CHAPTER 16
THE FORK MODEL FOR QUALITY MANAGEMENT: PRONG 1, OR DAILY MANAGEMENT

Sections

Chapter Objectives

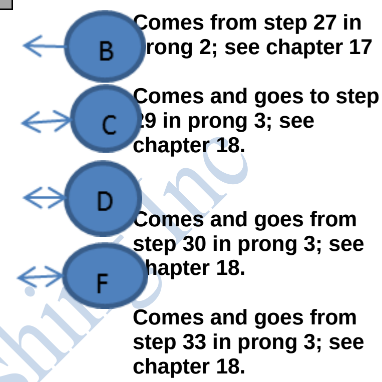
- To describe the selection of Process Improvement Leaders (PILs), initial projects, and initial project teams
- To define daily management, or the methods for managing daily work
- To describe and discuss function deployment and the development of an integrated flowchart to determine the existence of non-value-added steps, if any, in a function
- To discuss the development of results-oriented and process-oriented key indicators to monitor a best practice method
- To discuss the improvement and innovation of an existing process by the use of data-based decision-making tools; the use of change concepts; and the use of benchmarking
- To illustrate daily management by means of personal and business case studies
- To describe the process of management review of daily management projects
- To discuss the role of empowerment in successful daily management
- To discuss the development of Local Steering Teams to coordinate daily management projects at the departmental level

16.1 Introduction

In this chapter, we explain what is required to develop, standardize, deploy, maintain, improve, and innovate the methods required for daily work in all areas of an organization. Daily work is managed through "daily management," Prong 1 of the fork model presented in this section of the book, shown in Figure 16.1.

Figure 16.1
Prong 1 of the Fork Model: Daily Management

Prong 1 of the Fork Model (Daily Management)						
Steps						
14	15	16	17	18	19	20
	EC trains initial process improvement leaders	EC selects initial process improvement projects (daily management issues)	EC selects and trains initial process improvement team members	Initial PI teams improve processes using the QI story format	Other PI teams are formed in response to area issues. QI story format is used	Local steering teams coordinate projects



When top management is ready to begin the organizational transformation, it needs concrete ways of translating theory into practice. Daily management is one of the vehicles used to accomplish this task.

16.2 Selecting Initial Project Teams

The members of the **Executive Committee (EC)** select initial **Process Improvement Leaders (PILs)** in departments of the organization, as shown in step 14 of the detailed fork model in Figure 16.1. PILs can be assigned full-time or part-time. The decision to have only full-time PILs, only part-time PILs, or both types of PILs depends on the needs of project teams.

Early in a transformation, an organization may need a greater proportion of full-time PILs; as the transformation proceeds, a smaller proportion of full-time PILs may suffice. The change in the need for full-time PILs is generally due to an increase in the general level of quality knowledge in the organization and, consequently, a decrease in the need for the aid provided to project teams by full-time PILs.

PILs receive training in basic quality control tools as covered in previous chapters, and in the psychology of the individual and the team [Mizuno, 1988], as shown in step 15 of Figure 16.1.

Next, the members of the EC select the initial projects to be addressed by project teams, as shown in step 16 of Figure 16.1. Once the PILs and the projects have been determined, the members of the EC, in consultation with the PILs, select the members of each initial project team, as shown in step 17 of Figure 16.1. Project teams are formed with a specific purpose, consist of people from the same area or small unit, and exist in perpetuity. All project team members receive training in basic quality control tools and the psychology of the individual and the team, as shown in step 17 of Figure 16.1.

16.3 Performing Daily Management

After training, each initial project team works on one or more processes through **daily management**, as shown in step 18 of Figure 16.1. Daily management, or Prong 1 of the detailed fork model, is developing, standardizing, deploying, maintaining, improving, and innovating the processes required for daily work within work areas. The development, standardization, and deployment of methods for daily work is called **housekeeping** [Imai, 1986, pp. 158-9] because “it is a procedure which sets things in order.” [1] The maintenance, improvement, and innovation of methods for daily work are called daily management.

16.3.1 Housekeeping

The housekeeping functions of daily management are developed through a procedure called **function deployment** [Mizuno, 1988, pp. 55-61], which requires that relevant employees determine what functions are required by each process in their daily work. Each function is subject to the scrutiny of the following questions:

1. *Why* is this function required for this process?
2. *What* is this function intended to achieve? *What* is the aim of this function?
3. *What* resources are necessary for this function?
4. *What* target must be set to allocate appropriate resources to this function to optimize the aim of the organization?
5. *Where* in the process should this function take place?
6. *When* should this function be implemented?
7. *Who* is responsible for this function?
8. *How* does this function contribute to the optimization of the system of interdependent stakeholders for the organization?
9. *What* measurements are used to monitor this function?
10. *How* will this function be carried out?
11. *Does* this function contain non-value-added steps?

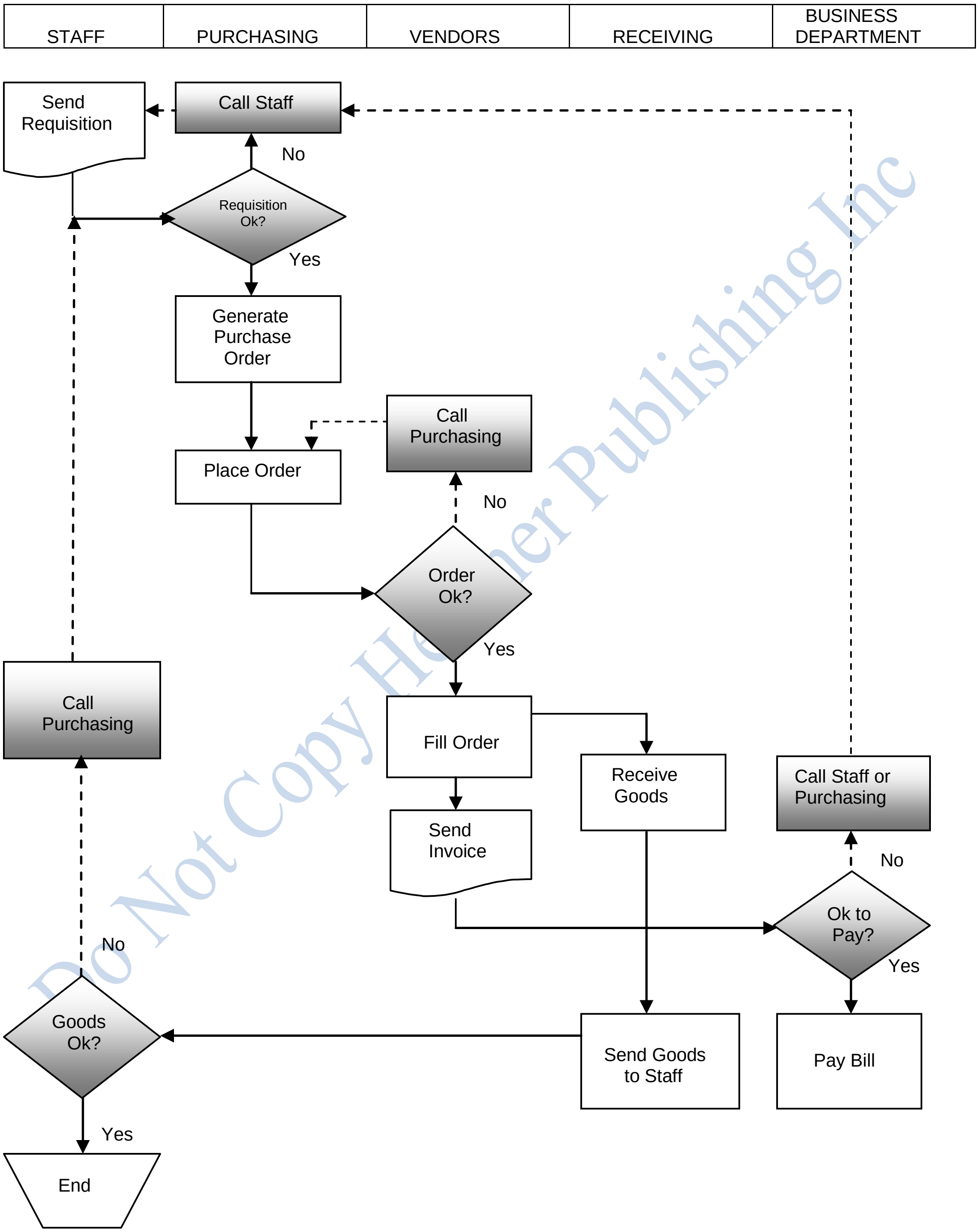
Housekeeping is practiced through the **SDSA cycle** and its four stages. Recall, the Standardize stage involves teaching employees how to study and understand the causal factors that affect each critical method they work with, using flowcharts. The employees developing the **best practice method** use the flowchart to highlight non-value-added steps, and work toward eliminating them. Employees can also use other tools to understand the causal systems that affect their methods, such as **cause-and-effect diagrams**, **interrelationship diagraphs**, and

[1] Quotation from Louis Schultz, *Process Management International*, Minneapolis, MN, 1990.

simulations. All the employees who use a particular method compare notes on causal factors and develop one best practice method for running a process, as seen through a **best practice flowchart**.

