4 Advanced Tools for Quality and Process Approach - Part 1

Learning objectives

- Familiarize with key concepts of quality models and systems
- Explore the frameworks of 3 essential quality tools: PDCA, FMEA and Kanban
- With a deeper understanding of the given tools, possess a vast know-how for process optimization and continuous improvement in companies

Keywords

PDCA, FMEA, Kanban, ASQ, Balbrige.

Required skills

A general knowledge of management on the bachelor's degree level.

Time requirements for the study

You will need approximately 90 minutes of your time to study this chapter.

4.1 Quality models and systems

Systems and processes must be viewed as components of the whole organization. What affects one process or set of processes impacts outcomes of the complete system. In order to effectively manage and control delivery of products and services to customers, we need an overarching model to help us formulate our vision and drive the mission and objectives of the business.

There are several “macro” quality models and systems that help organizations achieve this. The approaches listed hereafter as “macro” are achieved through the use of multiple “micro” quality tools.

Keep in mind while reading these explanations of the major approaches to quality and continuous improvement that this learning material does not endorse one model over another. Readers are encouraged to look to the needs of their own organization to decide what works best for their operational culture. Also, these approaches are not mutually exclusive; that is, they can be used in conjunction with one another if so desired. Look no further than the various case studies listed in the “Tools” section to see how, in fact, more than one of these is usually done at the same time.

At the end of this chapter, there are listed additional resources that give more in-depth explanations. Consult these for further learning and comprehension.

4.2 Review on the Balbrige Award

The Baldrige Performance Excellence Program is a national education program based on the Baldrige Criteria for Performance Excellence. The program is a customer-focused change agent that enhances the competitiveness, quality, and productivity of U.S. organizations for the benefit of all citizens. It develops and disseminates evaluation criteria and manages the Malcolm Baldrige National Quality Award in close cooperation with the private sector. It was established by Congress in 1987 and is named after the late Secretary of Commerce Malcolm Baldrige, a proponent of quality management. Three awards may be given annually in each of six categories:

- Manufacturing
- Service company
- Small business
- Education
- Healthcare
- Non-profit

Organizations that apply for the Baldrige Award are judged by an independent board of examiners, and recipients are selected based on how well they show achievement and improvement in seven areas, known as the Baldrige Criteria for Performance Excellence. The Criteria comprise seven categories:

1. Leadership
2. Strategic planning
3. Customer focus
4. Measurement, Analysis, and Knowledge
5. Workforce focus
6. Operations focus
7. Results

By attempting to satisfy the specific guidelines laid out for each of these Criteria, organizations improve. Many organizations have followed the Criteria without any intention of ever applying for the Award; the improvement resulting from viewing an organization through these requirements is enough reward.

Many state and local governments sponsor quality awards based on the Baldrige Performance Excellence Program Criteria as a means to encourage organizations to advance the level of the quality management processes in their respective communities.

4.3 PDCA

Dr. W. Edwards Deming was a strong proponent of the plan-do-check-act (PDCA) cycle. The PDCA improvement model is a detailed sequence of steps more associated with the standards or requirements approach seen in the ISO 9000 family of tools. Specific occurrences are identified and detailed targets are set for improvement tasks. Dr. Deming gives credit to his mentor, Walter Shewhart, for the development of the PDCA cycle. PDCA is a four-step model for carrying out change (see Figure 4-1). Just as a circle has no end, the PDCA cycle (also known as the plan-do-study-act cycle) should be repeated again and again for continuous improvement.

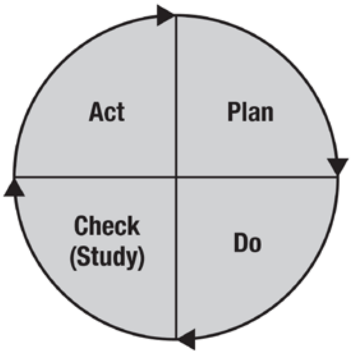

Fig. 4-1. The PDCA Cycle

PDCA involves the following:

PLAN

- Select project
- Define problem and aim
- Clarify/understand
- Set targets/schedules
- Inform and register the project
- Come up with most suitable recommendation

DO

- Record/observe/collect data
- Examine/prioritize/analyze
- Justify/evaluate cost
- Investigate/determine most likely solutions
- Test and verify/determine cost and benefits
- Test most likely causes

CHECK

- Observe the effects of the change or test
- Consolidate ideas
- Select next project
- Seek approval from management

ACT

- Plan installation/implementation plan
- Install/implement approved project/training

- Maintain/standardize

4.4 FMEA

An FMEA (Failure Mode and Effect Analysis) is a systematic method of identifying and preventing product and process problems before they occur. FMEAs are focused on preventing defects, enhancing safety, and increasing customer satisfaction. Ideally, FMEAs are conducted in the product design or process development stages, although conducting an FMEA on existing products and processes can also yield substantial benefits.

