Selecting Your Own Approach to P2

Robert B. Pojasek
Pojasek & Associates, Boston, USA

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My previous three “Quality Toolbox” columns have suggested ways to integrate the Systems Approach tools with the following established approaches to pollution prevention (P2):

- traditional P2
- a prevention-based environmental management system (EMS)
- quality-based P2

This column examines the option of establishing your own approach to P2. This option is also discussed in Chapter 8 of the U.S. Environmental Protection Agency’s recent publication entitled An Organizational Guide to Pollution Prevention (referred to here as the “Organizational Guide”).

The Organizational Guide is available free of charge; for readers who are interested in obtaining a copy, ordering information is included at the end of this column.

WHY GO YOUR OWN WAY?

There are a number of reasons why an organization may consider the “independent” option when developing a P2 program:

- The organization may wish to integrate process improvement efforts with other on-going activities that are not related to pollution prevention.
- The level of conformance and the prescriptive requirements associated with other types of approaches may be considered too expensive for the size of the organization.
- There may be some cultural aspects within the organization that are better suited to an alternative, “home-grown” approach.

Even if your organization has an established P2 program or a prevention-based EMS, there may be some ideas presented in this column that could be useful as you seek continuous improvement in your resource conservation and waste elimination efforts. This column outlines specific, achievable, and proven methods for implementing P2 or process improvement using the Systems Approach tools by themselves.

SYSTEMS APPROACH TOOLS

The Systems Approach tools are featured in Chapter 4 of the Organizational Guide. They also were described briefly in an earlier “Quality Toolbox” column i.

PREVENTING WASTE AT THE SOURCE: THE “PROCESS VIEW”

When looking for opportunities to conserve resources and eliminate waste, it is important to take a “process view.” P2 opportunities are found at the work-step level, but it is crucial to see how the source of the problem identified is linked to the rest of the process.

The ISO 9000:2000 quality systems conformance system requires participating organizations to take a process view of all activities and to consider activities as occurring within a system. This approach helps organizations see important relationships and find the source of problems.
Interestingly, the ISO 14001 technical committee has refused to adopt the process view as part of the ISO environmental management system standard, however.

**Process Mapping**

A process map comes in very handy when you are trying to take a process view. For a sample process map, see Exhibit 1. Process maps are a “hierarchical” set of diagrams that depict a process in ever greater detail as they descend through its levels. The example shown in Exhibit 1 depicts a third-level process map for a box-making process.

Using a process map, you can ask if a change to a particular work step will have unintended consequences “downstream.” Even more importantly, you can determine if changing a work step “upstream” could remove the need to make the particular modification you are considering. Every work step in a process is connected to every other work step -- just like you learned in ecology class.

Because process maps are a visual tool, they are useful for communicating information to all interested parties in the organization. In addition, process maps can be linked to accounting sheets that allow you to see all the resources and activities used in each work step, and all the losses that occur as a result of the work step.

**Supporting Processes**

All work steps in a process are supported by a number of other operations, such as cleaning, set-up, or make-ready, or operations that provide inputs such as steam, compressed air, or deionized water. Without these operations, the work step could not function properly. Safety controls and pollution controls are also viewed as supporting processes.

Supporting processes use and lose resources, and require human activity to operate properly. The accounting sheets that are linked to process maps help keep track of how these supporting processes affect the work step under consideration.

Indirect labor is also required to manage work steps; more indirect labor is needed to manage losses or wastes. Conserving this non-value added time can greatly contribute to productivity.

**Resource and Activity Accounting Sheets**

Using resource and activity accounting sheets can help employees visualize the sources of a problem. With these sheets, every work step is depicted with a “360-degree” view. All the supporting processes are linked to the work step through process mapping software.

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**Exhibit 1**

**Process Map at the Third Level**

![Process Map at the Third Level](image-url)
Exhibits 2 and 3 illustrate, respectively, resource and activity accounting sheets for the “Paint the Box” step shown in the Exhibit 1 process map.

Accounting sheets can be printed out, laminated, and posted at the location in the facility where the work step takes place. This allows employees who are involved in the work step to constantly monitor activities and the use or loss of resources.

A prevention-oriented approach can help avoid resource use and loss. The more resources and activities that are used and lost at each work step, the more likely it will be that opportunities to improve the process through prevention can be found.

