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Planning Projects and Tasks Using the 9-Steps

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David Walden is the editor of this journal and has long admired John Petrolini's understanding of how to mobilize change in organizations.

Readers familiar with the approach to business improvement used by many members of the Center for Quality of Management will recognize the WV model, shown in Figure 1.

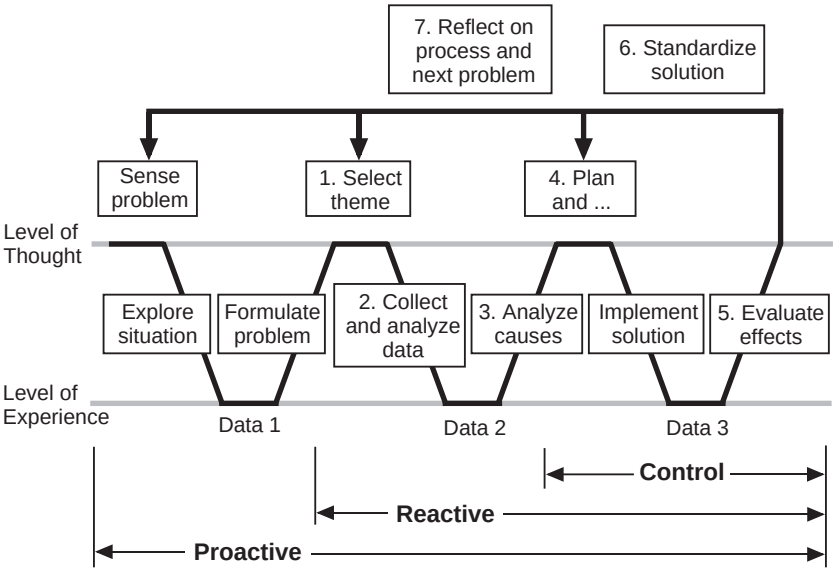

Figure 1 shows the WV Model.

The WV model shows problem solving moving between the level of thought and the level of experience. From left to right:

- you sense a problem,
- explore it broadly,
- formulate a problem to work on,
- state a specific improvement theme,
- collect data and analyze the situation,
- find the root causes,
- plan a solution and implement it,
- evaluate the effects of the solution,
- standardize the process to include the new solution if it is good, and then
- take on the next problem.

Thus, the WV model ranges from *proactive* improvement on the left, through *reactive* improvement in the middle, to *process control* on the right.[1]

This paper introduces a fourth, hybrid, type of process improvement or problem-solving, in addition to proactive, reactive and process control: *planning and executing tasks or projects* that have not been done be-

[1] For more detail on the WV model, see Shoji Shiba et al., *A New American TQM: Four Practical Revolutions in Management* (Portland OR: Productivity Press, 1993), 47-56 and 150-153.

fore. Thus, this paper also introduces a variation on the WV model, adding the bottom row of the WV model, as shown in Figure 2.

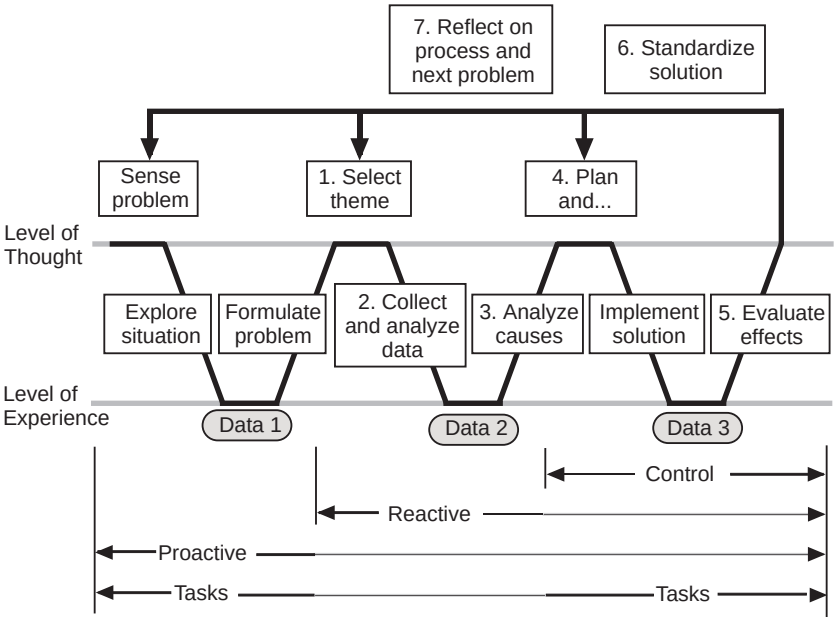

Figure 2 adds a bottom row to the WV Model.

As can be seen in the bottom row of the figure, planning and executing tasks or projects spans both sides of the WV model. First you decide what new task or project needs to be done (this is a proactive effort), and then you put in place an implementation plan that you try to follow accurately (as you do with a standard process under process control).

This paper is the first description in the *Center for Quality of Management Journal* of the tool for task or project planning and execution known as the 9-Steps method.

