popular that the library now has eight. These spaces have help to increase the number of students engaging with the library and by extension with the library's collection.

As the archive collection is used less regularly than either the blackboards or print copies of the circulating book collection, the naïve assumption that the library should make both the archive and circulating collections available to patrons would actually have reduced the Moore Library's value to its patrons. By focusing on items that they knew added value for patrons – thanks to their feedback, gathered on prominent whiteboards at the front of the library – rather than simply making sure as many titles as possible were available to those patrons, Nobis and her team have increased engagement with the library in ways that may not otherwise have been possible.

FREED UP TIME FOR VALUE ADDING ACTIVITIES

Cataloguing is an important activity in any library. Indeed, there are librarians who make whole careers from their skills as cataloguers. However, cataloguing items perfectly is a time-consuming activity. Moreover, as it does not directly solve patrons' problems it is a non-value added activity. And with so many fewer staff the team at the Moore Library needed to use as much of their time on value-adding activities as possible.

In addition, Cambridge University was facing a unique problem. As a legal deposit library, they have for hundreds of years been entitled to receive a copy of every book printed in the United Kingdom for free. Collection development had never been

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a concern: if the free copy of a physical book is used repeatedly, extra copies are bought. With the growth of ebooks, however, many of those books were now coming in digital form with various digital rights restrictions. For the first time, then, the university librarians started to need to spend time on collection development, an activity that adds a lot of value to their service.

Nobis worked with the cataloguing team to move away from a time-consuming manual cataloguing system to an internally developed system that:

- Allowed staff to get books onto the shelves faster, eliminating the Moore Library's cataloguing backlog entirely.
- Reduced shelving time for each book, which discussed in Chapter 6 increases the value of the library to patrons
- Helped staff to get their cataloguing work done faster, freeing up cataloguing specialists' time for other work

The cataloguing specialists were then trained in collection development, giving them multiple skillsets – exactly as the British Library did in Chapter 2 – and allowing the Moore Library to adapt to the new challenge that they faced. This meant the library could continue adding value for their patrons, even with reduced staff numbers and increased challenges.

At the same time, changes were made that reduced the amount of time librarians spent answering patron queries without reducing the quality of those answers. The team realised that the library website was the first port of call for many students but that it did not display the information those students needed. Previously, although several people at the library made changes when they had time nobody had overall responsibility for maintaining the website. Website usability was improved during a redesign and maintenance was added to somebody's role, giving them the responsibility for updating opening times, contact details, catalogue information, and all the other areas. This reduced the amount of time front-line staff spent answering simple queries and freed up their time for collection development, reshelving and other value-added activities.

Although a new website was a relatively small change, when combined with other projects for improving efficiency, like introducing a new cataloguing system, the result was that staff had much more time to spend on value-add activities, helping them to become a valuable resource for students and faculty members.

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IMPROVING THE ENVIRONMENT

Nobis's programme of improvements didn't just focus on service and process. They also recognised that unless people wanted to make the journey to the library they would not make the extra effort that getting there now required. As much as the librarians advertised the library's new location at the old Central Science Library; emailed students; told faculty members about the move; and otherwise advertised the change, they knew that the most important factor in hitting their increased usage goals was not encouraging people to come to the new site the first time but to persuade them to become regulars

One of the first changes came about almost by accident. The library had inherited a few jigsaw puzzles which the librarians realised were being used regularly by groups of students. Nobis bought more puzzles, with the result that more groups of students came to the library to relax and collaborate.

Nobis was then asked whether she had a "beanbag budget". This suggestion was initially treated as silly. After all, the library's reduced budget meant they had better things to spend the money on. But after some persuasion two beanbags were bought as an experiment – and proved so popular the library now has 16. Then, a member of staff started using a standing desk. This started to be used by patrons when the staff member was not working at it, so nine more were bought. Finally, after hearing that plants improve idea generation, problem-solving skills, and air quality the librarians also spent some money on large plants.

Compared to other changes that the library could have made, these environmental improvements were inexpensive but they may have been instrumental in making sure patrons return regularly. Those patrons may not always be using books, but when they need to discover titles the library is now their first port of call, not an afterthought when Google doesn't deliver.

SUMMARY

Nobis and her team at the Moore Library did not set out to become a Lean library. However, you may have noticed that many of the problems they have solved are great examples of rooting out different types of *muda* waste – as described in Chapter 1 of this FreeBook – and increasing value:

INCREASING LIBRARY USAGE

THROUGH CONTINUOUS IMPROVEMENT AT UNIVERSITY OF CAMBRIDGE

- The discrepancy between staff cataloguing skills and needing collection development librarians was a form of “employee underutilisation”
- Increasing the number of ebooks would have been a form of “excess inventory”
- Manual cataloguing was a form of “extra processing”
- Simple enquiries that needed to be handled by staff were a form of “defect”

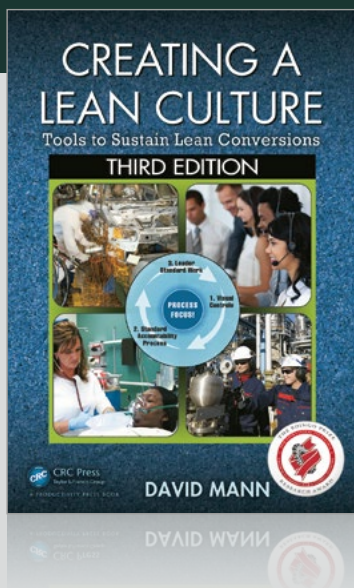
Their approach of eliminating these wastes and non-value adding activities with a series of continual improvement projects helped to make the whole running of the library more efficient, allowing librarians to focus on activities that were valuable to patrons.