At this stage, question 11 can be addressed by using an **integrated flowchart**. This type of flowchart adds at least one dimension to a typical flowchart. An example of an integrated flowchart with an extra dimension to highlight non-value added steps in a process is shown in Figure 16.2. The non-value-added steps are shaded in gray.

Figure 16.2
Integrated Flowchart Showing
Value Added and Non-Valued Added Steps



Legend: Non-Value Added steps are shown in gray.
Adopted from: PQ Systems, Total Quality Transformation, (Miamisburg, OH), undated.

An integral part of preparing a best practice method is developing **key indicators** to monitor the best practice method. Key indicators can yield data that is measurable or non-measurable. Non-measurable data, also called unknown and unknowable data [Deming, 1986, pp. 121-122], frequently includes the most important business figures, such as the cost of an unhappy customer or the benefits of a happy employee. It is not accurate to assume that if a process cannot be measured, it cannot be managed. Non-measurable data, like interactions with other people, are managed on an ongoing basis.

The Do stage entails a project team conducting a planned experiment to collect measurements on key indicators for determining the optimal configuration of the best practice method on a trial basis. The Study stage consists of project team members studying the measurements on the key indicators for determining the effectiveness of the best practice method. The Act stage involves the establishment of a standardized best practice method, using a best practice flowchart. This is then formalized by training all relevant employees in the best practice method and by updating training manuals.

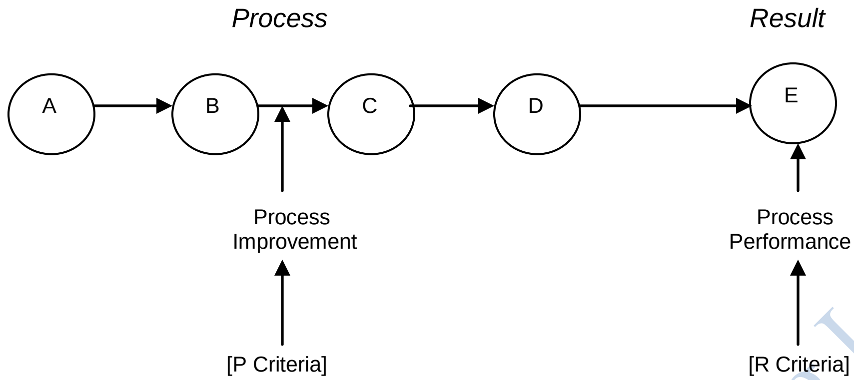
A best practice method can be quite complex, taking into account a great number of contingencies. For example, if a customer has complaint A, follow method A; however, if a customer has complaint B, follow method B, and so on. Or, if a customer has complaint A and claims it is urgent, follow method A1; however, if a customer has complaint A and places no urgency on the matter, follow method A2.

16.3.2 Measurements on Key Indicators

Best practice methods are monitored through measurements taken on key indicators. Key indicators possess two important characteristics that make them useful in a system of quality management: first, they are **operationally defined**, which promotes communication between people, as discussed in Chapter 4; and second, they monitor results and the processes that generate results.

Key indicators are either results-oriented or process-oriented. **Results-oriented key indicators**, called R **criteria**, are used to evaluate the results of a method in a process. They are called **control points** or check **points**. **Process-oriented key indicators**, called **P criteria**, are used to evaluate a method that creates results. They are called **control items** or **check items**. As Imai points out, “P criteria call for a long-term outlook, since they are directed at people’s efforts and often require behavioral change. On the other hand, R criteria are more direct and short term” [1986, p. 18]. Figure 16.3 depicts the relationship between P criteria and R criteria.

Figure 16.3
Relationship between P and R Criteria



Modified from: Imai, Massaki (1986)*, Kaizen: The Key to Japan's Competitive Success*, Random House Business Division (New York, NY), 1st ed., p. 18

The relationship between control points and control items is shown in the following example. An R criteria for a manager (e.g., number of OSHA reportable accidents per month) is explained by a P criteria of a subordinate (e.g., number of unsafe behaviors and/or conditions by physical area in a factory by month). In this way, an interlocking set of R and P key indicators are developed throughout an organization.

16.3.3 Daily Management

After a best practice method has been developed, standardized, and deployed by a project team, housekeeping activities give way to daily management activities. Daily management is used to determine the change concepts needed to maintain, improve, or innovate processes in work areas. Daily management is performed to decrease the difference between process (actual) performance and customer requirements. A process with a large variance that is not centered on nominal creates a problematic difference between process performance and customer needs. Daily management is needed to reduce process variation and center the process on nominal.

Daily management is accomplished by using the PDSA **cycle** and its four stages. In the Plan stage, a Plan is developed to improve or innovate a standardized best practice method. The plan can take the form of a modified best practice flowchart that incorporates a change concept.

Change concepts that can improve a process come from study of the causal factors that affect the process (P criteria). There are many tools that can be used to help employees understand causal factors; they fall into five categories. The first category includes data-based decision-making tools such as **check sheets**, **Pareto diagrams**, **histograms**, **run charts**, **control charts**, and **scatter diagrams**. The second category includes proven change concepts [Langley, et.

al., 1986, pp. 295-359], such as incorporating technology into the process, shifting demand patterns to off peak times in a process, reducing controls in a process, performing tasks in parallel in a process, conducting training in a process and outsourcing steps of a process. The third category is **benchmarking**. The fourth category is talking to an expert. The fifth category is searching the internet. All five categories assist an individual or team doing daily management to modify the existing best practice flowchart to a revised best practice flowchart using a change concept.

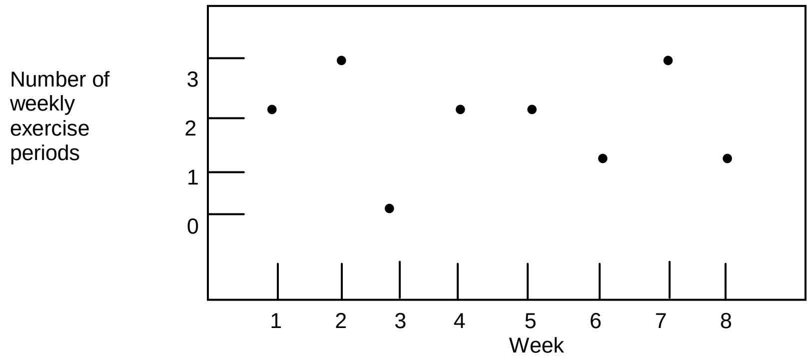
The Do stage tests the effect of the change concept(s) on the process through one or more planned experiments conducted by project team members. The Study stage analyzes the effects of the change concept on the process's key indicators. The Act stage calls for successful process changes to be formalized through training all relevant employees and updating training manuals. The PDSA cycle continues indefinitely in an uphill progression of never-ending improvement.

With respect to benchmarking to find a change concept, it is important to note that the success of another person or organization is not a rational basis for turning the PDSA cycle. For example, isolating one component of System A and expecting it to work within the context of System B is not necessarily valid; the reasons for the success in System A may not be present in System B. Therefore, imitating without a true understanding of the conditions or causal factors surrounding the imitated system can lead to misapplication of the PDSA cycle. For example, an electric utility copying a customer service process from a manufacturing company, without understanding the reasons why the customer service process was successful in the manufacturing company, can lead to a poorly conceived revised best practice method for the electric utility, and hence, a misapplication of the PDSA cycle. Benchmarking is not copying. It is learning from another person's or organization's process for the purpose of improving your process.

16.3.4 A Personal Example of Daily Management

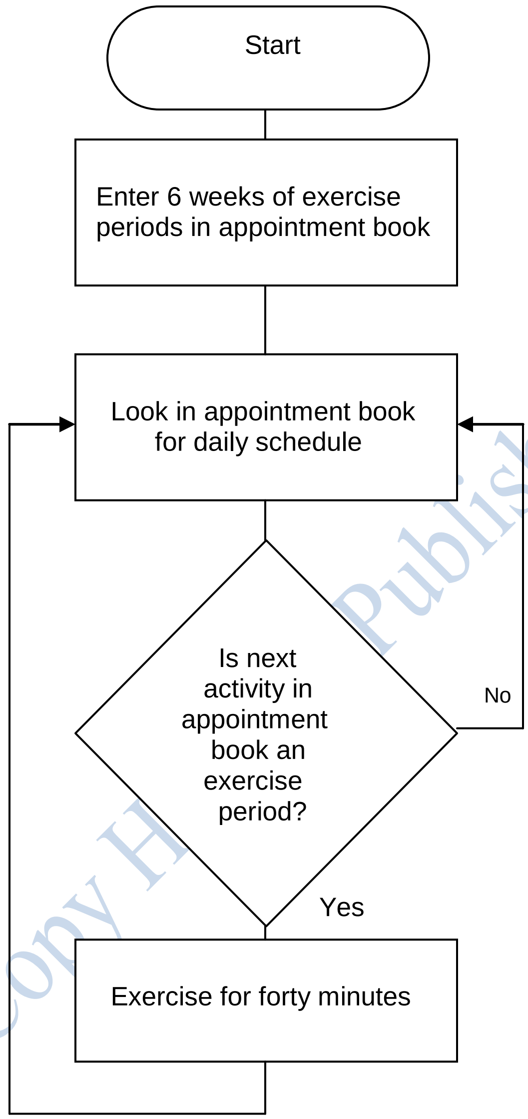
Bart's exercise regimen is important to him. He realizes that he is not exercising as much as he would like. He collects data on his exercise habits for a period of eight weeks. The data from his initial investigation is shown in Figure 16.4.