The 9-Steps Compared with the 7-Steps

The 7-Steps is a standard method for improving performance of existing processes, in keeping with the famous Plan-Do-Check-Act cycle. The boxes labeled 1 through 7 in Figure 1 are the names of the 7-Steps.[2] The 7-Steps assume previous experience with a process. Its Plan phase goes as follows:

- In Step 1 we select a theme (where there is weakness that needs improvement) for the existing process.
- In Step 2 we collect data and analyze it.
- In Step 3 we hypothesize the root cause of the problem we are investigating.
- In the first half of Step 4 we plan the implementation of what we believe will eliminate or substantially; reduce the root cause.

This pattern is shown in the right column of Figure 3 (next page).

The 9-Steps is a standard method for improving performance of new projects or tasks. It assumes little prior experience with a particular process. Thus, the 9-Steps start with deriving a Plan for what must be done. The steps for deriving this plan are shown in the middle column (Steps 1–5) of Figure 3. Where Steps 1–3 of the 7-Steps investigate an existing process, Steps 1–5 of the 9-Steps plan a new project.

[2] For detailed descriptions of the 7-Steps, see Shoji Shiba et al., *A New American TQM: Four Practical Revolutions in Management* (Portland OR: Productivity Press, 1993), chapters 5 and 6. See also, *The 7-Step Problem-Solving Method* (Cambridge MA: Center for Quality of Management, revised October 1997).

PDCA	9-Steps (Project Planning)	7-Steps (Reactive)
Plan	1. Describe project 2. Explore essentials/narrow focus 3. Establish metrics 4. Identify alternatives 5. Develop optimistic plan with obstacles and counter-measures	1. Select theme 2. Collect/analyze data 3. Analyze causes
Do	6. Develop, implement and monitor detailed plan	4. Plan/implement solution
Check	7. Evaluate results	5. Evaluate effects
Act	8. Standardize 9. Reflect	6. Standardize 7. Reflect

Figure 3 compares the 9-Steps with the 7-Steps method.

As can also be seen in the figure, both methods in their Do phase develop and execute a detailed implementation plan. They also have in common the same last three steps (Check and Act) — evaluate the results, standardize on what worked, and reflect on use of the method and what to do next.

The 7-Steps assume repetition. Their goal is to prevent recurrence of problems that have already been seen. Typically problems are found in the areas of the 5-Evils (defects, mistakes, delay, waste, accident/injury). When a defect or another of the 5-Evils occurs, we seek to prevent the problem that *already happened* from happening again, using the 7-Steps.

The 9-Steps assume a new task or situation. Often the situation is complex or uncertain. The goal in using the 9-Steps is to avoid *future* problems that might occur during implementation of the task or project. The premise is that good planning will lead to better projects.

The 9-Steps Mobilization at Teradyne

When Teradyne first launched its TQM efforts in 1990-91, it essentially focuses exclusively on use of the 7-Steps for improving existing processes.[3] By the beginning of 1992 it was becoming clear at Teradyne that only having one tool — the 7-Steps — was not enough. To some extent there was the problem that when the only tool you have is a hammer, everything begins to look like a nail. Also, people in engineering and marketing had been having a hard time seeing the relevance of the 7-Steps in their areas, where projects were either long and it was hard to collect data very fast, or were seen as not being repetitive processes — where each new customer or development project requires unique handling.[4] Also, some teams in Teradyne were missing project due dates for a variety of different types of projects. Therefore, Teradyne sought a new tool that supplement the 7-Steps, particularly in marketing and engineering that operate less consistently from one cycle to the next.

With Shoji Shiba's help, the tool Teradyne chose for planning projects and tasks was the 9-Steps. There were two sets of reasons why Teradyne adopted the 9-Steps.

First, the 9-Steps were relevant to Teradyne's situation. The 9-Steps, with its project and task orientation, seemed relevant to engineering and marketing, with their project and task orientation. Also, Teradyne was missing project dates on all sorts of project throughout the company, and this often happened because a team hadn't anticipated potential

[3] The Teradyne TQM effort is described at greater length in Shoji Shiba et al., *A New American TQM: Four Practical Revolutions in Management* (Portland OR: Productivity Press, 1993), 313-317 and 321-327.

[4] Even though a new product is produced each time through a development process, that does not mean that there is not a repeatable development process (or at least a repeatable way of developing resources that can reliably produce new products). However, at Teradyne, as at so many other companies, people in some functions did not see it this way.

problems. Thus, the 9-Steps' emphasis on understanding potential obstacles and undertaking countermeasures to avoid the obstacles was very relevant to Teradyne.

Second, the 9-Steps was another method (in addition to 7-Steps) that had specific steps and involved specific tools. Alex d'Arbeloff preferred methods that had explicit steps. The powerful seven QC tools didn't get significant use at Teradyne until they were presented to employees embedded in the 7-Steps. The seven management and planning tools were another set of powerful tools relevant to task and project planning that could be brought into use at Teradyne if embedded in an multi-step process.