Further, by maximising the value to patrons of their limited space and by continually experimenting with new environmental ideas – both big and small – the team at the Moore Library have turned the building into a place that people want to visit. They have adapted to their changed circumstances, surpassed their aims, and proved their value to patrons and university administrators alike.

CHAPTER

9

LEARNING LEAN MANAGEMENT THE SENSEI AND GEMBA WALKS



This chapter is excerpted from

*Creating a Lean Culture:
Tools to Sustain Lean Conversions, Third Edition*

By David Mann

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LEARNING LEAN MANAGEMENT

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The principal elements of the Lean management system do not seem to be complex or difficult to understand. Yet they represent the rocks on which so many Lean initiatives have run aground. Why?

Part of the answer involves discipline, certainly. But, another part of the answer involves a teaching and learning model for Lean and Lean management, and how to be a Lean manager.

Lean's classic master-apprentice teaching and learning model has long proved effective with leaders in tactical positions, those responsible for and familiar with day-to-day operations (and Lean leaders responsible for supporting Lean implementation). Or, it is useful to think of the tactical chain of command as extending from a plant manager or a customer service director, or a director responsible for surgical operations down through floor-level team leaders and Lean resources. This chapter covers the approach for learning Lean and Lean management for those new to Lean in this segment of leaders, and in some cases for their bosses as well.

Before continuing, however, it is important to make a distinction I have learned to recognize in the ten years of experience since the first publication of this book. What works for those directly involved with tactical day-to-day operations is not the same as the approach that has proved to be effective with senior executive leaders whose concerns are usually more strategic in nature (**Case Study 9.1**).

In the master-apprentice model, the master (the Lean *sensei*, or teacher) and apprentice walk the floor, a *gemba* walk. The master points out examples where a Lean approach might apply and asks probing questions to stimulate the apprentice's thinking. The master continues until she is satisfied the apprentice has grasped the concept (for example, produce smaller quantities more frequently, replenish only what has been consumed, make sure what is needed for the work is readily available at hand and obvious at a glance, arrange the work so as to minimize or eliminate wasted motion, and so on). Then, the master makes an assignment, usually in the form of a suggestion. "Why don't you see if you can apply this concept here? We'll see how it looks next time" (often, next week).

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CASE STUDY 9.1: GEMBA WALKING A VP FOR LEAN PRODUCTION

A new VP had just been transferred from marketing to take over manufacturing. His undergraduate degree was in engineering in addition to an MBA. He had not worked in engineering or operations for many years. The three-person team responsible for the Lean initiative across the 12 manufacturing plants met with him his first day on the job. He told us to “treat him as a student.” We gave him several books to read and asked him to *gemba* walk with us individually, one on one. He agreed.

My colleagues and I *gemba* walked the factory floors with him, stopping to ask him to observe something and asking him, for example, if he could tell from a generic reorder card the specific quantity of parts to be produced. Or, how he could know amid the mountains of parts crowding the area whether parts needed to be reordered, and what information would be needed to answer the question. He was a quick study, able to answer any of our questions after a brief pause.

As he learned from us, he began asking similar questions of his plant managers on frequent drop-in visits to *gemba* walk in the plants. The plant managers scrambled to get up to speed with Lean, suddenly becoming much more interested in our help.

Five years later, now as a corporate officer and senior VP for global operations, he was the key sponsor on the senior executive team for an enterprise Lean initiative at a critical point for the business. Despite the objective success of enterprise Lean, his peers, VPs in other areas of the business, lacked interest in our *gemba* walks focused on the nitty-gritty details of Lean applications in enterprise administrative operations. The initiative was losing support and was on increasingly shaky ground until we developed a way to engage our senior executive clients. See Chapter 8 for the details of our recovery.

YOUR SENSEI AND “TRUE NORTH” PROVIDE DIRECTION

Lean is tricky, because it is so much more difficult than it seems. Reading about Lean, attending workshops on Lean, or participating in simulations is no substitute for real-world, on-the-floor coaching and critique from someone who has experienced implementing Lean. An effective sensei will be insistent and at times critical, to the point of being at least mildly abrasive. Most of us need a sensei to

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help us understand how to translate basic Lean concepts into actual functioning applications. More than that, your sensei should also instil in his or her students the discipline needed to effectively sustain a Lean conversion and have it improve consistently.