Figure 16.4
Initial Analysis of Exercise Habits



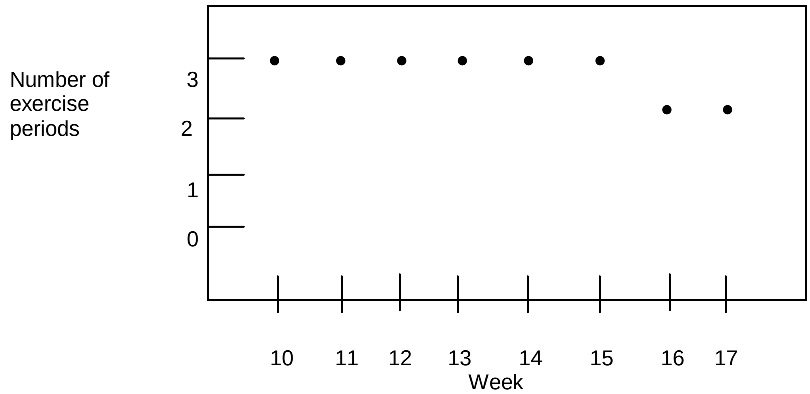
Analysis of the data leads Bart to question his method for “making exercise happen.” He realizes that he has no method, so he develops the flowchart shown in Figure 16.5.

Figure 16.5
Flowchart of Exercise Program



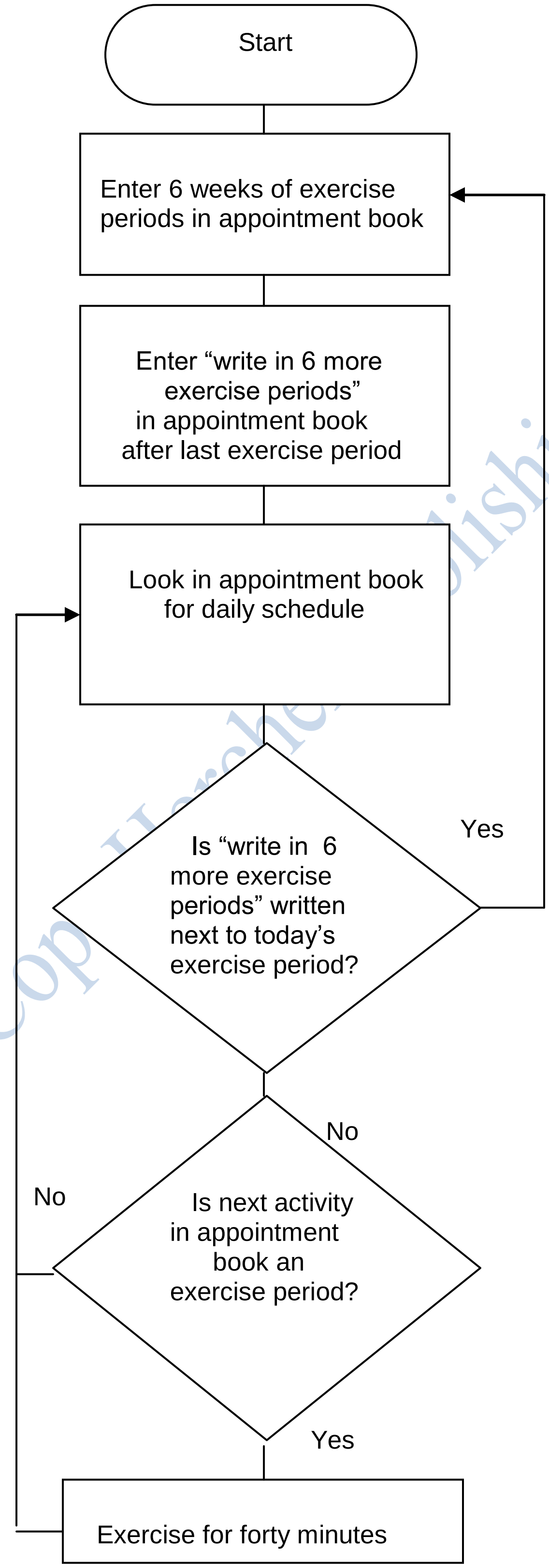
Bart discusses his exercise method with his physician during week 9 of his exercise process. His physician states, based on medical facts, that Bart should exercise for 40 minutes at least three times per week. Thus, he establishes a target of three exercise periods per week. The measurement for this method is the number of 40-minute exercise periods per week. Bart records the number of 40-minute exercise period per week, shown in Figure 16.6.

Figure 16.6
Analysis of Exercise Habits



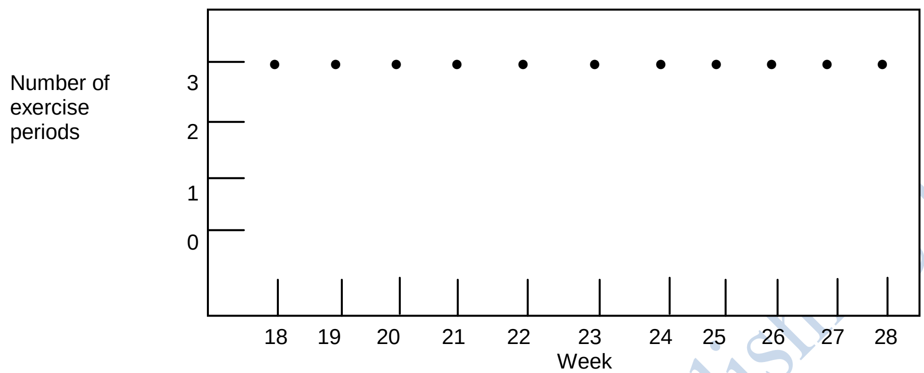
The record shows that the target of three exercise periods per week is achieved for weeks 10 through 15, but not in weeks 16 and 17. This leads Bart to go back and examine his method. In so doing, he discovers that the reason he failed to exercise three times in weeks 16 and 17 was that he simply forgot during those weeks. He realizes that his exercise method has to be changed to prevent this from happening in the future. He revises his method to add in a notation to “write in more exercise periods” after his last noted exercise period. This revision is shown in Figure 16.7.

Figure 16.7
Revised Flowchart of Exercise Program



Bart collected more data and consistently met his target for weeks 18 through 28, as shown in Figure 16.8.

Figure 16.8
Continuing Record of Exercise



16.3.5 A Business Example of Daily Management

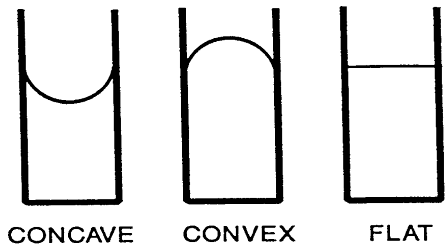
In the following business example [Krishnan, et. al., pp. 603-614], we see how daily management and the PDSA cycle work in a business setting.

Cold gas plasma treatment consists of exciting gas molecules to strip and recombine the electrons in the surface of a polymer. By varying the conditions of cold gas plasma treatment, it is possible to obtain a particular effect on the surface of a polymer, such as superior bonding, printing, potting, or wetting.

Cuvettes are molded plastic containers used to hold a sample for analysis. In this study, cold gas plasma treatment is used to improve the wettability of the surface of cuvettes, allowing for accurate analysis of the sample. Poor wettability causes material from sample i to remain in the cuvette after the introduction of sample i + j, where j = 1 to m. This can result in "carryover" error.

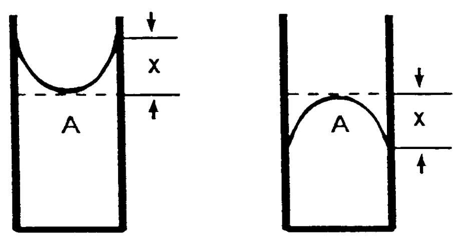
Operational Definition of Wettability. A surface is wettable when a liquid has the ability to spread on it. Wettability is measured by meniscus size; a meniscus can be concave, convex, or flat, as shown in Figure 16.9. Superior wettability is exhibited by a large concave meniscus.

Figure 16.9
Illustration of a Meniscus



Measurement of a meniscus is shown in Figure 16.10. The distance X is obtained by squirting distilled water into a cuvette that is held upright at eye level such that point A is between 0.25 and 0.50 in from the base of the cuvette. X is measured by using an optical eyepiece (Mitutoyo 183 or equivalent) with a millimeter scale with gradations of 0.10 mm and distilled water at room temperature $(72 \pm 10^{o}\,F)$.

Figure 16.10
Measurement of a Meniscus



The specification for an acceptable meniscus is 2.4 mm to 3.2 mm; the desired level, or nominal, is 2.4 mm, the acceptable lower deviation from nominal (lower tolerance) is 0.0 mm, and acceptable upper deviation from nominal (upper tolerance) is 0.8 mm. That is, a meniscus below 2.4 or over 3.2 is not acceptable.

Background Information. The cold gas plasma treatment method has been employed in the process under study for over 5 years. Discussions with the process engineer, area supervisor, and operators reveal that the cold gas plasma treatment process produces output that meets specifications most of the time. If the meniscus size is below the lower specification limit or above the upper specification limit, the cuvette is not accepted. Operators measure, but do not record, meniscus measurements.