Shoji Shiba and Teradyne were inventing much of the 9-Steps as the steps were being taught to the Teradyne people. In this sense, the rollout of 9-Steps was similar to the way Teradyne rolled out the 7-Steps and other methods now widely used in the company. A little bit about the method was learned, in this case from Shoji Shiba (who knew of earlier rudimentary methods used in the QC Circle movement),[5] and people began to use the method. In time, workshops were held at which insights of managers, facilitators and team members were gathered, and a manual and standard course were created for the 9-Steps.

As use of the 9-Steps spread in Teradyne, 9-Steps activities were managed and monitored similarly to 7-Steps activities. Teams finishing the 9-Steps process presented their improvement stories to division management, which diagnosed the team's use of the 9-Steps process using the 70/30 rule of 70% comments to reinforce and encourage good process practice and 30% mention of areas for improvement.[6] 9-Steps activities were included in the Teradyne's overall quality improvement team (QIT) metrics of number of active teams, average time from start to finish of a QIT, percentage participation of employees, and so on. 9-Steps teams were sponsored and managed in the same way that Teradyne had learned to sponsor and manage seven step teams. By 1996–97, approaching 35% of Teradyne improvement teams were 9-Steps teams.

In time, the Teradyne developed 9-Steps manual that was passed on to the CQM for sharing with other CQM member companies.[7] Shoji Shiba and Petrolini taught the first course to other CQM members interested in learning the method and how to teach it. Thus, the 9-Steps mobilization at Teradyne was example of a full cycle of societal networking. Shoji Shiba brought some initial ideas from outside the company to Teradyne, teams within Teradyne collaborated to develop and improve the method, and finally the newly codified method was passed on to other organizations in the CQM.

A Teradyne Illustration of 9-Steps Use

This illustration of the 9-Steps was used as part of Teradyne's preparation for the 1994 annual "TQM at Teradyne" update to all employees.[8]

Step 1: Describe the project

As with a 7-Steps theme, you want to state clearly in one sentence the objective of the project at hand. Teradyne's experience is that this statement should be positive and action oriented. An example is, *"Deploy the TQM at Teradyne presentation to all employees by March 1, 1994."* This first statement is a general statement of the problem and may well be revised as more is learned about the issue.

[5] There is a 9-Steps method that prevails in Japan, however, it is very much different than the 9-Steps method described here.

[6] The Teradyne system for having teams present their work for management diagnosis (whether 7-Steps or 9-Steps work) includes self-diagnosis by the team of its own efforts prior to management diagnosis. This eases the difficulty of management providing 30% corrective comments — the team has often recognized the problems themselves.

[7] *9-Step Project Planning System* (Cambridge MA: Center for Quality of Management, revised January 1997).

[8] Editor's note: John Petrolini also presented this example on a 12 tape video tape series entitled, *A New American TQM: Revolutions in Management* (Cambridge MA: MIT Center for Advanced Engineering Study), "Reactive Improvement II", tape 4. The tapes are now reproduced by the Center for Quality of Management. See also *9-Step Project Planning System* (Cambridge MA: Center for Quality of Management, revised January 1997). This CQM manual includes detailed instructions, guidelines and tips for using the method not included in this paper.

Step 2: Explore the essentials, and narrow the focus

Step 2 has two parts.

Step 2.1 — Explore the essentials.

The purpose of step 2.1 is to get a broader perspective of the project described in step 1. You need to understand the issues, grasp the essential issues, and confirm the real purpose of the project. To do this, it is important to *jump up* to see a bigger picture, using both language data and numeric data (see Figure 1).

The Teradyne team created the relationship diagram shown in Figure 4 to help them jump up and see the bigger picture.

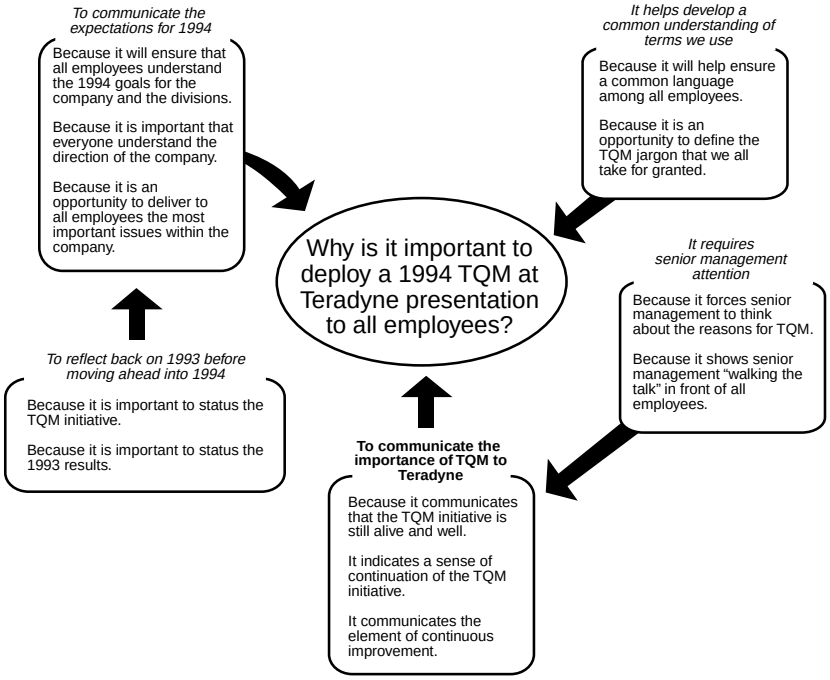

Figure 4 is a Relationship Diagram to Investigate the Project Description.