FINDING OPPORTUNITIES FOR IMPROVEMENT

In previous columns, I have noted that P2 involves a lot more than just having an “expert” walk around your facility and come up with “right answers.” An effective P2 initiative involves developing a system to find and solve problems on your own.

Process maps and their associated accounting sheets are great problem-finding tools since they list all resources and activities associated with a work step. This is a crucial consideration because every time a resource is used in a work step, there is an opportunity to conserve that resource. Similarly, every time a resource is lost or wasted in a work step, there is an opportunity to prevent that loss or waste.

The search for opportunities to improve processes should be systematic and should involve all employees. The validity of process maps and accounting sheets should be verified by talking with the employees involved in the process that is being studied.

Each employee should be asked to describe past efforts to improve the process at each point. This also offers a great opportunity to ask employees for their suggestions on further improving processes at each work step.

Listening to Employee Feedback

This verification effort will likely yield many ideas for improving the process. By gauging the level of employee interest at various points in the process, it will be possible to find opportunities for improvement in those work areas where employees most genuinely want to realize the benefits of improvement efforts.

In the first couple of years of a P2 program, this “employee feedback” mechanism can be a very important driver of success. What you wish to avoid is having management alone pick problems to solve. Everyone needs to be involved.

SELECTING OPPORTUNITIES

In any organization, there will be is no shortage of opportunities for improving processes. Thus, it is important to select a manageable number of opportunities to concentrate on each year in the process improvement effort.

Screening Opportunities

Reviewing process maps and resource/activity accounting sheets can operate as a “first screen” when selecting opportunities for improvement. Work steps that use and lose many resources, and those that have the most supporting processes associated with them, often are the most susceptible to change. Points of complexity frequently provide a reliable focus for simplification efforts.

Conservation of natural resource use may be leveraged if several different resources are associated with a particular work step. The same can be true of wastes or losses. The use and loss of resources in supporting processes can be assigned back to the work steps responsible for these uses and losses.

It is also important to determine the degree to which the work step is subject to regulatory requirements. This information will be reflected in your activity accounting sheets.

Reviewing Business Risks

Next, the significant opportunities can be evaluated by determining the business risk associated with each opportunity. It is usually possible to derive a Pareto distribution for significant opportunities. (The Pareto rule states that 20% of the opportunities will represent approximately 80% of the business risk.)
Exhibit 2
Resource Accounting Sheet for “Paint the Box”

**RESOURCE ACCOUNTING SHEET #4**

Description of the Work Step:
The metal box that will house the electrical product is put on a hanger and moved through the paint booth where it is painted using an electrostatic charge on the box to improve the paint spray efficiency.

Supporting Process:
- Paint mixing and blending
- Cleaning of paint mixing pots and paint lines
- Clean paint booth and hangers
- Disposal of waste solvents, waste paint, waste filters, and personal protection equipment
- Repair of damaged boxes or salvage for metal
- Maintain conveyor belt, electrical connections, booth exhaust fan and paint spray nozzles
- Electric generator
- Air heater
- Quality control sampling
- Supply and maintain personal protection equipment.
Exhibit 3
Activity Accounting Sheet for “Paint the Box”

ACTIVITY ACCOUNTING SHEET #4

Description of the Work Step:
The paint operation is a highly controlled operation. The customer demands a good paint job
and the painting operation is highly regulated by both health & safety and environmental
regulations.

Supporting Functions:
- Quality
- Purchasing
- Environment
- Health & Safety
- Legal
- Outside Consulting
- Management Oversight
In order to make the determination of business risk, the organization should assemble a small team of people who are knowledgeable about the risks. This group can then evaluate opportunities using a tool known as “nominal group analysis.” With this tool, each significant opportunity is scored against a number of criteria, such as:

- probability of occurrence of the problem associated with the opportunity
- potential for serious damage to the environment
- regulation by governmental rules and other requirements
- potential for substantial negative impact on company image
- potential for a complete or partial operations shutdown
- potential for substantial cost savings if the adverse impact, risk, or liability is eliminated or minimized

Each of these criteria is scored separately by each of the team members using an exaggerated scale, as follows:

1 -- Little capacity to create a significant business risk
3 -- Moderate capacity to create a significant business risk
9 -- Would result in a significant business risk

Cost Analysis

Cost is also an important factor in selecting opportunities for improvement. In fact, each of the selection methods described above is directly related to cost.