Toyota refers to “true north” as its ultimate direction for perfection in Lean. It has relied on its internal sensei to keep the company on that path, just like early travellers relied on the North Star, Polaris, to keep them headed in the right direction as they traversed unfamiliar territory. In a Lean implementation, the sensei plays the role of Polaris. Working with a sensei is not like conventional training. Instead, it more closely resembles an internship or apprenticeship. In these models of teaching and learning, the student learns over time, through experience from applying concepts to actual live situations and carefully observing the consequences under the tutelage of the sensei.

The classic sensei is Socratic in approach, teaching by asking questions that stretch the student’s thinking and perceptions and stimulate the student to consider entirely new possibilities. Students might encounter questions such as:

- How can you tell what is normal in this area?
- What would you learn if you measured in smaller intervals of time?
- Can you tell what is supposed to be here—and what should not?
- How frequently are the supervisor and his or her boss in this area?
- How can you tell?
- What is the team leader supposed to be doing in this situation?
- Why should you expect the team leader to know that?
- How could these expectations be made clearer?
- How do you know that the designated person carried out these posted procedures?
- How could someone know who was responsible for this task?
- How could you know these things with more certainty?

Some of the sensei’s teaching is likely to be typical classroom instruction, especially early on when introducing the basic concepts of Lean or of a particular technique or approach. To be effective, these sessions should be immediately translated to observation and application on the production floor, a destination to which the sensei will often appear impatient to return. Once the conventional training is over, sensei and student begin or resume *gemba* walking to reinforce what has been presented

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and to extend the lesson through extending the principles to situations encountered where people are doing actual work (**Case Study 9.2**).

Think of your sensei as a personal trainer, one who sets expectations for you and then teaches, coaches, and prods you to meet them. Can you learn Lean production and Lean management by yourself through study, application, and self-critique? Certainly, you can. Perhaps more pertinent, however, is how long do you have? How persuasive can you be with your peers and superiors as you work your way through the learning curve, stumbling occasionally as anyone would with brand new ideas? In most cases, probably not long enough. This is a place where calling on outside expertise is well worth it, subject to all the caveats of working with external—or internal—consultants, as in **Case Study 9.3**.

CASE STUDY 9.2: LEARNING TO SEE PROBLEMS, NOT JUST CORRECTING THEM

In one case, I was working with a supervisor on basic 5S discipline in a welding department. Except for the weld tips themselves, nothing in the place had been cleaned since it opened many years earlier. You can imagine its condition: grime and dirt seeming to grow from every surface—horizontal and vertical, top and bottom. After a few weeks of pointing out several particularly dirty areas and talking about the benefits of discipline and order, it became clear that the supervisor was only cleaning up the specific spots we had looked at. I admonished him: “Learn to see the dirt yourself!” He did, took initiative to get the entire area cleaned up, and needed no more coaching on this topic.

CASE STUDY 9.3: DON'T USE CONSULTANTS AS A PAIR OF HANDS

A regional health services organization became convinced Lean was the way it was going to survive and prosper in its rapidly changing industry. It had no internal expertise with Lean concepts or their applications in healthcare settings. To begin its Lean journey, the organization engaged a consulting firm whose approach was to implement Lean through a series of kaizens. For two years, every time a kaizen was identified, consultants from the firm came in from out of town to lead the kaizens.

In all that time, they did not train anyone in the client organization to lead or facilitate a kaizen event. The client eventually stopped working with the consulting firm and developed its own Lean resources. Since then, it has gone on

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to develop deeply rooted and widespread Lean thinking and a robust and effective internal Lean application capability that is a model for many in the industry.

Another healthcare firm, consisting of a mutual health insurance business and a number of physician practices, or clinics, in a large metropolitan area had heard about Lean successes in healthcare. It too was convinced that Lean would help it survive and prosper, in this case in the rapidly changing environment as the 2010 Affordable Healthcare Act moved toward implementation.

The firm identified roughly a dozen internal resources to be trained in Lean tools and Lean implementation, and used outside experts as trainers. Once training was complete, the internal resources were deployed across the organization, each one linked with one to three specific departments. Three years later, most of the internal resources had their employment terminated. A few had returned to their previous positions.

When asked about the reason for this abrupt change of direction, the VP responsible for process improvement indicated that only two of the Lean staff had developed into Lean coaches and teachers; the rest of the internal consultants acted as a standby fix-it staff. When a department had relatively minor internal process problems, the standby fix-it resources were given the problem to own and fix. In the course of their three years on the job, only 2 of the 12 Lean consultants had taught anybody Lean thinking, not to mention bringing Lean applications to problems of significance beyond any single department. Most of the staff had simply been a convenient remedy for minor departmental irritations rather than resources enabling strategically important improvements. When budgets had to be cut, almost nobody but their own VP spoke up for the potential strategic value of the fix-it resources. True, they had been a convenience for the departments, but they had not demonstrated anything their internal clients considered essential or that helped to invigorate a stalled corporate strategy for improving effectiveness and efficiency.