Relationship diagrams are one of the seven management and planning tools for processing qualitative data.[9] It is a form of cause-and-effect diagram for use when there is potential for loops in the network of causes and effects.

The Teradyne team followed the typical process for constructing a relationship diagram. The project description from Step 1 was placed in the center of a large sheet of paper in a Why format. Then the team brainstormed answers to the question of why it is important to deploy a TQM at Teradyne presentation to all employees. The brainstormed answers were organized in a succession of cause and-effect relationships. After creating this diagram and studying it to jointly gain broader understanding of the stated project, the team concluded that, "*To communicate the importance of TQM to Teradyne*" was the highest priority reason for addressing the stated project.

Jumping up is very important. Often the specification for a problem comes from above, and the team needs to find a point of view one level above the system it has been directed to improve to make sure it is working on the right problem. Shoji Shiba emphasizes the importance of

[9] Shigeru Mizuno, *Management for Quality Improvement: The Seven New QC Tools* (Portland, OR: Productivity Press, 1998), 23-26 and 87-113.

jumping up with a story of when he was a young consultant and was doing consulting work for a ship building company. The company had two businesses: building ships to a schedule, and repairing ships. Both of these functions were performed out of a single factory, as in the left of Figure 5.

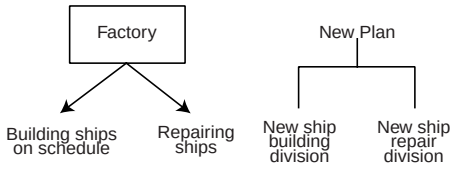

Figure 5 shows alternative approaches for a shipbuilding company.

The CEO of the company told Shoji Shiba that they had decide to split the company into two divisions, each of which would handle one of the two businesses, as in the right of the figure. The CEO asked Shiba to analyze how many people would need to be employed in each of the new divisions. This analysis required forecasting the future business of the divisions, understanding the skills of the employees, and so on. Shiba first worked on a plan for the new repair division, and when done presented it to the company. No one, especially the CEO, paid any attention to his proposed plan. Therefore, Shiba studied the situation from a broader perspective, and he discovered that the company wanted to decide *whether* to split the company into two divisions or to continue to run the two businesses out of a single factory. The CEO had said it was decided that there would be two divisions, but this was not so. This early business experience drove home to Shiba the need to jump up to see the problem one level above the system, to grasp the essence of the problem.

Step 2.2 — Narrow the focus.

Having understood the problem, the Teradyne team needed to understand the details of what they were proposing to undertake, which detailed elements could be done relatively routinely, and where the key problems were likely to be.

To investigate the details, the Teradyne team started with the end points of their proposed project, with dates, as shown on the left side of Figure 6.

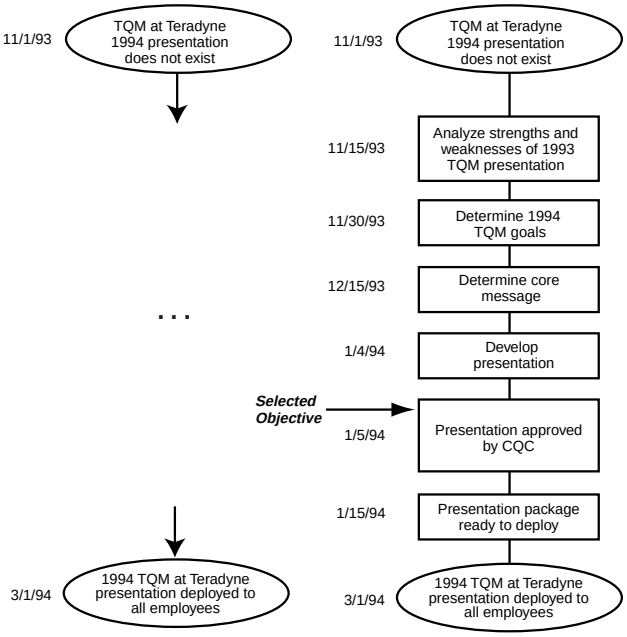

Figure 6 helps in understanding the details of the project.

Then, as shown on the right side of Figure 6, they filled in the sub-steps that they felt had to be accomplished to get from the start point to the end point, again with desired dates. They felt they needed to:

- analyze the strengths and weaknesses of the previous year's TQM at Teradyne presentation,
- determine the goals of the current year's presentation, determine the core message of the presentation,
- develop the presentation,
- get approval of company top management (called the Company-wide Quality Council, or CQC, when considering matters relating to TQM), and finally
- prepare the presentation package for deployment throughout the organization.