The first formal FMEAs were conducted in the aerospace industry in the mid-1960s and were specifically focused on safety issues. Before long, FMEAs became a key tool for improving safety, especially in the chemical process industries. The goal with safety FMEAs was, and remains today, to prevent safety accidents and incidents from occurring.

While engineers have always analyzed processes and products for potential failures, the FMEA process standardizes the approach and establishes a common language that can be used both within and between companies. It can also be used by nontechnical as well as technical employees of all levels.

The automotive industry adapted the FMEA technique for use as a quality improvement tool.

Preventing process and product problems before they occur is the purpose of Failure Mode and Effect Analysis (FMEA). Used in both the design and manufacturing processes, they substantially reduce costs by identifying product and process improvements early in the develop process when changes are relatively easy and inexpensive to make. The result is a more robust process because the need for after-the-fact corrective action and late change crises are reduced or eliminated.

All product/design and process FMEAs follow these ten steps:

Step 1. Review the process or product.
Step 2. Brainstorm potential failure modes.
Step 3. List potential effects of each failure mode.
Step 4. Assign a severity ranking for each effect.
Step 5. Assign an occurrence ranking for each failure mode.
Step 6. Assign a detection ranking for each failure mode and/or effect.
Step 7. Calculate the risk priority number for each effect.
Step 8. Prioritize the failure modes for action.
Step 9. Take action to eliminate or reduce the high-risk failure modes.
Step 10. Calculate the resulting RPN as the failure modes are reduced or eliminated.

These steps are explained in detail following the FMEA worksheet section
and are illustrated in a case study.

The FMEA process should be documented using an FMEA worksheet (see Figure 4-2). This form captures all of the important information about the FMEA and serves as an excellent communication tool.

Failure Mode and Effects Analysis Worksheet

Process or Product: ______________________ FMEA Number: ________

FMEA Team: ______________________ FMEA Date: (Original) ____________

Team Leader: ______________________ (Revised) ____________

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	FMEA Process													Action Results				
Line	Component and Function	Potential Failure Mode	Potential Effect(s) of Failure	Severity	Potential Cause(s) of Failure	Occurrence	Current Controls, Prevention	Current Controls, Detection	Detection	RPN	Recommended Action	Responsibility and Target Completion Date	Action Taken	Severity	Occurrence	Detection	RPN
1																	
2																	
3																	
4																	
5																	
6																	
7																	
8																	
9																	
10																	

Fig. 4-2. Blank FMEA Worksheet

4.5 Kanban

The Japanese word kanban, which translates as ‘‘signboard’’, has become synonymous with demand scheduling. Kanban traces its roots to the early days of the Toyota production system. In the late 1940s and early 1950s, Taiichi Onho developed kanbans to control production between processes and to implement Just in Time (JIT) manufacturing at Toyota manufacturing plants in Japan. These ideas did not gain worldwide acceptance until the global recession in the 1970s. By using kanbans, he minimized the work in process (or WIP) between processes and reduced the cost associated with holding inventory.

Originally, Toyota used kanban to reduce costs and manage machine utilization. However, today Toyota continues to use the system not only to manage cost and flow, but also to identify impediments to flow and opportunities for continuous improvement. Interestingly, Mr. Onho modeled many of the control points after U.S. supermarkets - hence the term kanban supermarkets.

It should be noted that the idea of JIT manufacturing was originally conceived by Kiichero Toyoda, founder of the Toyota Motor Company, and son of Sakichi Toyoda, the founder of the Toyota Company, the parent company. However, it was Mr. Onho who developed the strategy of kanban, which became one of the pillars of Toyota’s successful implementation of JIT manufacturing.

With kanban scheduling, the operators use visual signals to deter-mine how much they run and when they stop or change over. The kanban rules also tell the operators what to do when they have problems and who to go to when these problems arise. Finally, a well-planned kanban has visual indicators that allow managers and supervisors to see the schedule status of the line at a glance.

We define kanban scheduling as demand scheduling. In processes controlled by kanbans, the operators produce products based on actual usage rather than forecasted usage. Therefore, for a scheduling process to be considered a true kanban, the production process it controls must:

❑ Only produce product to replace the product consumed by its customer(s)

❑ Only produce product based on signals sent by its customer(s)

The kanban boards are a variation on the kanban cards. Instead of the cards, the board simply utilizes magnets, plastic chips, colored washers, etc. as the signal. The objects represent the items in inventory. However, instead of chasing cards around the building, you are moving the objects around on a board. The movement of the objects corresponds to the production and consumption of full containers of product. The process works like this:

❑ As a container of product is completed and moved into inventory, an object gets moved into the inventory section of the board.

