➤ BY TONY KUSNERIK, LORTON TECHNOLOGY INC.

Solving the Profitability Puzzle

Effective problem solving is the key to boosting profits.

Remember that basic lesson about combustion we learned in high school science? All we need is fuel, oxygen, a source of ignition and presto! We have fire. When we turn up our thermostats or turn the ignition key in our cars, unseen combustion quietly goes to work for us. We hardly ever think about it.

The same basic combustion process takes place in power plants. Because few workers are needed to tend the fires within these plants, most go about their jobs without ever thinking about the combustion process that employs them.

Earning a profit is another basic process we learned in school. It is expressed by this simple equation: P=R-C, where P is profit, R is revenue and C is cost. Profit is revenue minus cost.

Yet for many people, profit is anything but simple. They view it as an unsolvable puzzle—one with many missing pieces. Like the people in the power plant, few in manufacturing really think about the profit process at the core of their employment. This is unfortunate, because all manufacturing workers can have a direct influence on the profit process.

As many manufacturers have failed to make profits in recent years, hundreds of thousands of workers have lost jobs without ever knowing how to help their companies. To reverse this trend, manufacturers—along with their employees—must learn creative profit improvement techniques.

Generating Revenue

First, let's examine the profit equation: P=R-C. Revenue is derived only from customers who purchase goods and services. Yes, manufacturers must provide quality goods on time, but that alone does not generate revenue. People employed in manufacturing add cost and decrease profit with each ounce of material purchased, each man-hour paid, each tool requisition, each kilowatt hour consumed and each dollar of depreciation. The only ways to increase profit are to charge customers more or reduce costs.

Many companies have spent fortunes educating management and line workers on "improvement programs" designed to enhance the performance of labor and capital, such as lean

manufacturing and Six Sigma. Manufacturers that have adopted these programs often adorn their lobbies and visitor areas with impressive plaques, awards and certificates attesting to their level of improvement and proficiency. Unfortunately, a number of these same plants have closed their doors. And an even larger number have lost business and are undergoing painful "downsizing."

How can so many who have invested so much in improvement be losing so much? The answer is simple: insufficient profit. Improvement programs have typically dealt with profit improvement only implicitly rather than explicitly.

As many manufacturers have failed to make profits in recent years, hundreds of thousands of workers have lost jobs without knowing how to help their companies.

Without comprehensive problem-solving tools, few employees actively improve profits during good times. When business slumps, most organizations respond in haste to lost market share and shrinking revenue by destructive downsizing—without improving their core profit making process.

Without a systematic means for tracking problem-solving progress, there is no sure way to measure and improve employee performance. When downsizing begins, many companies often eliminate highly paid technicians, engineers and technical managers, unaware of the potential damage they are doing to their future competitiveness.

Following downsizing, the remaining, less experienced staff is spread thinner, often over areas where they

Figure 1: Tool purchase based on total cost.

Tools are often purchased on the basis of their initial cost or the cost of replacement inserts. Instead, manufacturers should look at the total cost, which includes operating cost, when selecting tools.

The table below details the purchase cost and operating cost for two types of cylinder-head valve seat finishing tools used on CNC machining cells. Note that if vendor A would be selected on the basis of purchase cost alone, the company would actually incur much higher operating costs.

Although Vendor B charges more for initial tool sets as well as replacement inserts, the fact that the tool can be set in less time and achieves "first part good part" with a higher operating reliability factor means that it yields the lowest total cost.

Cylinder-head valve seat purchasing and operating costs

	Vendor A		Vendor B		
Cost Factor	Cost ($)	Cost/piece ($)	Cost ($)	Cost/piece ($)	Notes
Initial purchase of (10) tool sets	16,000	0.008	22,000	0.011	(1)
Purchase cost (1) set replacement inserts and reamer	140	0.467	235	0.783	(2)
Tool purchased cost		0.475		0.794	
Resetting cost		0.800		0.400	A = 1 hour/tool B = .5 hour/tool (3)
Setup and scrap		0.300		0.150	(4) (5)
Tool operating cost		1.100		0.550	
Total tool cost	945,000	1.575	806,400	1.344	(6)

(1) Amortized over 2 million parts; estimated job life
(2) Tool is changed every 300 pieces
(3) Setting/sharpening rate of $240/hour
(4) Cost to scrap/rework (1) part is $100
(5) Vendor B achieves "first part good part"
(6) Annual volume = 600,000 parts

have little knowledge and experience. With the loss of experienced mentors and without comprehensive problem-solving methods, the remaining employees may not only fail to reduce costs, but also risk making things worse while they learn.

Companies have made great strides educating employees on quality methods and systems. Hopefully, the same can be done for cost-reduction methods. The following is a summary of key methods for solving problems and systematically reducing cost.

Separate Deviations and Problems

A deviation is an outcome or a condition that is neither desired nor ideal, but is tolerable and does no real harm. A problem is a deviation that cannot be tolerated and must be corrected immediately.

All problems contain deviations but all deviations are not necessarily problems. To understand the basic difference, think about a vehicle's fuel level. Drivers would always like to have a full tank of gas, but they know that a fuel tank is full only immediately following fill-up. Drivers don't waste time refilling their tanks every few miles. They know the deviation from full alone will not cause a problem and that deviation from full becomes a problem only when they run out of gas. Problem solving is expensive and consumes resources so it makes no sense to work on the wrong things at the wrong time.