Some of these sub-steps were relatively straightforward, while one of the sub-steps (Presentation approved by CQC) seemed the most problematic. Therefore, "Presentation approved by CQC" was chosen as a more narrow focus for the project, completing Step 2.2.

Step 3: Establish Metrics and Determine Constraints

In Steps 1 and 2 the overall project was described and a specific objective was chosen. The team's next step was to establish metrics by which they could tell if they accomplished their objective or not and to make explicit to themselves any other constraints the team and project would have to live within.

Step 3.1 — Establish Metrics.

At Teradyne teams look at four areas to help themselves consider what appropriate results metrics might be: Quality, Cost, Delivery and Amount. In the case of the selected objective "Presentation approved by CQC," it made sense to the team to develop metrics for two of these four categories, as shown in Table 1.[10]

[10] If metrics were being developed for another objective, such as "Presentation package ready to deploy" (as in Figure 6), then metrics for all four of the metrics could make sense. For example: Q — package for each site cross checked for completeness; C — less than $500 per site; D — at least 3 business days before the meeting scheduled at the site; A — copies to each of eleven sites.

	Metric	Value
Quality	Consensus of senior management	At least 80% with core message and and package
Cost		
Delivery	Number of days beyond 1/5 before review is approved	Plus or minus one day
Amount		

Table 1: Metrics for the Objective "Presentation approved by CQC"

Step 3.2 — Determine Constraints.

The specific objective often is not the only goal a team must work toward. Frequently a team also must live within (or desires to live within) other constraints.

At Teradyne, teams check whether there is a due date or time frame that they must live within, and they also find it useful to review the 4Ms (manpower, method, material, machine) or the 4Ws (who, what, when, what) for other possible constraints.

In this particular case, the Teradyne team developed the additional constraints shown in Table 2.

Time frame	Approved by 1/5/94
Manpower	TQM Managers and TQM Office primarily
Methods	-Delivered by senior managers
	-Include reflection and then a look forward
	-Communicate/exhibit PDCA being user

Table 2: Constraints for the Teradyne Project

As per Figure 6, the team desired CQC approval by 1/5/94. The team was also aware that the people available to develop the presentation package were themselves — the divisional TQM managers and a couple of people in the corporate TQM office. The team also wanted the presentation to be delivered by senior managers (see Methods in the table), because they believed in the importance of senior management leading by example or "walking the talk"; and they wanted the presentation process to illustrate the use of PDCA, by looking back at the weaknesses from the previous years and fixing them.

Step 4: Identify Possible Alternatives and Select the Best Alternative

Step 4 involves identifying alternative approaches of accomplishing the milestones and objectives and selecting the best alternatives for each milestone and objective.

In this step the Teradyne team reviewed the milestones from Step 2 (see the right side of Figure 6) and considered different approaches that could be used to accomplish each. Their lists of alternatives are shown in Table 3.

Analyze strengths/weaknesses of 1993 TQM Presentation
0 - Form subcomittee to analyze
7 - TQM office to analyze *
Determine 1994 TQM goals
7 - CQC to finalize at 12/3 meeting *
Determine core message
2 - Ask Alex to formulate message
5 - TQM office gains CQC consensus *
0 - TQM office formulates
Develop presentation
2 - Ask Alex to develop
5 - TQM office gains CQC consensus *
Presentation approved
0 - TQM office conducts one on ones
0 - TQM office presents at CQC meeting
7 - TQM office briefs each individual and then presents at CQC *
* indicates selected alternative

Table 3: Alternative Approaches to Meeting the Milestones

There was only one alternative for Determining 1994 TQM Goals because doing so is the job of the CQC, and only they can do it.

For the other milestones leading to presentation approval by the CQC, the team had alternatives. For instance, for the first milestone, a subcommittee could have been formed to analyze the strengths and weaknesses of the 1993 TQM presentation, or the TQM office personnel could do it. The team unanimously (7-0) believed the latter was a better approach and selected it (indicated by the asterisk). For the third and fourth milestones, some members of the team believed that it would be best for

the core message and the presentation to come from CEO Alex d'Arbeloff. However, a majority of the team felt that having the TQM office work to gain consensus would be more constructive in the long run. For the last milestone, there again was unanimity about the best approach — the TQM office would brief people individually (to be able to answer questions and get feedback) and then would brief the entire CQC about the presentation at the CQC meeting.

Step 5: Develop an Optimistic Plan with Obstacles and Countermeasures

Step 5.1 — Develop an Optimistic Plan.

In Step 4, more specific approaches were selected for the milestones developed in step 2.2. This transformation of milestones to specific tasks is shown in Figure 7.