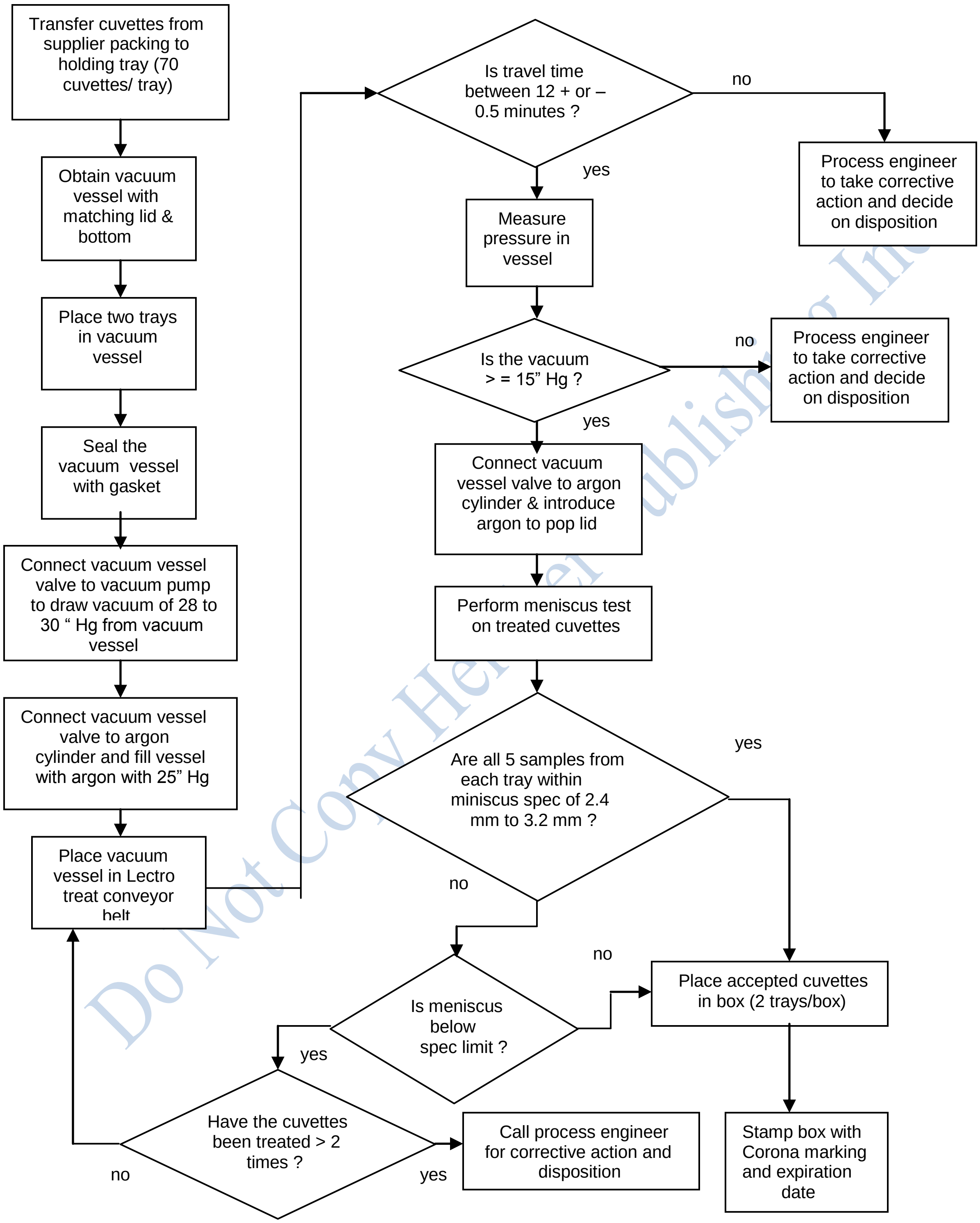
Operators collect data for a control chart analysis of the cold gas plasma treatment process. The operators fill in a process control data sheet, as shown in Figure 16.11, and record meniscus measurements directly onto a control chart.

Figure 16.11
Process Control Data Sheet

Date: __________	Time in: _________	Time out: ___________
Part Number: 6603624		Lot Number: ________________
Lid number: ___________________		Bottom number: ____________
(In) Vacuum: __________________		(Out) Vacuum: ____________
Quantity: 70	Quantity inspected: 5	Inspected by: ____________

Process Flowchart. A flowchart of the cold gas plasma treatment process prior to control chart analysis is shown in Figure 16.12. In most cases, a cuvette will be reprocessed if its meniscus specification is below the lower specification limit. This is reflected by the loop in the flowchart. Usually, the lower specification limit will be met with two or three loops through the process. If the equipment is malfunctioning, the process engineer is called to take corrective action.

Figure 16.12
Flowchart of Original Cold Gas Plasma Treatment Process

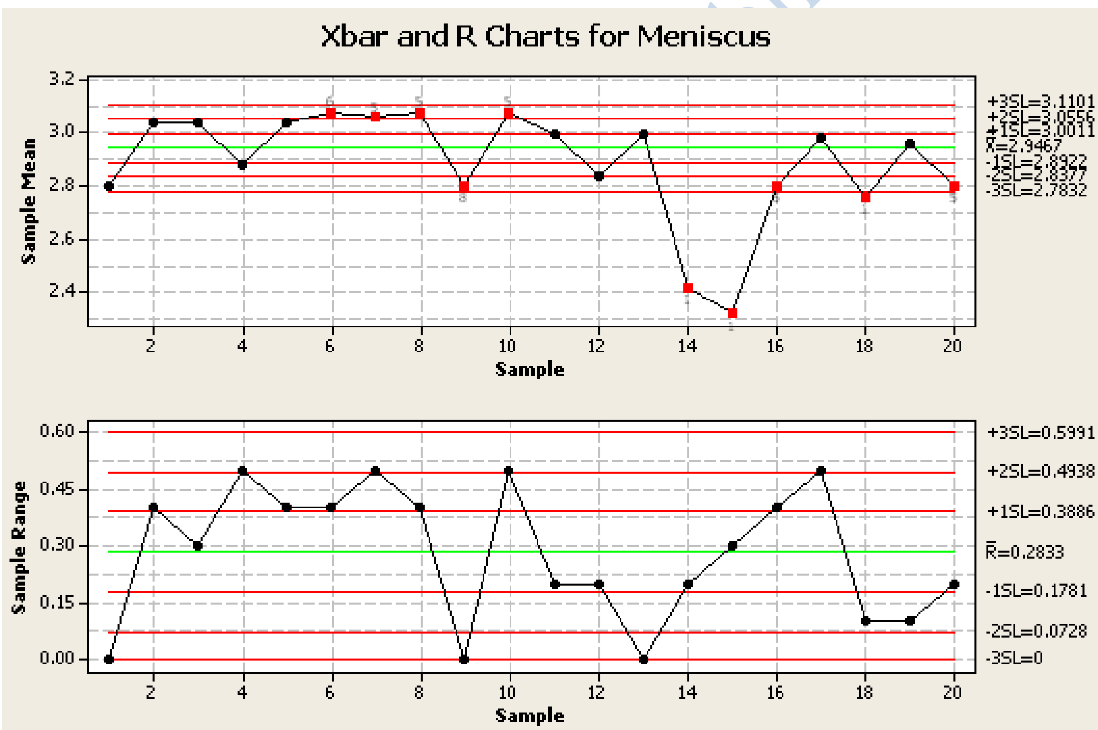


The PDSA cycle is turned twice in this case study. The first turn stabilizes the cold gas plasma treatment process. The second cycle improves the capability of the cold gas plasma treatment process.

PDSA Cycle One. In the first cycle, the Plan stage consists of understanding and analyzing the present situation by constructing the flowchart of the current process, as shown in Figure 16.12, and collecting meniscus measurements from 20 subgroups of cold gas plasma treated cuvettes for an $\bar{x}$ and R chart, as shown in Figure 16.13. Each subgroup consists of a random sample of 5 cuvettes from a tray of 70 cuvettes. Each production run consists of 20 trays. The cuvettes within a tray are assumed to be homogeneous by the process engineer.