In one important way, the *sensei* should be like any good consultant, recognizing the division of responsibility between client and professional advisor. That is, the *sensei* or consultant is responsible for teaching, giving advice, stimulating new thinking, and identifying new directions. The client is always responsible for decision making, that is, for whether and how to apply the advice of the teacher. In this relationship, the only

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decision the *sensei* makes is whether to continue working with the student, based on how the student follows through on commitments.

GEMBA WALKING

Gemba is roughly translated from the Japanese as “the real place.” In this sense, real refers to where the action is happening. To illustrate, Japanese television news reporters covering the devastating 2011 earthquake, tsunami, and nuclear plant disaster that struck Fukushima introduced themselves on camera standing in front of a site near the disaster zone as “reporting live from *gemba* in Fukushima.” If your focus were on improving customer service in a call center, *gemba* would be the call center floor and workstations; for a hospital’s emergency services, *gemba* might include the ER waiting room, registration stations, and patient care areas. For manufacturing, *gemba* is the production floor.

The idea of *gemba* is simple:

1. Go to the place.
2. Observe the process.
3. Talk with the people

Gemba walks typically take place on a regularly scheduled basis. An optimal schedule is at one-week intervals. This is enough time to allow the student to digest the lesson and complete assignments the *sensei* gives, but short enough to maintain a sense of pace. In some cases, the assignment will be to develop an explanation for why something appears as it does and what an alternative might be. As the teaching and learning progress, the *gemba* walks shift to the *sensei* suggesting assignments for the student, and then following up on the next walk. The *gemba* walks are another instance of accountability for bringing actual (what the student has been able to accomplish) in line with expected (the assignment from the *sensei*). In these cases, *gemba* walks become a method for setting and following up on expectations for Lean learning and implementation. As the student begins to correctly interpret what the *sensei* points out, the *sensei* will make assignments to implement the concept the student has seen on the *gemba* walk. Next, the *sensei* will expect the apprentice to initiate similar action when encountering a need for applying the same concept, but in circumstances and processes different from those in the areas where they have already walked (**Case Study 9.4**). What is being tested here is the apprentice’s ability to recognize the concept and its potential application in unfamiliar areas, processes, and settings.

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CASE STUDY 9.4: HOW *GEMBA* WALKS CAN REVEAL OPPORTUNITIES FOR IMPROVEMENT

Illustrating this aspect of *gemba* is a case where a value stream manager had brought his area from chaos to stability and excellent performance. The area missed its daily production targets and pitch rhythm only when materials failed to arrive on time from outside suppliers. The leader was restless; he believed the area could improve further, but did not know what to do. We went on a *gemba* walk, looking for opportunity.

From the day the plant opened, parts were unloaded from the paint line into kit racks that held components for ten units. The units could be up to 6 feet long and 4 feet wide, so the racks had to be big enough to hold the components safely. They were big, about 8 feet long by 4 feet high, heavy, and not easily manoeuvred. Formerly, they were staged at two-person assembly benches where each unit was built complete from start to finish by the two-person team. Now, they fed an L-shaped assembly line. The painted parts held in the kit racks were hung on the paint line in groups of four units.

I asked the leader if the balance on his assembly process would improve if it were arranged in the classic U shape. "I can't do that; the racks wouldn't fit inside a U," he said, and then quickly realized the implications of cutting down the racks for tightening the footprint of his assembly line, bringing better balance to it, and improving its performance.

HOW LEAN TYPICALLY STARTS AND GROWS

The orthodox or purist approach for bringing Lean to an organization calls for the Lean *sensei* to start at the top. In this view, the Lean *sensei* starts by *gemba* walking the CEO to teach him or her to see through Lean eyes. The *sensei* then works his or her way down through the organization structure, building knowledge and support for Lean from the top down.

In my experience, this approach is unrealistic.

In 15 years I have seen the top-down *sensei* approach work in a large, complex organization only once. On rare occasions I have seen it work in small manufacturing companies or self-contained administrative operations units. But in the vast majority of cases, senior executives, even in smaller organizations, do not have the

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time, patience, or interest in learning Lean to the depth and in the way the *sensei* learned. They have neither the patience nor willingness to learn in the way the *sensei* wants to teach. And, they typically are not interested in learning to become a Lean implementer; they have people like us to worry about implementing the nuts and bolts of Lean tools.

By far the most typical scenario I have seen is for Lean to start in the middle of an organization, then spread like a slowly propagating beneficial virus. In this scenario, one or a few people somewhere in the middle of the organization, say, an engineer or department manager, have gotten the Lean bug. They have read something, been to a conference, visited or toured a Lean operation somewhere. They begin experimenting with small-scale Lean applications within their sphere of control. Their success piques the interest of others and the experiments expand. As Lean applications succeed and spread, the improved results catch the attention of their superiors. Eventually, the organization hires a consultant to help Lean grow, or forms an internal Lean resource team for the same purpose. At that point, the Lean initiative has access to people in more senior operations positions. Now *gemba* walks can begin higher up in the operations chain of command, either in response to a request from operations executives or in response to a proposition from the Lean advocates to *gemba* walk their operations superiors (as in [Case Study 9.1](#)).