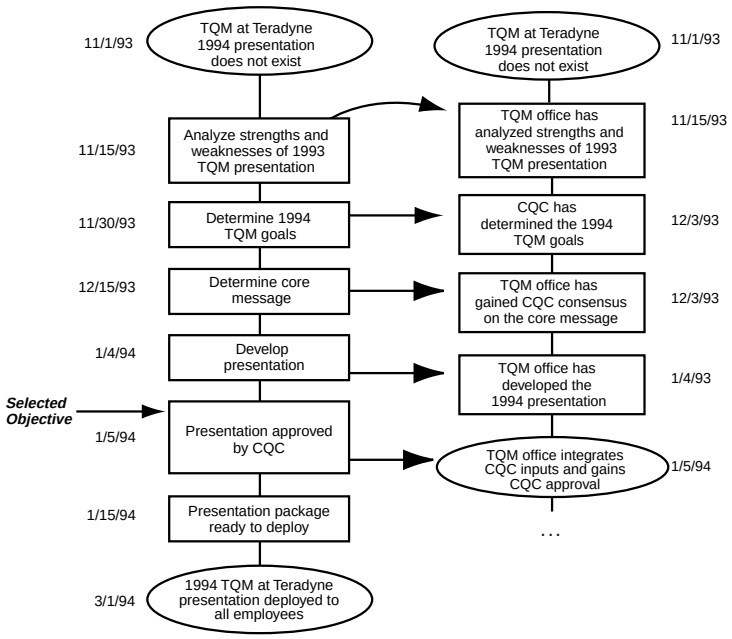

Figure 7 illustrates the transformation of milestones to the most appropriate specific tasks.

Next, the team needed to make this detailed set of specific tasks — this plan — be "optimistic" (aggressive). They decided on optimistic dates for the specific tasks on the right side of the figure. By creating an optimistic plan (but not impossible) for achieving the milestones, the team in fact had a better chance of meeting the milestones.

Step 5.2 — Forecast Obstacles

It is never sufficient to simply make a plan, especially an optimistic plan — much can go wrong. Therefore Step 5.2 requires the team to forecast the obstacles that might derail each element of the optimistic plan. The aim of this sub-step is to anticipate what might go wrong with the optimistic plan — forecasting as many obstacles as possible to each element of the plan (without becoming unrealistic) based on the team's knowledge — and then focusing on the vital few obstacles.[11]

The Teradyne team did this for each element in the right column of Figure 7. For instance, for the second element on the right side of the figure ("The TQM office has analyzed the strengths and weaknesses of

[11] Seeing the obstacles in Step 5.2 seems to be enhanced if the milestones of the plan from Step 5.1 are stated in the past tense. Stating the milestones as if they have already happened somehow enables a point of view in which the obstacles stand out.

the 1993 TQM presentation"), the team forecast possible obstacles as shown in Figure 8.

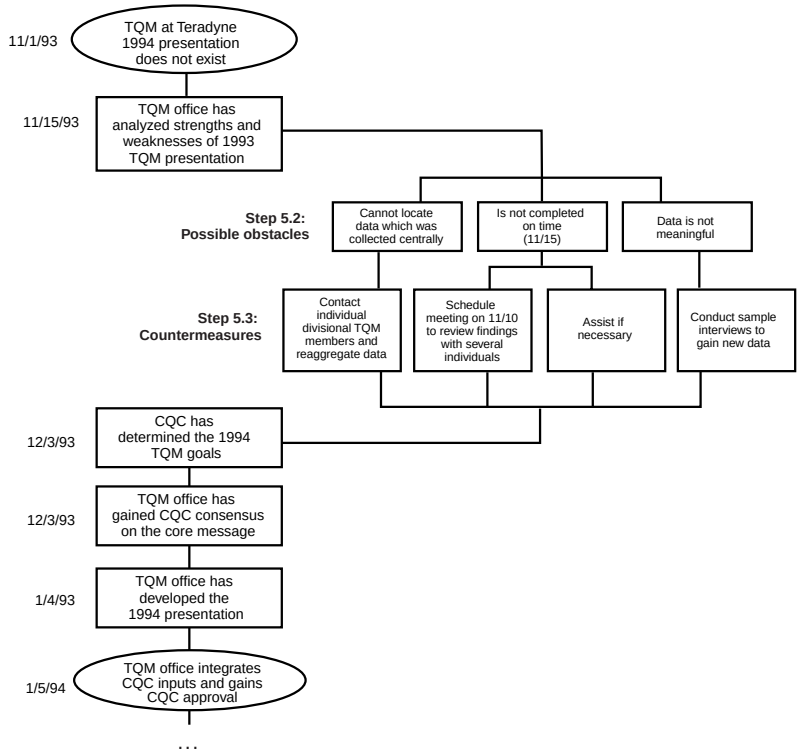

Figure 8 shows obstacles and countermeasures.

As shown in the first row of boxes on the right side of the figure, obstacles to analyzing the strengths and weaknesses of the 1993 TQM presentation by 11/15 might include not being able to locate the prior year's data, which was supposedly collected centrally, not getting done on time, and finding that the data is not meaningful.

Step 5.3 — Develop Countermeasures

For each possible obstacle, the Teradyne team then developed a countermeasure, as shown in the second row of boxes on the right side of Figure 8. In the situation that the data could not be located at its supposed central repository, then perhaps it could be obtained again from the divisional TQM managers and re-aggregated. To counter the possibility of not getting done on time, a meeting could be scheduled for a few days before the due date to review the finding to date and, if necessary, assistance could be obtained. If the prior year data turned out to be not meaningful, new data could be gather by interviewing selected people.