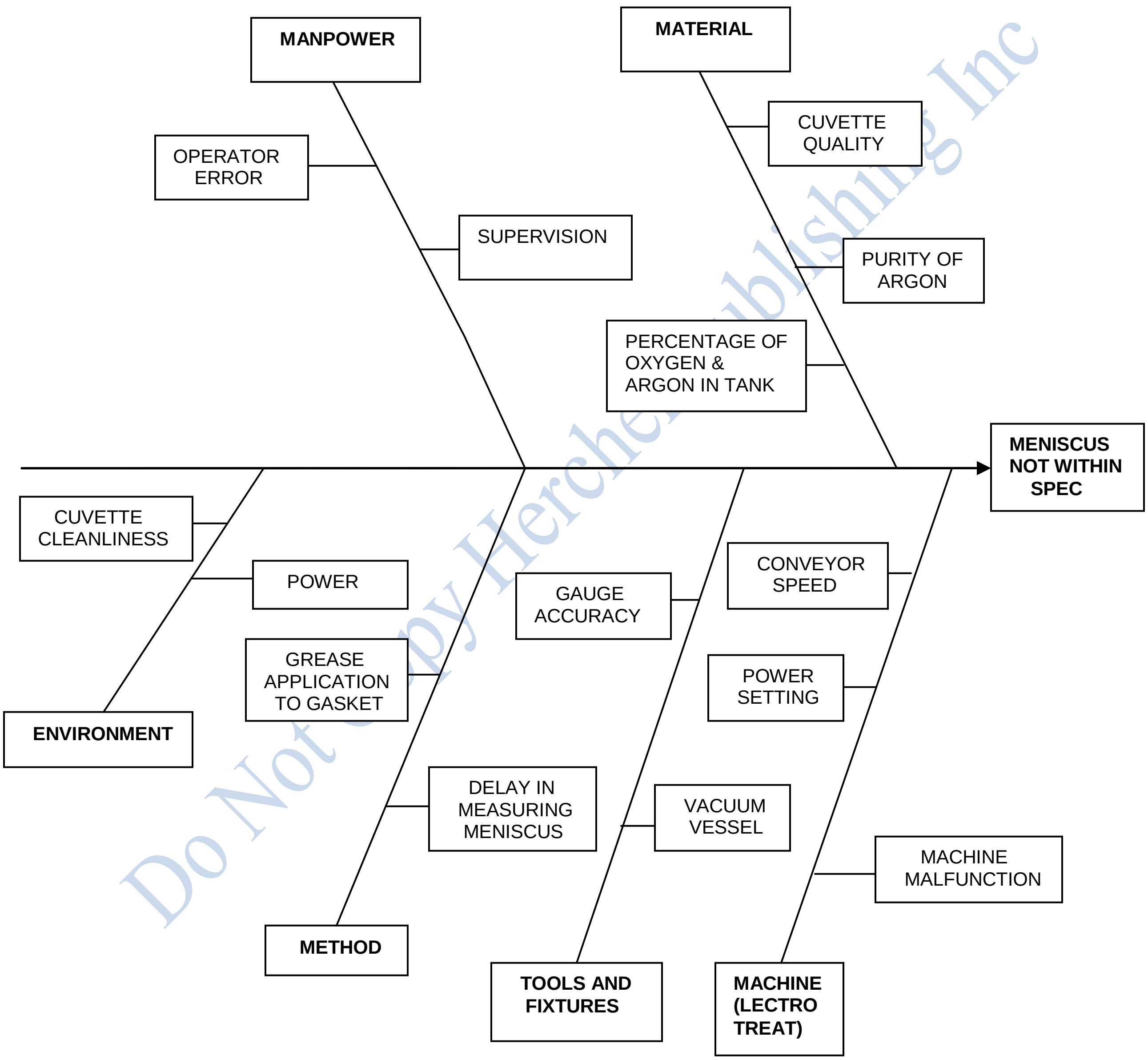
Figure 16.13
Control Chart for Meniscus Measurements

(COLDGASPLASMA1)



The R chart indicates a stable process with respect to variation, using the Minitab zone rules. There are no out-of-control points. The $\bar{x}$ chart shows ten out-of-control points. They are analyzed by the process engineer and the operators. They develop a cause and effect diagram to identify the possible factors that could cause an out-of-specification meniscus, as shown in Figure 16.14. The cause and effect diagram is used to study the ten out-of-control points on the $\bar{x}$ chart. The process engineer and operators are not able to assign any special causes to the out-of-control points corresponding to subgroups 6-10, 14-16, 18 and 20. However, it is quickly realized that a power interruption caused the out-of-control points corresponding to subgroups 14 and 15. These two points cause the UCL, the $\bar{\bar{x}}$, and the LCL on the $\bar{x}$ chart to be lower than they should be. This creates a false out-of-control signal for all other out-of-control points.

Figure 16.14
Cause and Effect Diagram: Reasons for Out of Specification Meniscuses



Subgroups 14 and 15 are from one vacuum vessel that was inside the cold gas plasma treatment equipment during the occurrence of a power interruption. As this is a special cause, a new policy is instituted concerning electrical failure of the cold gas plasma treatment equipment, as shown in Exhibit 16.1.

Exhibit 16.1
Procedures Manual Reflecting Policy Change for Electrical Failure

Corona Treatment of Cuvettes

7.16 Close cuvette vessel valve.
7.17 Disconnect argon/oxygen vacuum from cuvette vessel valve.
7.17.1 Record “In Vacuum” on the *Process Control Data Sheet*, Figure 3.
7.17.2 Record “In Vacuum” on *Cuvette Vessel Usage Log*, Figure 2.
7.18 Immediately place vessel on Lectro-Treat conveyor belt.

Note: Vessels must be placed onto the center of the conveyor in single file one behind the other, and with the valve end of the vessel facing the conveyor entrance. Spacing is not a concern.

Note: Vessels *must not* be placed side by side.
7.18.1 Log treatment time in and time out on Process Control Data Sheet.
7.19 Travel time for a vessel must be 12 ± .05 min.
7.20 Remove vessel from Lectro-Treat.
7.20.1 In the event of electrical failure during the vessel treatment process, the cuvettes must be removed and scrapped, MRR disposition is to be performed on a weekly basis.
7.21 *Immediately* attach the 30 in. Hg vacuum gauge to vessel.
7.21.1 Open vessel valve and note reading. If vacuum is equal or greater than 15 in. Hg, then record “Vacuum Out” on *Process Control Data Sheet.*

The operator is asked why the two trays indicated by the out-of-control points for subgroups 14 and 15 are not identified in the comments section of the log as having occurred during a power interruption. The operator says that due to her limited English-speaking abilities, she did not know what to write in the log. A new policy that log sheet comments could be written in English or Spanish was established by the area supervisor.

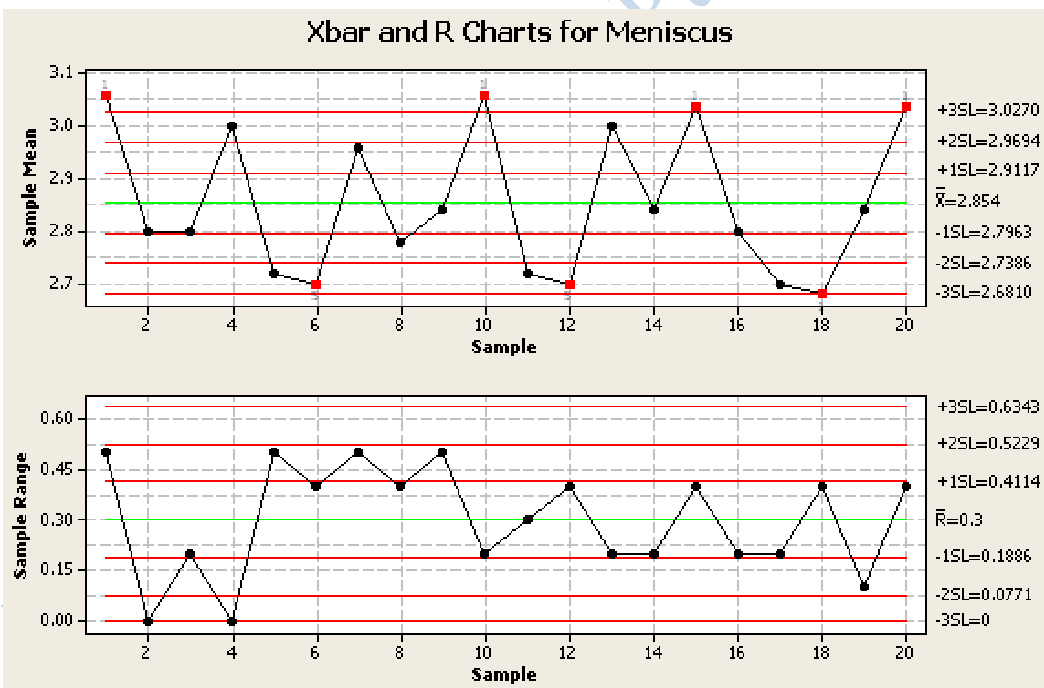
The Do stage in the first cycle consists of testing the two new policy guidelines during full-scale operation of the cold gas plasma treatment process.

The Study stage in the first cycle consists of determining if all the operators know what to do in case of a power interruption and if all the operators write their process comments on the log sheet in English or Spanish. The effectiveness of the power interruption policy cannot be verified because there are no further power failures during the course of this study.

The Act stage in the first cycle consists of updating the procedures manual to ensure that the new policies are followed by operators, as shown in Exhibit 16.1.