GEMBA WALKING TEACHES HOW TO SEE IN NEW WAYS

People in hierarchical organizations (which are, after all, most of us) respond to the requests, suggestions, and directives of their superiors. As the superior learns to ask for and teach how to apply the principles of Lean production and Lean management, the subordinate is likely to listen carefully, learn the new expectations, and learn how to comply.

Gemba walking is a practice with a definite tie to the expected versus actual theme in the Lean management system. This explains the Lean *sensei*'s desire to start his or her regimen of *gemba* walks as high in the operations chain of command as possible. When those in positions of greater authority learn to point out forms of waste on the operations floor that have escaped the notice of, for example, the plant or unit manager, it creates powerful motivation to get up to speed with what the boss expects (see [Case Study 9.1](#)).

And when superiors are able to teach Lean principles, expect to see them applied, and are able to evaluate progress on sight, the chances for sustaining a Lean

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initiative greatly improve from Lean's informal beginnings somewhere lower in the organization.

The object of *gemba* walking is teaching to see through different eyes what the student has been looking at for an entire career. The alternative is for the student simply to follow the directions of the teacher to “do this” and “do that” without being taught or understanding how the assignment relates to a Lean rationale or principle. Even worse is when a consultant, internal or external, selected to teach and build internal Lean capability, instead simply does the work himself or herself, acting as a “pair of hands,” as in **Case Study 9.3**. Some, but usually not much, learning happens this way, and when the *sensei* departs he or she leaves no lasting transfer of knowledge.

The desired outcome is for the student to learn to see where the principles of Lean or Lean management can be applied. Importantly, this is because application of the principles is an invention derived to fit the unique nature of a given situation. The student's knowledge is best demonstrated by his or her ability to see the application of the same principle in completely different environments and work processes. Where possible, the teacher will want to see the student transfer what he or she learned in a factory to an administrative process, from a healthcare or office setting to a physical production process, or at least in different ends of processing areas in the same setting, or in an entirely different setting, be it manufacturing, administrative, healthcare, or services.

SEEING THROUGH THE SURFACE

This is the skill of being able to “see through” the surface of any given work process to the underlying potential application of one of the handful of Lean principles. For example, a clerk in finance accumulates a week's worth of credit card charges and then posts them all at once. This, he or she tells a *gemba* walker, is more efficient for her. An operator of automated equipment with an order for 5,000 of one part number produces 35,000 because, he or she tells a *gemba* walker, the job was running well and he or she figured letting it run was more efficient than stopping to change the material and tooling to the next part number on the machine's order board.

What is the same in these two examples? Is this batching? Is one or both an example of the waste of overproduction? What is the effect of each on the value stream? On each facility? Does the inventory produced or accumulated add value or add cost? What would be an alternative approach and method, and what should be points of

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focus in developing the alternatives? These are the kinds of situations that clearly test a student's or a practitioner's grasp of Lean concepts.

Few Lean applications are literally answers to be found in a book—including this one! As Lean or Lean management apprentices become more skilled through *gemba* walks with their *sensei*, they gradually develop their own expertise as *gemba* walkers, teachers, and assessors. It then becomes their turn to *gemba* walk with their subordinates or others, teaching and helping them develop their own mastery of Lean production and Lean management.

Learning to be a Lean implementer and teacher through *gemba* walking requires patience and high tolerance for frustration. It is not fast. One of the main ways of learning is from experience as you work to make the corrections and refinements you find necessary (often prompted by your *sensei*) as you apply newly learned concepts and tools. There is no good alternative to *gemba* walks as the method to learn Lean production and Lean management.

That is because Lean is a mindset, a different way of seeing. Learning to see through different eyes is a process, one that develops over time with practice, feedback, and hands-on experience (**Case Study 9.5**). If that is the bad news, the good news is *gemba* walks are extremely effective as a learning model. Through *gemba* walking you gradually establish a new, durable, Lean way of seeing and thinking. Six months of weekly *gemba* walks is on the low end of the period necessary to develop eyes for Lean and a Lean approach to managing.

CASE STUDY 9.5: LEARNING LEAN MEANS EXPERIENTIAL LEARNING

A manufacturing VP who had a good grasp of Lean concepts agreed to participate in a kaizen event, the goal of which was to simplify the process in a workstation where component parts were subassembled before going through a finishing process and then to final assembly. The VP's Lean preparation had been by *gemba* walks with internal Lean resources, in which he learned to see where Lean tools could apply. He was a quick study, and had soon begun *gemba* walking his subordinates, energizing the Lean initiative throughout the company's manufacturing operations.