At this point in the improvement process, it may not be possible to examine cost as a separate category unless the resource and activity accounting sheets are linked directly to the company’s enterprise resources planning (ERP) system or to another management information system. Several computerized methodologies are available for linking management information systems to activity accounting sheets in order to automate cost accounting.

Selecting an Appropriate Range of Opportunities

The goal of the selection process is to identify eight to 11 opportunities for improvement. Experience has shown that identifying fewer than eight opportunities often results in a number of unrelated projects. It is hard to run an effective process improvement program when there are too few opportunities available to work on.

On the other hand, if more than 11 opportunities for improvement are chosen, it can be difficult to formally track program activities.

This is a narrow range, but it has been shown to work very well with process improvement programs.

ACTION PLANNING

Investors often judge a business based on how well it predicts financial performance and delivers on that projection. Process improvement is a key element in enhancing business financial performance.

Nothing helps ensure the success of a process improvement program more than having written action plans prepared by the employees who will be involved in the action plan projects. Business performance literature stresses the importance of employee participation. The Systems Approach provides a structured method for ensuring this participation, in both the planning and the implementation of each improvement effort.

Employees sometimes are asked to volunteer for the process improvement projects selected by the organization. Most often, a business will assign three employees who are quite familiar with the work step, and will have them work with two resource providers. The employees can come from any of several departments within the organization, including maintenance; environment, health, and safety; quality; accounting; engineering; human resources; and other functions.

Before the employee team can draft its action plans, it must first work through a number of problem-solving steps, using Systems Approach tools such as root-cause
analysis, generation of potential solutions to the problem, and selection of the most promising solution. These steps are briefly summarized below.

**Root Cause Analysis**

In a facilitated work session, each team should examine the potential causes for the problem at issue, using a cause-and-effect diagram. Team members discuss specific causes and how they may interrelate with other potential causes.

It is important that the team avoid trying solve the problem at this stage. The idea here is to consider all the potential factors that may be contributing to the problem, rather than coming up with the “right answer.”

Many times, problem-solving sessions avoid cause-and-effect analysis, fearing that it will take too much time. However, the amount of time necessary can be minimized by a skillful facilitator. Moreover, the process of generating ideas makes this step worthwhile.

**Generating Potential Solutions**

Next, the team generates a number of potential solutions to the problems identified. To accomplish this, the Systems Approach uses a written version of brainstorming known as “brainwriting.” The facilitator should also have the team use a method known as “provocation” to help them think “outside the box.”

With just 15 minutes of activity, it is often possible to generate more than 20 alternative solutions.

**Selecting a Solution**

Using a forced-pair comparison tool known as “bubble-up/bubble-down,” the team prioritizes the potential solutions and selects one to implement. Bubble-up/bubble down is a technique that allows team participants to quickly sort through alternatives by comparing them two at a time and choosing the better of the two.

**Drafting the Action Plan**

Once these steps are completed, the team must prepare an action plan for the solution that has been selected.

The first step in the draft action plan should focus on analyzing the resources used and lost around the work step under question. The resource accounting sheet can be used to guide this activity. The cost of the operation as it is currently being run can be determined using the activity accounting sheet.

Work on the improvement project should be broken down into a logical sequence, and workers should assume accountability for tasks as stated in the plan.

The last step in the action plan should be re-analysis of the resources and costs involved with the work step that has been improved, in order to measure the results achieved by the improvement effort.

Allowing employees to participate in this way helps to provide a pronounced “bottom-up” component to the process improvement program. We have long been familiar with the adage that “an employee never resists his/her own idea.” The Systems Approach provides the framework that allows bottom-up processes to happen.

**IMPLEMENTING THE IMPROVEMENT PROGRAM**

It is important to have a program management plan covering the various elements of the process improvement efforts. Exhibit 4 outlines important program planning elements.

**Oversight Committee**

A key component in managing the plan is the formation of a process improvement oversight committee. Top management representatives should serve on this committee, which will provide the “top-down” component of the process improvement program.