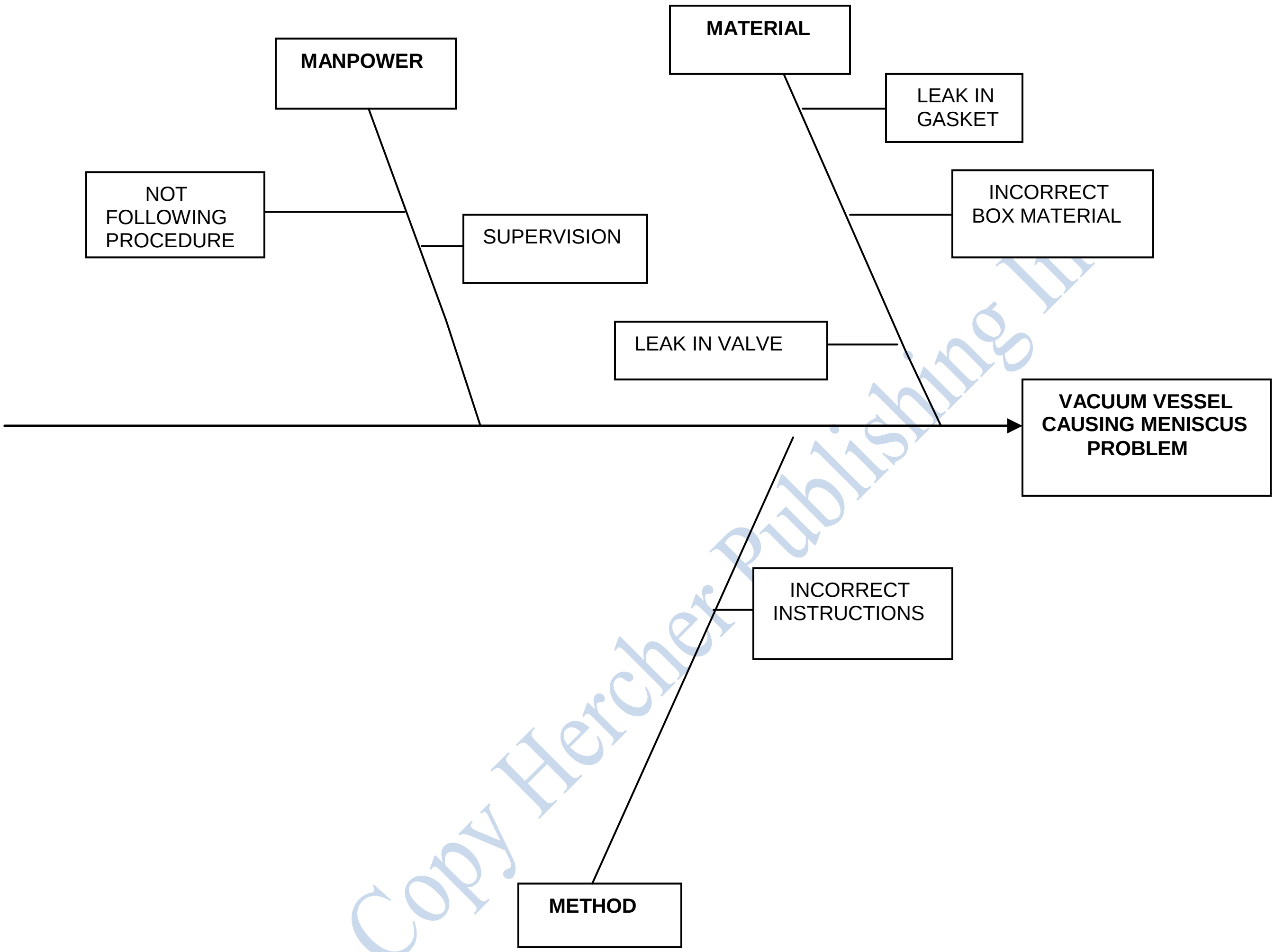
PDSA Cycle Two. In the second cycle, the Plan stage consists of monitoring the process by plotting 20 new subgroups (COLDGASPLASMA2) on the existing $\bar{x}$ and R charts, as shown in Figure 16.15. Note that the control limits are dashed lines, indicating that they are projected from the prior $\bar{x}$ and R charts. Again, the R chart indicates a stable process. However, a cyclical pattern is observed on the $\bar{x}$ chart, indicated by every fifth and sixth subgroup being below the lower control limit. In the past, the operators would not have noticed anything abnormal because the individual meniscus measurements are within specification limits.

Figure 16.15
Control Chart on 20 New Meniscus Measurements



An analysis is done by the process engineer using the previously developed cause and effect diagram, as shown in Figure 16.14. In the process engineer's opinion, the cyclical pattern on the $\bar{x}$ chart indicates that the meniscus problem is related to one of the vacuum vessels used in the cold gas plasma treatment process. Consequently, the process engineer expands the sub-causes for "vacuum vessel" on a new cause-and-effect diagram, as shown in Figure 16.16.

Figure 16.16
C&E Diagram: Reasons for Meniscus Problems Due to Vacuum Vessel

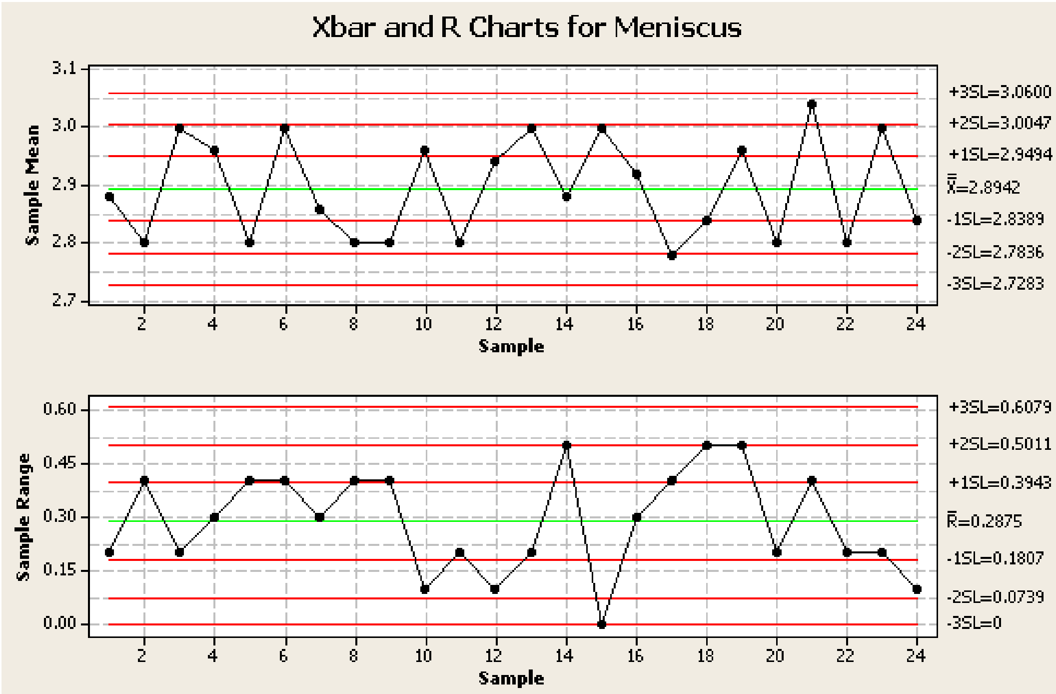


Vacuum vessel 021 is identified from the log sheets as the troublesome one. The process engineer concludes that the cause of the problem is a leak either in the gasket area or in the valve area of vacuum vessel 021.

The Do stage in the second cycle consists of testing vacuum vessel 021 for leaks in the gasket and valve areas. It is determined that the leak is in the gasket seating area of the vessel. Vacuum vessel 021 is scrapped in conformance with company procedure and a new vessel is installed in its place.

The Study stage in the second cycle consists of sampling 24 additional subgroups (COLDGASPLASMA3) to determine the stability of the cold gas plasma treatment process. New $\bar{x}$ and R charts indicate that it is stable, as shown in Figure 16.17.

Figure 16.17
Control Chart on 24 Additional Meniscus Measurements



The Act stage of the second cycle consists of changing the procedures manual for the cold gas plasma treatment process to ensure that there is a standardized method for dealing with leakage in vacuum vessels, as shown in Exhibit 16.2. The revised procedure ensures that the vacuum is maintained for two minutes in the vacuum vessel. If a vacuum cannot be maintained for two full minutes, the procedures manual states the appropriate course of action to be taken by the operator.