The *kaizen* focused on ergonomic and efficiency improvements, including reducing the operator's walking and reaching in the workstation. One element of the improvement addressed the way the parts to be subassembled were presented to the operator. One of the components was a steel stamping, almost a

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foot long, with several complex folds and protrusions. All the parts were delivered to the workstation in separate plastic totes. The long stamped parts came tangled together in a larger tote. Each time the operator reached for a part, he or she had to untangle a piece as if solving a puzzle. It was time-consuming and clearly seemed to involve wasted effort, a burden on the operator.

Among the ideas in the *kaizen* was the VP's observation that if the parts were placed in the totes in a nested arrangement, one against the other, they could be in a smaller tote for less reaching, and easily removed one at a time. It would save several seconds each cycle and improve the ergonomics for the operator.

Some of the *kaizen* team members, including the VP, tried out this idea. They arranged several totes of these parts in nested order. Sure enough, they proved easy to remove one at a time. They showed this to the operator and asked her to try it. It turned out the team had failed to account for the fact that because the stampings had sharp edges, operators who handled them had to wear gloves, a safety requirements for that station. Wearing the proper gloves, the nested parts fit together too closely to be easily picked, requiring almost the same amount of jiggling and jostling as the original presentation.

The team went on to make other improvements in the ergonomics and flow of work through the workstation, but nested parts was not among them. Lean concepts are easy to grasp in the abstract, but it takes practice to learn to see how they might apply. Ideas for improvement can be easy to see, but attempting to apply them in the real world often teaches experiential lessons that are not so easily seen.

FOCUS ON BOTH PROCESSES—TECHNICAL AND MANAGEMENT

Focusing on process is essential for success in a Lean operation. That focus must include the elements of Lean production and the elements of Lean management. The components of these two aspects of Lean—technical production and management systems—are often intertwined with each other. That means effective Lean leaders need to be well versed in both sides of Lean.

Table 9.1 shows some aspects of Lean management that a *gemba* walk might focus on. The point here is that a *gemba* walk can focus on far more than the technical aspects of Lean production. When you know what to look for, evidence for the presence or absence of a robust Lean management system is everywhere on a

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production, processing, or service delivery floor. *Gemba* walking, traditionally focused on the technical side of Lean (is inventory being pushed or pulled? is standard work balanced to *takt*?), is indispensable in learning Lean management and especially in maintaining it.

As leaders become proficient in the first several levels of Lean, *gemba* walks are still useful for asking operations leaders to reflect on what they have done and learned, and for challenging them to go further. This is particularly applicable in situations where leaders have led progress to a plateau and either do not know how to push further improvement (as in [Case Study 9.4](#)) or have become satisfied with the current state. Here, *gemba* walks are likely to encounter the bedrock of the batch production mindset, the old-school view: “If it ain’t broke, don’t fix it.” This runs counter to the Lean principle in which perfection is the goal, and the related tenet that everyone in a Lean system has two responsibilities: to run the business and to improve the business.

Table 9.1 • Looking for Lean Management

What You Should See	What People Should Know
Process Focus	
<ul style="list-style-type: none"> Tracking charts show current actual versus expected status for all processes, in-cycle and out-of-cycle. Production-tracking charts initiated by supervisors at least twice daily. Reasons for misses noted on tracking charts. 	<ul style="list-style-type: none"> How are you doing at hitting your production goals? How can you tell if out-of-cycle and daily or weekly tasks are getting done as they should? (Leaders) Is there a regular schedule for <i>gemba</i> walks in this area? What is it? What happens on a typical <i>gemba</i> walk? Have these charts resulted in process or performance improvements? Examples?
Process Improvement	
<ul style="list-style-type: none"> Top three to five reasons for misses documented and visible at cell/line, department, and value stream information boards. Summary project plans (A3s) for improvement posted and current at department and value stream information boards. Employee suggestion system shows recent suggestions, current action on suggestions, and implemented suggestions with trend chart of numbers submitted and implemented. A visual daily task assignment and accountability process is in use and current. 	<ul style="list-style-type: none"> What are the three biggest problems in this area? How do you know these are the biggest problems? Is any work being done on these problems? How can you tell? Is there a regular method for operators to make suggestions for process improvements? What is it? Does it work? Examples? How can you tell your suggestions are listened to? (Leaders) What improvement activity is going on in this department? (Leaders) How do daily task assignments work here? Is there regular follow-up on assignments?