Forecasting obstacles and developing countermeasures is one of the most important parts of the 9-Steps. With good scenarios for what might happen and what can be done to prevent these things from happening, *future problems can be prevented*. Doing this well depends on the skill of the team members to propose things that really might get in the way.

Step 6: Develop, Implement and Monitor the Detailed Plan

Steps 1 to 5 of the 9-Steps state and refine the objective of the project, lay out the project milestones and select the best detailed approach to ac-

complishing each, consider the obstacles and countermeasures to each detailed step. Next the detailed plan needs to be developed, implemented and monitored.

Teradyne uses traditional project planning tools such as arrow diagrams, flow charts, and Gantt charts to diagram the detailed plan. Whichever tool is used provides a chart against which to monitor project progress. Teradyne also uses the 4Ws and 1H to make clear ownership of tasks and the means of accomplishing them.

Figure 9 shows an example of the 4Ws and 1H for the same element of the Teradyne project that we have been considering in the last several steps and sub-steps.

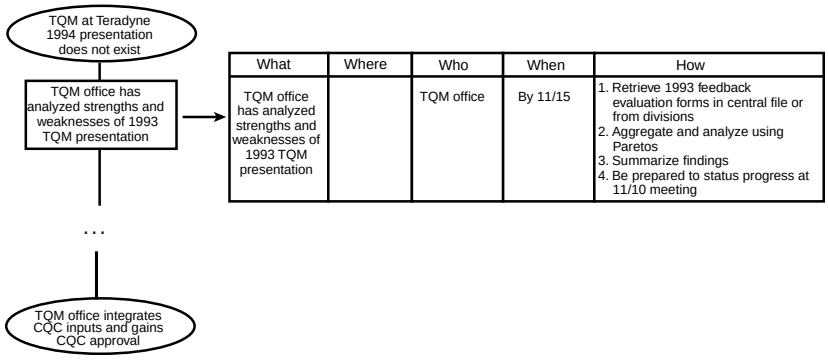

Figure 9 shows Teradyne's example of "4Ws and 1H."

Figure 10 is an example of a Gantt chart for the same element of the project.

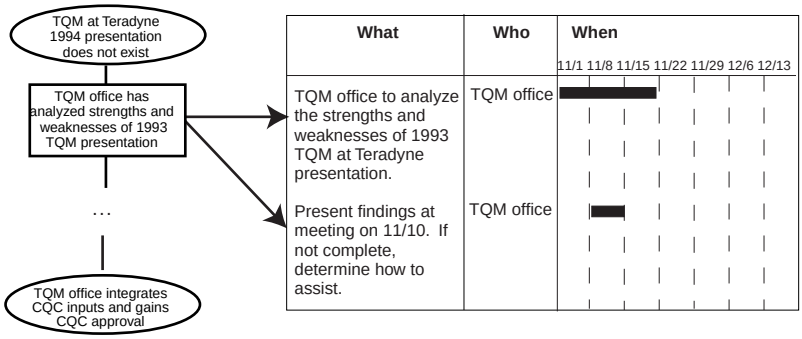

Figure 10 shows Teradyne's example of a Gantt Chart.

While it might seem to be overkill to have both the 4Ws and 1H and a Gantt chart available for project planning, Teradyne finds that each tool has its own strength. The Gantt chart is better for monitoring progress against plan, and the 4Ws and 1H chart is better for understanding who is doing what.

Steps 7, 8 and 9

Steps 5, 6 and 7 of the 9-Steps are very parallel to the same numbered steps of the 7-Steps.

In Step 7 the team uses the metrics developed in Steps 3 to confirm whether (or not) we met objectives. Table 4 shows an example from the Teradyne project.

Type	Metric	Target value	Actual	Conclusion
Quality	CQC score on planned evaluation	>80% agree on each question	Q1: 90.9% Q2: 81.89% Q3: 81.8%	CQC member agreed that TQM at Teradyne package delivers desired message.
Delivery	Number of days beyond 1/5/94 before the package is approved	+ one day	Completed 1/5/94	Intermediate milestone measure helped ensure final date success.

Table 4: Target versus Actual for Metrics

Since the task at hand has not been done before (otherwise the 7-Steps for reactive improvement would have been a more appropriate tool), use of the 9-Steps results in a new process for performing the task defined in Step 1. In Step 8 the team standardizes that process so we can repeat it when we next need it. For instance, in the example we have been following, the process developed in late 1993 and early 1994 could be the basis for developing the process for the TQM presentation that is updated and deployed every year.

In Step 9, the team reflects on their just finished use of the 9-Steps so they may improve the next time they use the 9-Steps. The team also determines its next activity. Once the Teradyne team got approval from the CQC for the 1994 TQM at Teradyne presentation, the selected objective in Figure 6, the *next* 9-Steps cycle was to return to Step 2.2 and to use Steps 3 to 9 of the 9-Steps to plan and execute the last two tasks from the figure, as shown in Figure 11.