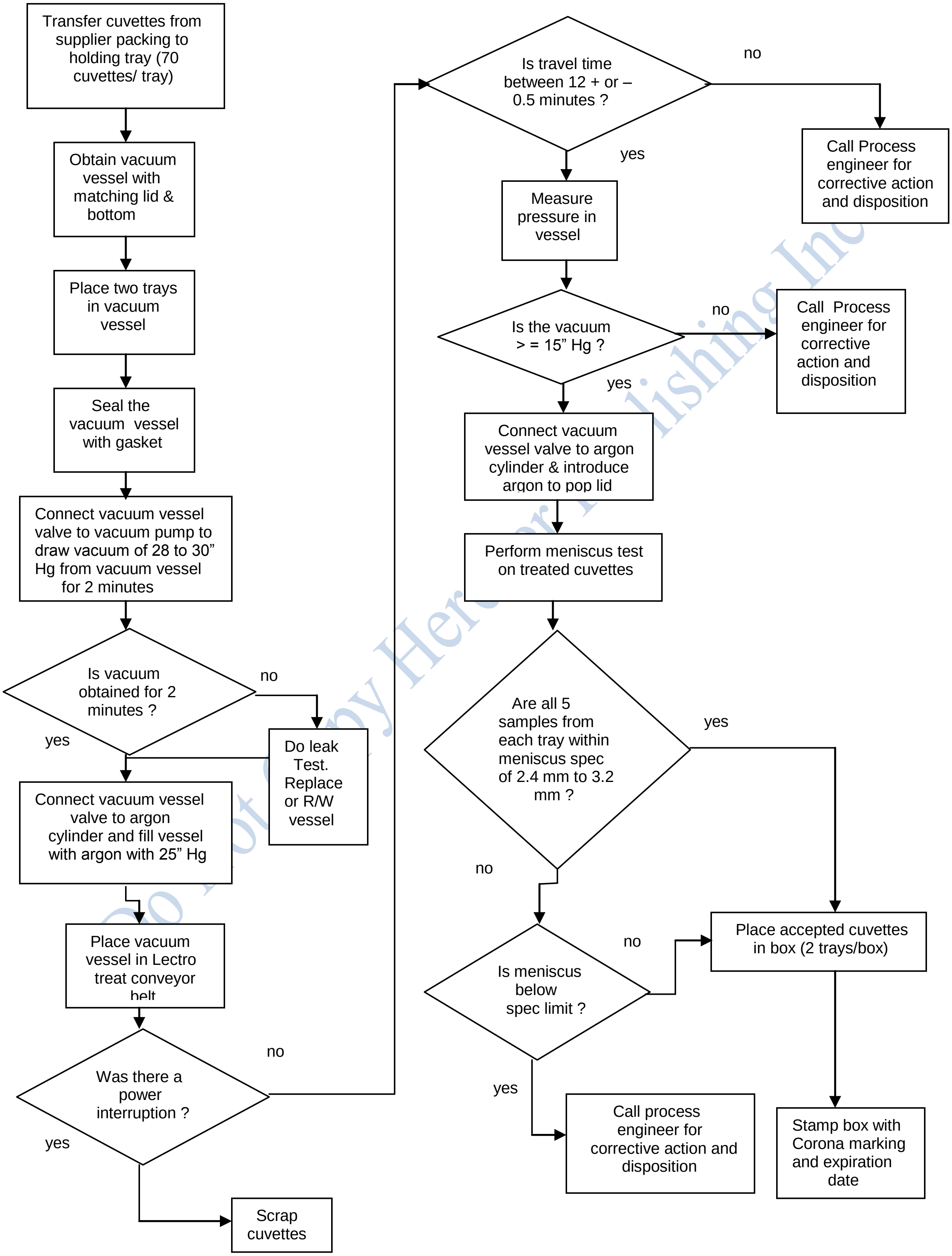
Exhibit 16.2
Procedures Manual Reflecting Policy Changes for Leakage in Vacuum Vessel

Corona Treatment of Cuvettes

7.6 Ensure vessel valve is open
7.7 Ensure argon-oxygen regulator valve is closed.
7.8 Start vacuum pump
7.9 Open vacuum pump valve.
7.10 Draw vacuum of 28 in. Hg to 30 in. Hg reading on the vessel gauge. While vacuum is being drawn, *press firmly* on vessel lid. Use a rubber hammer and strike vessel lid gently to ensure a good seal.
7.11 When 30 in. Hg of vacuum is obtained, continue to draw vacuum for 2 min.
Note: If vacuum of 30 in. Hg is *not* obtained, go to step 8.0. If steps 8.1 thru 8.11 are performed and the gauge still does *not* reach 30 in. Hg or vacuum decays after pump is switched off, go to step 12.0, *Procedure for Checking Vessel Leakers*.
7.12 Close vacuum pump valve.
7.13 Shut off vacuum pump
7.14 Open argon/oxygen valve until vacuum reads 25 in. Hg.
7.15 Shut off argon/oxygen regulator.
7.15.1 Hold vacuum for 1 min. If vacuum does not drop below 22 in. Hg, then proceed to step 7.16.
7.15.2 If vacuum decays below 22 in. Hg, repeat steps 7.4 thru 7.15.1.
7.15.2.1 If leak continues to occur, replace the Teflon valve and tube. See step 13.0, *Valve and Tube Replacement.*
Note: If the vessel continues to leak after valve and tube replacement, go to step 12.0, *Procedure for Checking Vessel Leakers.*

Improved Process. The two turns of the PDSA cycles resulted in a revised method for cold gas plasma treatment, as shown in Figure 16.18. Based on the last 24 data points, the revised method is stable; its capability is indicated by $Z_{USL} = 2.47$ and $Z_{LSL} = 4.02$, and its upper natural limit (UNL) is 3.264 mm and lower natural limit (LNL) is 2.526 mm, compared to the specification values of 3.2 and 2.4, respectively. Further improvements can now address reducing the UNL to within the specification limits.

Figure 16.18
Flowchart for Revised Cold Gas Plasma Treatment Process



Conclusion. This study produced several benefits. First, it produced benefits to the internal customers of the cold gas plasma treatment process in the form of reduced network costs from not recycling cuvettes and decreased surface degradation to cuvettes due to fewer cold gas plasma treatments. Second, it yielded benefits to the external customers of the final product (a chemical instrument) through increased on-time delivery, decreased scrap rates, and increased quality. In view of the improvements created in this case study and the simplicity of maintaining a hand-drawn control chart, the area supervisor and the process engineer will continue the use of the control chart.

16.3.6 Management Review

Project teams present their housekeeping and daily management projects to managers for approval in **management reviews**. A management review [Mizuno, 1988, pp. 269-280] involves comparing the actual results generated by applying a set of methods with the targets established, allocating resources to optimize the organization's progress toward its aim; and finding opportunities to improve and innovate methods.

Three critical inputs are required for a management review. They are a well-researched method (called a best practice method), a target established to allocate resources to optimize the organization toward its aim, and an actual result that has been measured through an R criteria. The development of the first and second inputs requires that a manager have a deep and thorough understanding of the process being studied; a firm grasp on where the process stands with respect to its capability and environment; knowledge of the aim of the organization to determine appropriate change concepts to get there [Mizuno, 1988, p. 98]; the realization that a method is used to predict a result, recognition that a method should yield a high likelihood of achieving a target before it is implemented [see Mizuno, 1988, p. 99]; and understanding that targets are vehicles for allocating resources between processes.

A set of suggested questions that can form the basis of a management review of a project team appears below. These questions will help all stakeholders involved in the management review focus on opportunities for improvement and innovation of methods. These questions are only suggestions. Management reviews have natural flows. A manager can use preset questions, but also needs to go with the rhythm of the review to accomplish its purpose.

1. What is your area's most important process?
2. Are you (as an individual) or your colleagues working on improvement or innovation of your most important process?

3. How do you measure the performance of your most important process? What are the R and P criteria for this process?
4. Do you have targets for this process? Monthly? Yearly?
5. Did you study this process last year? How have you incorporated the results of that study into your current process?
6. What is the status of your most important process to date?
7. Is your most important process hitting its target(s)? Monthly? Yearly?
8. If targets are not being achieved, what change concepts have your team members taken?
9. What change concept(s) will prevent your most important process from hitting its target(s) in the future?

A management review probes the **root cause(s)** of the differences between actual results and targets without tampering with methods. A management review includes a questioning process that asks questions "one inch wide and one mile deep," as opposed to questions that are "one mile wide and one inch deep." This means that the management review probes root causes to a high level of detail. A technique that helps people probe for root causes in the above manner is the **5W1H process** [Imai, 1986, p. 235]. The 5W1H process is used to ask "Why" a problem occurs five times and then "How" the problem can be resolved, as opposed to just asking "How" the problem can be resolved. Historically, a person asks a question like, "Why didn't the lawn get mowed this week?" and gets an answer like, "The mower broke." This usually leads to the person responsible for mowing the lawn being blamed and no improvement in the lawn-mowing process. What the 5W1H process is suggesting is something like the following:

Sample "5W1H" Process

Question 1: "*Why* didn't the lawn get mowed this week?"
Answer 1: "The mower broke."

Question 2: "*Why* did the mower break?"
Answer 2: "The bearing burned out."

Question 3: "*Why* did the bearing burn out?"
Answer 3: "The bearing burned out because it wasn't oiled properly."

Question 4: "*Why* wasn't the bearing oiled properly?"
Answer 4: "The bearing wasn't oiled properly because the oil line was clogged."

Question 5: "*Why* was the oil line clogged?"
Answer 5: "The oil like was clogged because there is no routine and proactive maintenance program to examine the oil line."

Question 6: "*How* can we resolve this problem so it doesn't happen again?"

Answer 6: "Develop and follow a policy of routine and proactive maintenance for the oil line."

As you can see, questions 1 through 5 focus on the root cause ("Why") of the problem, while the last question focuses on "How" to improve a process; the procedure promotes asking questions that are "one inch wide and one mile deep."

16.3.7 Variance Analysis

Management reviews should be conducted in accordance with Deming's System of Profound Knowledge (SoPK). Not all sources of variation are due to special causes of variation. A manager following SoPK does not tamper with processes under his or her control. Instead, causes of variation are separated into common and special sources by statistical methods. Then, employees work to resolve special sources of variation, and management works to remove common sources of variation by modifying methods.

The management review focuses on whether the actual method used by an employee follows the best practice method. Table 16.1 shows the relationship between following methods and achieving targets.

Table 16.1
Relationship between Following Methods And Achieving Targets

		Achieving Targets	
		Yes	No
Followed Method	Yes	1	3
	No	2	4

Source: Noriaki Kano, Science University of Tokyo, presented on April 1, 1990 in Atlanta, GA.

Cell 1 shows the outcome of an employee following a best practice method as the attainment of a target.