During the first meeting of the oversight committee, members will finalize the program management plan, as well as all the formal action plans for the first year of the program. By accepting the action plans that have been drafted, the management team accepts responsibility for ensuring that employees have adequate resources to complete the work outlined. The committee should meet regularly to review the progress being made in each of the efforts involved in the program.
The review activity of the oversight committee can be expanded beyond just reviewing the formal project. By using a process called “look out,” managers on the committee can make the other members aware of additional activities occurring within the organization that may be improving processes. It is important that the committee be aware of all process improvement efforts, and that these efforts be adequately recognized and tracked.

Keeping the Program Going

At the end of the first year, an audit of the program should be conducted. The lessons learned from the first year can then be considered as the committee selects projects for the next year.

This selection process may yield a variety of projects for the following year: Some projects that are already underway may be extended for another year. Some of the look-out activities that have been identified might be expanded into specific projects. Management may have a list of organizational projects that it intends to fund in the following year; these projects should be examined to determine how they may fit into the process improvement effort. Employees may have some ideas to submit. In addition, process maps can be re-examined to determine if there are other potential projects that might be addressed.

At this point, the committee will most likely be able to draw up a list of more than 30 potential projects. Although excitement with the progress of the program at this point may tempt the oversight committee to rapidly expand its efforts, the committee should resist the urge to formally track more than 11 projects. Additional projects can wait for another year, or can be tracked as look-out projects.

Studying Program Results

The results of the process improvement program should also be studied by the committee. Here, you should not necessarily be seeking to measure outcomes in the traditional sense. Instead, it is more effective to adopt the type of performance-oriented approach discussed in last issue’s column.

To do this, the oversight committee can score program results using the performance methods discussed in that prior column, as well as in Chapter 7 of the Organizational Guide. Results are scored based on three considerations:

- Did the teams adequately plan for the results in their action plans and achieve them through their work?
- Does the organization track and trend the results in a manner that can explain every variance over time?
- Does the organization benchmark its results against others in the industry?

Using the Baldrige Approach

It is not sufficient to simply rely on this scoring of the results, however. Instead, the results can be rolled into an overall performance score obtained by using the Baldrige quality model approach, as discussed in Chapter 7 of the Organizational Guide.

Based on this model, the performance of the improvement program can be gauged by surveying a statistical sample of the organization’s employees. As noted in last issue’s column, I have helped develop a list of 22 survey questions covering performance-related items; these questions were chosen, based on factor
analysis, from the 100-plus items used by the Baldrige model.

The 22-item survey offers organizations a more streamlined version of the Baldrige model, which many companies may consider too complex and unwieldy unless they have committed to a full-fledged Baldrige-based quality improvement program.

The survey questions seek to determine how performance behaviors drive continuous improvement. Employees answer the questions using a scale ranging from 1 (not significant) to 7 (very significant). More detailed written answers can also be submitted for each of the questions.

The results of this survey can provide something very much like the 360-degree performance evaluation that is used by many companies to review personnel performance.

The survey can provide both a score and standard deviations for each of the questions. The process improvement program can then be enhanced by increasing the score, or reducing the standard deviations, or both.

ADDRESSING KEY PROGRAM ELEMENTS

No matter what approach your organization takes to your process improvement program, you need to address a number of key implementation elements. Chapter 8 of the Organizational Guide discusses the kind of questions you should consider with regard to several aspects of program implementation, including:

- Extent of planning required
- Leadership
- Performance goal setting
- Focus on results
- Information and analysis
- Process management
- Employee participation
- Focus on interested parties
- Guiding principles or core values
- Improvement program elements

By using the Systems Approach, it is possible to use these questions to guide the planning, development, and implementation of your process improvement effort.

The Systems Approach is flexible enough that it can be modified to fit virtually any working culture or organizational situation. This flexibility can also help lower the cost of your process improvement program by eliminating unnecessary prescriptive elements.

FOR MORE INFORMATION

More information on the topics discussed in this column can be found in EPA’s An Organizational Guide to Pollution Prevention (EPA/625/R-01/003). Readers can obtain a copy of the Organizational Guide by calling EPA’s National Service Center for Environmental Publications at 800-490-9198. It can also be ordered online at http://www.epa.gov/ttbnrmrl/ (scroll down to “Pollution Prevention”).

Notes