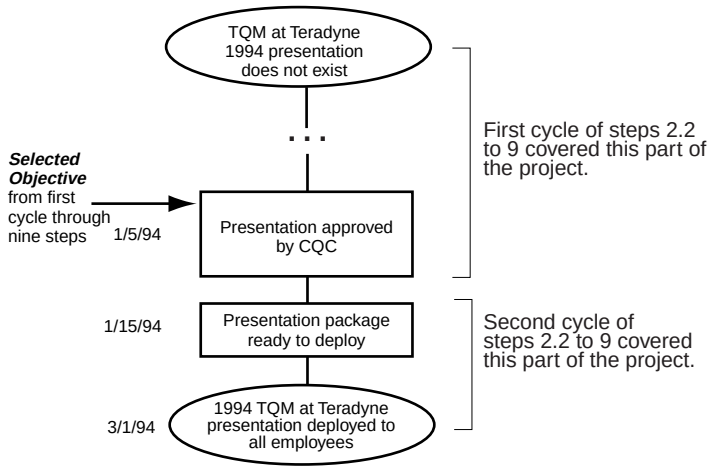

Figure 11 illustrates the second cycle through the 9-Steps.

Other Uses of the 9-Steps

The detailed illustration of the use of the 9-Steps of the previous section was one of the earliest 9-Steps projects at Teradyne. In addition to addressing a real problem, that 9-Step project also helped us learn about the 9-Steps. Since then, the 9-Steps tool has been used for a variety of other projects, many in the mainstream of the company's business. Some example uses are:

- breaking into new customer accounts,
- preparing for audits to remain qualified as suppliers to major customers,
- moving groups from one building to another, and
- installing new equipment.

Relationship of the 9-Steps to Other Methods

There are many methods that people use to systematically plan and execute projects and tasks. The 9-Steps process is one of many. However, the 9-Steps does have several beneficial components that people planning projects and tasks would do well to look for and use in whatever specific planning tool they are using.

Some strong benefits of the 9-Steps include:

- Step 2.1 jumps up and explores the potential project from one level above the system under consideration. This significantly increases the probability of working on the right problem.
- In Step 5.2 team members use their knowledge and experience to forecast obstacles that may interfere with project tasks. This allows countermeasures to be developed that may prevent the future problem from ever happening and thus increases the probability of successfully carrying out the project.
- Step 6 provides mechanisms that allow constructive attention to and support of the project by management. Without such management attention and support, the probability of any complex project succeeding goes down significantly.

The 9-Steps is a scientific problem solving method. It attacks problems by collecting data and hypothesizing a solution, planning and carrying out implementation of the solution, checking whether the solution works, and taking appropriate follow-on action to standardize on successful solutions and to going on to the next appropriate task. The 9-Steps also leads systematically to development of skill in using the method, by applying it to real problems, finding your weakness in using the method, and using it again.

In addition to the parallels between the 7-Steps and the 9-Steps that we noted at the beginning of this chapter, the two processes may also be combined in useful ways. For instance, the 9-Steps could be used as Step 4 (plan and implement solution) of the 7-Steps, and the methods of the 7-Steps can be used to help with the analysis for the Plan and Do phases of the 9-Steps.

The 9-Steps also use many of the tools that are part of reactive improvement and proactive improvement (tools for the former have been described in preceding chapters and tools for the latter will be described in the following chapters. These tools encourage systematic and scientific problem investigation and hypothesis testing as well as a graphical form of statistical data analysis that non-statisticians can use. Figure 12 lists many of these tools in the right column.

PDCA	9 Steps	Tools
PLAN	1. Describe the project 2. Explore the essentials and narrow the focus 3. Establish the metrics and constraints 4. Identify possible alternatives 5. Develop an optimistic plan with obstacles and countermeasures	LP Relation Diagram Flowchart Block Diagram Graphs Tree Diagram Selection Matrix
DO	6. Develop, implement and monitor the detailed plan	Arrow Diagram 4W, 1H Chart
CHECK	7. Evaluate the results	Graphs
ACT	8. Standardize 9. Reflect on the process and select the next project	4W, 1H, 1C Chart Flowchart

Figure 12 shows PDCA using the 9-Steps and tools.

Every business function (sales, marketing, development, manufacturing, support, administration, etc.) has both repetitive and new projects. By using the 7-Steps for improving repetitive tasks and the 9-Steps for new projects, a company will be using scientific improvement in both situations. If people in marketing or development believe that their projects are always different (even if some people might think they are wrong in this assessment), then use of the 9-Steps will still lead them along a path of increasing skill in scientific improvement. Furthermore, the last two steps of the 9-Steps will encourage a transition from this new project to use of a repetitive process (which can therefore be further improvement over time using the 7-Steps). And functions such as manufacturing and administration that mostly have repetitive processes (and where the employees are familiar with the 7-Steps) will be able to easily move to a similar method — the 9-Steps — when they do have a project requiring a new solution.

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