Cell 4 shows the outcome of an employee not following a best practice method as the failure to attain a target. To reverse this failure, the employee follows the best practice method. In this case, the management review determines answers to the following questions:

1. What best practice method was not followed?
2. Who failed to follow the best practice method? Note: The focus is on system problems, not on the individual. This will help promote joy in work and pride in the outcome.
3. Why did the employee not follow the best practice method? Was it due to ignorance, misunderstanding, lack of training, negligence, problems with a machine, or problems with raw materials?
4. Should the best practice method be changed to resolve problems due to ignorance, misunderstanding, lack of training, negligence, problems with a machine, or problems with raw materials?

Cell 2 shows the outcome of an employee not following a best practice method as the attainment of a target. In this case, depending on prevailing pressures, the employee may adopt a slower pace when determining why the method used yielded the target.

Cell 3 shows the outcome of an employee following the best practice method as the failure to attain a target. In this case, the best practice method is improved or innovated, and/or a change is made in the target; the employee is not blamed. This change is accomplished by asking the following questions proposed by Kano:

1. What best practice method missed its target?
2. How can the best practice method be changed to attain its target?
3. Must the best practice method be changed to resolve problems due to ignorance, misunderstanding, lack of training, problems with a machine, or problems with raw materials?
4. What target was missed?
5. How much was the target missed over time? Is the process under study stable? Will adjustment of the target result in tampering with the best practice method?
6. Why was the target missed? Was the target set incorrectly due to ignorance, lack of training, problems with a machine, problems with raw materials, management or by guesswork?

Once these questions are answered, the necessary information may be available for improvement or innovation of the best practice method or change of the target. These questions focus on improvement and innovation of the best practice method, not on blaming the individual.

Frequently, it is not possible to investigate the negative scenarios presented in cells 2, 3 or 4 on a daily basis. One day may not provide enough time to perform all four stages of the PDSA cycle to achieve the desired improvement and/or innovation.

16.3.8 Empowerment

Steps 18 and 19 of Figure 16.1 include empowering employees through daily management [Pietenpol, et. al., 1996, pp. 50-57]. **Empowerment** is a term commonly used by managers in today's organizational environment. However, it has not been operationally defined, and its definition varies from application to application. Currently, the popular definition of empowerment relies loosely on the notion of dropping decision-making down to the lowest appropriate level in an organization. The basic premise of empowerment is that if people are given the authority to make decisions, they will take pride in their work, be willing to take risks, and work harder to make things happen. Frequently, the reality of empowerment is that employees are empowered until they make a mistake; then the hatchet falls. Most employees know this and treat the popular concept of empowerment with the lack of respect it merits; empowerment in such a form is destructive to quality management.

Empowerment in a quality management sense has a dramatically different aim and definition. Its aim in quality management is to increase pride in work and joy in the outcome for all employees.

The definition of empowerment that translates this aim into a realistic objective is as follows: Empowerment is a process that provides an individual or group of employees the opportunity to:

1. Define and document methods.
2. Learn about methods through training and development.
3. Improve and innovate best practice methods that make up systems.
4. Utilize latitude in their own judgement to make decisions within the context of best practice methods.
5. Trust superiors to react positively to the latitude taken by employees making decisions within the context of best practice methods.

Empowerment starts with leadership, but requires the commitment of all employees. Leaders provide employees with all five opportunities stated above. Employees accept responsibility for:

1. Increasing their training and knowledge of methods and the systems of which they are a part.
2. Participating in the development, standardization, improvement, and innovation of best practice methods.
3. Increasing their latitude in decision-making within the context of best practice methods.

Latitude to make decisions within the context of a best practice method refers to the options an employee has in resolving a problem within the confines of a best practice method, not to modification of the best practice method. Differentiating between the need to change the best practice method and latitude within the context of the best practice method takes place at the operational level.

Empowerment can only exist in an environment of trust that supports planned experimentation concerning ideas to improve and innovate best practice methods. These ideas can come from individuals or from the team, but tests of the worthiness of those ideas are conducted through planned experiments under the auspices of the team (the Do stage of the PDSA cycle). Anything else will result in chaos.

Individual employees are taught to understand that increased variability in output will result if each employee follows his or her own method. This increased variability will create additional cost and unpredictable customer service. Employees must be educated about the need to reach consensus on one best practice method.

The best practice method will consist of generalized procedures and individualized procedures. Generalized procedures are standardized procedures that all employees follow. Individualized procedures are procedures that afford each worker the opportunity to utilize their individual differences by creating their own standardized procedure. However, the outputs of individualized procedures are standardized across employees. Individualized procedures can be improved through personal efforts. In the beginning of a quality improvement effort, employees and management may not have the knowledge to allow for individualized procedures.

A professor following an approved departmental syllabus for a certain course is an example of an employee using a generalized procedure. When that professor injects her own examples, experiences and jokes, she is using individualized procedures.

Empowerment is operationalized at two levels. First, employees are empowered to develop and document best practice methods using the SDSA cycle. Second, employees are empowered to improve or innovate best practice methods through application of the PDSA cycle.

16.3.9 Continuing the PDSA Cycle

As managers see the results from improved processes, they will want to expand the number of daily management project teams. This should be discouraged in the beginning of a quality management effort.

Instead, managers should be asked to direct their existing project teams to continually subject the processes already under study to more iterations of the PDSA cycle. The benefit of this action is ensuring that managers learn how to continuously improve and innovate processes, not how to make one improvement in a process and jump to another process. Management reviews are an excellent vehicle to promote this type of training experience. Reviewers can ask the following question: “Can I see your improvement action memoranda for this process?” Those reviewed should be able to show multiple improvement action memoranda, including changes to training programs, for the process they are studying with their project team.

16.3.10 Coordinating Project Teams

As the initial process improvement teams begin to show positive results, other process improvement teams will be formed by area or department managers in response to localized issues, as shown in step 19 of Figure 16.1.

The initial and other process improvement teams require resources, such as PILs, members to work on projects, training, financial resources, physical space in which to meet, and the direction and guidance of a higher level of management.

As the number of teams increases, a structure to coordinate and manage the teams at the department level is necessary. The structure is called a **Local Steering Team (LST)**, as shown in step 20 of Figure 16.1. Each department’s LST has the responsibility to coordinate daily management projects, as shown in steps 18 and 19 of Figure 16.1.

16.3 Summary

This chapter presented a discussion of Prong 1 of the fork model, daily management. Daily management is used to develop, standardize, deploy, maintain, improve, and innovate the methods required for daily work.

The first phase of implementing daily management involves selecting initial project teams. Process Improvement Leaders (PILs) are chosen by the Executive Committee and trained in basic quality control tools and the psychology of the individual and the team. Then the initial projects are determined, and project teams are formed.

After training, each initial project team works on one or more methods using daily management. Daily management includes housekeeping, which is the development, standardization, and deployment of methods required for daily work, and, in its second sense, daily management is the maintenance, improvement, and innovation of methods for daily work.

Housekeeping functions are developed through a procedure called function deployment. This is the way employees determine what functions are required to perform each method they use in their daily work. Housekeeping is accomplished by employing the SDSA cycle. The objective is to determine the best practice method for each function. Best practice methods are monitored through key indicators that are operationally defined and measure the results and the processes that generate results.

After a best practice method has been developed and deployed by a project team, housekeeping activities give way to daily management activities. Daily management is used to reduce process variation and to center the process on the customer's requirements. The PDSA cycle is used in daily management in a continuous progression of never-ending improvement.

Project teams present their housekeeping and daily management projects to managers for approval in management reviews. This is the process that involves comparing actual results with established targets. It is critical that management reviews take into account common and special causes of variation. If a management review is done properly, there is no place for tampering with the process or blaming employees for problems out of their control.

Empowering employees through daily management has as its aim, in a quality management sense, to increase joy in work. It is operationalized at two levels. First, employees are empowered to develop and document best practice methods using the SDSA cycle. Second, they are empowered to improve and innovate best practice methods through the continuous application of the PDSA cycle.

As the initial process improvement teams begin to show positive results, and more teams are formed by area or department managers, a structure coordinates the teams at the department level. This structure is called the Local Steering Team.

EXERCISES

16.1 Reread the personal example of daily management in this chapter (section 16.3.4). Perform a similar analysis for yourself by selecting a problematic key process in your life, and do the following:
PLAN
a) flowchart the process,
b) identify the key objective(s) of the process,
c) identify the key indicator(s) for each key objective,
d) develop a change concept using data analysis, benchmarking, or the list of change concepts to develop a revised and improved flowchart,
DO
e) use the revised flowchart in a pilot study,
STUDY
f) study the effect of the revised flowchart on the relevant key indicator(s),
ACT

g) if the change is positive, formalize it by placing it in your daily routine; if the change is negative, go back to the plan stage of the PDSA cycle and identify another change concept.

16.2. Reread the business example of daily management in this chapter (section 16.3.5). Perform a similar analysis for your organization by selecting a problematic key process, and do the following:
PLAN
a) flowchart the process,
b) identify the key objective(s) of the process,
c) identify the key indicator(s) for each key objective,
d) develop a change concept using data analysis, benchmarking, or the list of change concepts to develop a revised and improved flowchart,
DO
e) use the revised flowchart in a pilot study,
STUDY
f) study the effect of the revised flowchart on the relevant key indicator(s),
ACT
g) if the change is positive, formalize it by training all relevant employees in the revised process and putting it in your training manuals; if the change is negative, go back to the plan stage of the PDSA cycle and identify another change concept.

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