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What You Should See	What People Should Know
Leader Availability	
<ul style="list-style-type: none"> • Team leaders on the floor in their process area virtually all the time and available to operators. • Supervisors on the floor in their process area. • Response system to summon supervisors, team leader, others when needed. 	<ul style="list-style-type: none"> • (Leaders) How many hours/day on average do you spend on the floor? • How do you contact your team leader when you need him or her right away? • How quickly is help available when the process is interrupted by a problem the team leader cannot fix?
Labour Planning (at team boards)	
<ul style="list-style-type: none"> • Rotation path and starting assignments displayed. • Expected attendance chart up to date, displayed. • Qualification matrix up to date, displayed (including qualified out-of-zone operators). 	<ul style="list-style-type: none"> • How can you tell who's supposed to be here on any given day? How can you tell when you have call-ins? • (Leaders) What do you do when there are call-ins? • How do you know how many people you need for a given rate of production? • Do you rotate jobs here? How do you know where you'll be working at the start of any given day? • How can you tell who's qualified to do which jobs in the area?
Standard Work	
<ul style="list-style-type: none"> • Operators and leaders have and are following their respective standardized work. • Standard work charts, complete with cycle times for in- and out-cycle work, are posted and clearly visible from operator workstations. • Leaders' standard work is displayed day by day for up to a week. 	<ul style="list-style-type: none"> • Can you show me the standardized work or procedures for this station or role? Do people in this area follow standardized work? Does anyone ever monitor to see it's being followed? • (Leaders) What's your process for monitoring standardized work? How often do you monitor it? • (Leaders) Do you use standard work? Let's look at it for today.
Communication	
<ul style="list-style-type: none"> • Daily shift meeting agenda visible on the team info center. • Where applicable, info from other shifts is displayed in cell/line or department info board. • Team leaders', supervisors', value stream daily meetings occur. 	<ul style="list-style-type: none"> • How often does your team meet as a group? Is it a regularly scheduled meeting or just once in a while? • (Leaders) How do you know what topics you'll cover in any given day's start-up meeting? • (Leaders) Do you lead or attend any daily meetings? What are they?

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What You Should See	What People Should Know
Workplace Organization	
<ul style="list-style-type: none"> • Weekly 5S audit form and action items for the week are current, displayed at team info boards. • Cleaning routines and checklists visible, current. • Total Productive Maintenance (TPM) checklists current at each asset. • Clearly visible indicators of location and quantity for each object in the area. • Signage or identified addresses for tools, WIP and raw materials, reorder points and max quantities, kanban cards. • No clutter, dirt, or debris on floors, shelves, tops of cabinets, under racks and conveyors, etc. • All horizontal surfaces clean. • Cabinets, drawers labelled, contents match labels. 	<ul style="list-style-type: none"> • How do you keep track of housekeeping in this area? Are there standards for housekeeping? • (Of any object) What's this? How can you tell where it's supposed to be? How many of them should be here? • How much material are you supposed to have in this location? How can you tell? • What are the reorder points for (any and all) materials? What's the process for reordering?
Working Buzzer to Buzzer	
<ul style="list-style-type: none"> • Work starts and stops on time 	What times are breaks in this area? Are people usually back on time or are there usually stragglers?

BEING THE *SENSEI*: GEMBA WALKING AS A STRUCTURED, REPEATABLE PROCESS

A Lean *sensei*, if he or she is worthy of the name, should be able to make a Lean assessment in any area of your organization by following three basic steps:

1. Go to the place.
2. Observe the process.
3. Talk to the people.

He or she will likely ask you a bunch of questions, some of which you may not have thought of and to which you do not have a ready answer. Welcome to the *sensei's* process for stimulating your efforts to see through the surface and recognize application of Lean's principles! That approach by the *sensei* is probably fine if you are one of your organization's identified Lean geeks. You may well have volunteered or been asked to become an internal Lean resource capable of teaching others.

It is worth keeping in mind that you signed up for what is, in effect, this series of the *sensei's* seemingly random pop quizzes. Others—your students—might not take as well to such an unstructured routine. Remember, in your role as resource, coach, teacher, *sensei*—however you are identified—you are the supplier. Your students are your customers, and the first Lean principle is: value is defined from the point of view of the customer. Even so, it is perfectly appropriate to ask questions your

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students cannot yet answer. It is equally appropriate to suggest they think again about what they have learned, and how to apply it *right now, right here*. Their status as your customer does not entitle your students to expect you to think for them, to receive your answer before giving their own; that creates dependency rather than developing capability.

There is, however, an “on the other hand” here. That is, you could easily end up frustrating students whose learning style is not well adapted to what might appear to them as random walks and out-of-the-blue questions. Frustration does little to advance a student’s knowledge and confidence. This might not be much of a concern among traditional hard-core Japanese *sensei*. Their gruff methods were supported by their employers, especially early on at Toyota. Or, working as outside consultants, Lean *sensei* risk only losing a client, rather than losing employment altogether. Neither of these conditions may completely apply to you, the internal coach.

LETTING “STUDENTS” KNOW WHAT TO EXPECT

An approach to consider is to make your *gemba* walks a structured, repeatable process. The process is based on a Lean or Lean management assessment. A Lean management assessment—Lean management standards—can be found in Appendices A and B and as PDF downloads from www.dmannlean.com. The standards cover the Lean management system in manufacturing and nonmanufacturing operations. For Lean production, the publicly available Rapid Plant Assessment by Eugene Goodson is an example of an assessment for Lean manufacturing (<http://webuser.bus.umich.edu/Organizations/rpa/tools.html>; see also www.hbr.org/2002/05/read-a-plant-fast).