❑ When the container is consumed or moved to a staging area for consumption, then an object gets moved into the awaiting production section of the board.

To determine what gets produced next, you look at the board and follow the rules.

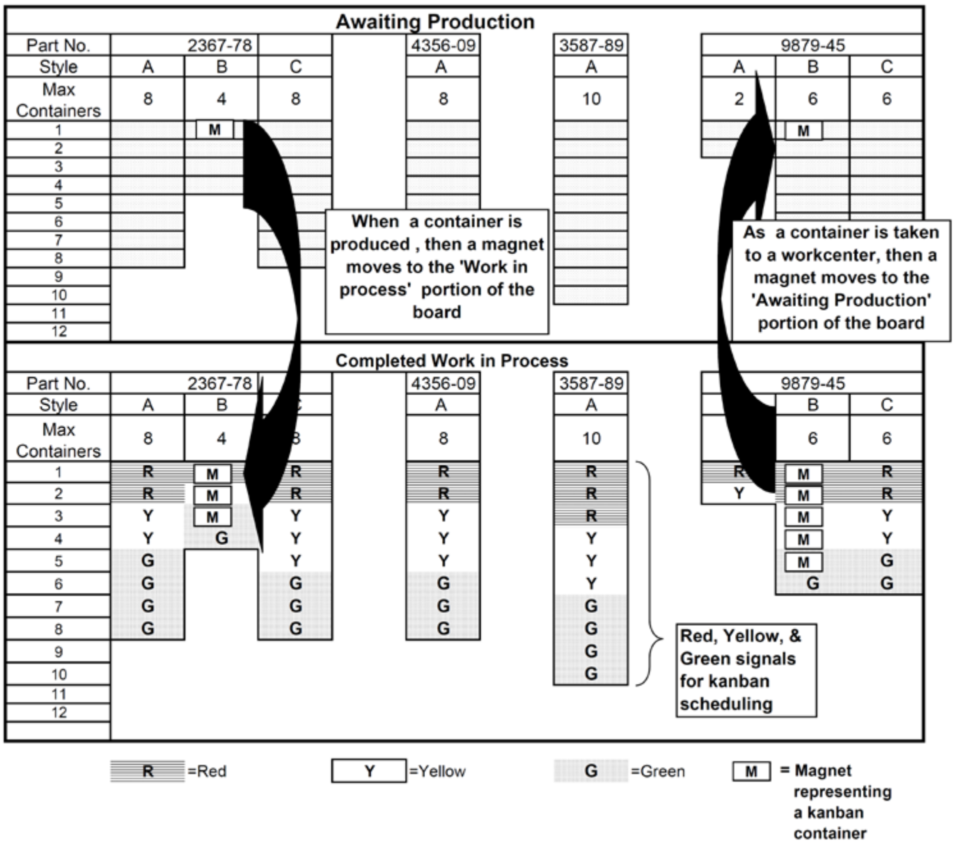


Fig. 4-3. Kanban Board and its instructions.

If these conditions can be met, then the board works wonders. It is visual and provides an up-to-date schedule status. It also eliminates one of the major objections to the kanban cards people forget to return the cards to the card racks. The board also makes it easy to add and subtract containers. In fact, if these two conditions can be met, then we recommend boards as our first choice for a scheduling signal.

Summary

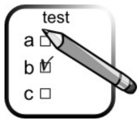
Good news: by learning and using the ideas found in this chapter, you will make huge improvements by being more process oriented in your thinking and applying quality tools as needed.

The bad news? You have probably thought it at some point while reading: many problems are extremely difficult to solve and intimidating in scope. A lot of them require advanced thinking and tools described in books that fill entire professional libraries. So what about those problems?

Begin to tackle them by learning more about those “macro” quality models and systems. Becoming familiar with the concepts and tools in this guide will give you a huge jump-start. In fact, some quality professionals like to say that any new management concept that comes along, from Six Sigma to lean to anything else, is just a repackaged version of the quality basics, and there is some truth to that. In some ways, those models are simply a specific way or sequence to apply a certain portion of the tools.

Despite the impression you might get from a quality fanatic, quality isn’t magic. Management simply directing employees to “do quality” or “do Lean-Six Sigma” won’t accomplish as much as it could. We won’t lie: you will see some results even with a partial or half-hearted use of quality management techniques and approaches. They are that powerful. But using the concepts and tools with greater nuance and complexity will, not surprisingly, yield even bigger and better results.

Review questions



1. Describe the 4 steps of the PDCA cycle.
2. What is the difference between FMEA, D-FMEA and P-FMEA?
3. Describe the calculation and purpose of the RPN.
4. List at least 3 benefits of implementing a Kanban system in a process.

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