Using of one of these tools or something similar as the basis for *gemba* walking lets students know what process to expect even though each walk’s content may differ. It eliminates surprises from the process and expectations differing from one *gemba* walk to the next. A set of standards provides them, and you, with a straightforward way to gauge their progress. (For the student: How well did I do assessing the status of the daily accountability process last *gemba* walk? For you: Is the student ready to move on to the next standard, or does he or she need another walk on this one?)

Each Lean management standard has the same one-page format. The standards assess eight dimensions of Lean management, each on a 5-point scale. As you begin the walk, you tell the student which element of Lean or Lean management will be the focus. You hand him or her the assessment sheet for that element. The one-page

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standard acts as the structure, process, content, and agenda for each *gemba* walk, as well as a picture for the student of what good practices look like.

The Lean management standards (Appendices A and B) include three features designed to be helpful in using them for teaching and learning. The first is the set of diagnostic questions at the top of each dimension's single page. A *gemba* walk for visual controls based on that standard could go like this: the teacher considers the student's progress on visual controls and what can be observed in an area for the *gemba* walk. Based on this, the teacher highlights two or three of the questions for the student to address on this *gemba* walk. It is the student's responsibility to make the observations and have the conversations needed to answer the highlighted questions.

For example, the standard for visual controls lists these diagnostic questions:

1. Can you see visual cycle or procedure tracking charts in the area? Do they show expected versus actual times?
2. Are the charts current to this or the last shift?
3. Are incidents that delay work described clearly (what we had but did not want, or wanted but did not have)?
4. Are visuals reviewed regularly? How frequently? How can you tell?
5. Can leaders and task-level people in the area cite improvements from problems noted on visual charts?
6. Are visuals used here for support tasks, e.g., materials, transport, attendance, assignments, qualifications?
7. Do leaders regularly review the visuals? How often? How can you tell?

The second feature is the self-describing levels on the assessment's 5-point rating scale, used on all the standards. The scale's 5 points are shown here:

1. Preimplementation
2. Beginning implementation
3. First recognizable state
4. System stabilizing
5. Sustainable system

The self-describing levels give some detail on what an observer might see in, for example, an area at level 2 (beginning implementation). The visual controls are shown here:

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- Some cycle tracking charts, irregularly filled in
- Most charts record numbers, not document delays, problems
- Where problems described, too vague for action
- No or irregular review for action on problems
- Visuals more “check the box” than tool to highlight problems, delays, and drive improvement

The self-describing rating levels provide some concrete examples for the student to consider in evaluating what he or she has observed about visuals on a *gemba* walk in a particular area.

The third feature is an immediate test and feedback. At the end of the *gemba* walk, as student and teacher leave the area, the teacher asks: “So, what rating would you give for the visuals in this area?” Student and teacher compare ratings. When they reach different conclusions, the discrepancy makes for an immediate teachable moment.

The teacher gives immediate feedback, indicating what he or she saw and why the observations supported the rating he or she gave. (Early on, students tend to give higher ratings than the teacher.) Each Lean management standard includes space for notes; student and teacher briefly compare what they recorded. The student gets immediate feedback on key points the teacher saw, and the difference between how the teacher and the student evaluated what they observed. Next time, the teacher will probably return to this dimension, visual controls, and at least one of the questions at the root of the difference between the student’s and teacher’s conclusions and ratings.

In these ways, a Lean production or Lean management standard provides the agenda, content, structure, process, and feedback in a consistent program of repeatable, predictable *gemba* walks.

SUMMARY: LEARNING LEAN MANAGEMENT BY BEING A *SENSEI*'S APPRENTICE

This chapter concentrated on two aspects of developing and maintaining focus on process. The first involves learning the principles of Lean by stepping into the role of student, engaging a Lean *sensei* to teach you the principles and guide you through initial applications. This will happen principally through your *gemba* walks with the *sensei*. Before you can teach others, you must develop an initial level of mastery of Lean concepts and learn to see where and how to apply them.

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Second, you become the teacher through *gemba* walks with those who report to you, often as you continue to learn from your *sensei*. As Lean produces improvements and your ability to teach others develops, you will most likely develop the informal authority that allows you to be effective in coaching those who may be several organizational levels above you.

Keep in mind, the way your *sensei* taught you might not be effective with those who are new to Lean and less enthusiastic about it than you. If your teacher's approach to *gemba* walks appeared to be unpredictable and without a discernible structure, consider an approach where the ends are clear to the student, the process is predictable, and some criteria for good practice are spelled out. But do not hesitate to compare what you see in an area with what your student sees. The objective in *gemba* walking is for the student to develop eyes that see what the *sensei* sees.

It is not unusual for a Lean advocate somewhere in operations to drive implementation far enough to produce success that gets the attention and then support from senior leadership in operations.

Lean management is, as much as anything, a way of thinking. A paradox is that this way of thinking arises from new ways of acting, giving credence to the saying: "You can act your way into a new way of thinking faster than you can think your way into a new way of acting." Learning, teaching, documenting, and following up on specific expectations for focus on process are the first steps in implementing Lean management and developing a Lean mindset.