Solving for Lowest Total Cost

A manufacturing problem is solved properly when it is solved to achieve the lowest total cost. Unfortunately, an "improvement" in one area often negatively affects costs in another area. Consider tooling and metalcutting. It is a rare individual with sufficient knowledge of machines, cutting tools, coolants, gages and component design who can also systematically solve problems for the lowest total cost.

Often, manufacturers are forced instead to rely on commodity vendors or outside consultants to solve their problems. But, since "outsiders" have neither the means nor a vested interest in minimizing a manufacturer's total cost, problems are often silenced with a narrow focus on the cost of a tool, the shop rate or material consumption. The effect on total cost may be positive or negative, but without a comprehensive system for evaluating problems and their solutions, nobody knows for sure. Figure 1 shows how a new tool was purchased based on lowest total cost.

Many manufacturers that have focused on improvement programs alone, without developing systematic cost-reduction methods, are now in trouble.

Prioritize Problems

Manufacturers typically have a long list of problems to solve at any one time; a logical method is needed to prioritize them. Many people wrongly assume that the most expensive problems must be tackled first. In reality, the greatest possible amount of money saved in the shortest time increases profit the most. Two lesser problems that can be solved in a month may save much more money than one expensive problem that takes 6 months to study.

Problem solving is an investment. Early on, management must establish a budget for the solution, the probability of success, the timing and amount of expected net savings, and set priorities accordingly (see Figure 2).

Understand Problem Mechanism

Successful problem solvers realize that manufacturing problems are the result of several connected actions and conditions that can be viewed as a "mechanism."

Figure 2: Setting problem-solving priorities.

Based on recorded problems, a tool engineer ranked the five most costly tooling problems at his company as follows:

Rank	Operation description	Annual excess cost $(000)
1	Cross-shaft gundrilling	160
2	Crank-bore machining	140
3	Oil-feed deep-hole drilling	110
4	Valve-seat finishing	95
5	Pinion-hub thread grinding	80

When the engineer factored in the added cost and time to solve each problem, the priority for reducing cost and improving profit was as follows:

Priority	Operation description	Annual excess cost $(000)	Cost to solve $(000)	Time required to solve (Months)	2-year net savings $(000)
1	Oil-feed deep-hole drilling	110	30	3	163
2	Valve-seat finishing	95	10	3	156
3	Pinion-hub thread grinding	80	20	2	127
4	Crank-bore finishing	140	80	7	118
5	Cross-shaft gundrilling	160	70	11	103

For example, if deep-hole-drill breakage is a problem, what should be done to fix it? Increase coolant concentration? Increase the cutting speed? Reduce the feed rate? Peck feed? Increase the clamping pressure? Increase coolant pressure? Change the tool more often? Change the bag filter?

All of these things and more can be changed, but some of them have no direct linkage to the problem; changing them may lead to other problems. Attempts to make quick fixes, changes and adjustments to a problem without first understanding the underlying cause- and-effect relationships are apt to make things worse and actually more costly.

Manufacturing problems are rarely solved by one person—they typically require the efforts of many people working in different job functions who may not be able to get first-hand information on a particular problem. These people need more than verbal communication. Manufacturing problems must also be communicated with summary sketches, drawings, photos, charts and graphs.

Build Enterprise Teamwork

While teamwork is vital to problem solving, most complex manufacturing problems cannot be solved by just one local team. Also, teams often have "visibility boundaries" that limit their effectiveness when working with other teams. When people are separated by distance and organizational divisions, cooperation and progress suffer. In addition to prioritizing problem-solving activities, management must educate workers and establish systems for moving cost-problem solutions rapidly through the enterprise.

While teams can provide a solution, or a portion of a solution, one person should have the responsibility of defining, coordinating and conducting the solution activities. The "person in charge," or PIC, can be a technician, engineer or manager but must always be a logical problem solver with nothing less than a passion for reducing costs.

Costs can only be reduced by skillful management. All too often, managers assume they have subject experts working for them and do not need to get personally involved in problem solving. This is a mistake. Management should be part of the problem-solving process, determine that plans are realistic and that resources are available to support cost-reduction activities.

Treat Problems as Projects

Successful problem solving consists of distinct, interrelated events. The event elements in problem solutions can be predefined, assigned to an ordered time frame and monitored accordingly.

All too often, problem solvers proceed without a plan. They try to do things without evaluating the available resources, personnel and time required to complete certain activities. Conflicts can stall and defeat problem-solving efforts.

Using project management tools to manage manufacturing problems forces problem solvers to plan and think through the events needed to produce a desired outcome. Readily available, computer-based Gantt and PERT charts provide adequate solution planning templates. From there, problem solvers should post and coordinate solution plans within and across organizational boundaries for maximum visibility, effort and efficiency.

In 1905, George Santayana, the Spanish-born American philosopher, wrote: "Those who cannot remember the past are condemned to repeat it." Organizations often end up solving the same, or related, problems repeatedly. Companies with distributed manufacturing sites experience the same basic problems at several locations at different times and never realize the needless cost of those multiple occurrences.

Manufacturing problems—especially recurring ones—are prime opportunities for cost reduction. Manufacturers should retain problem histories in databases that can be referenced to avoid future mistakes, spot repeat problems, and save time, effort and cost when solving new problems. △

About the author

Tony Kusnerik, P.E, is owner of Lorton Technology Inc., Cleveland, a provider of specialized training and consulting services for manufacturers. More information, including training materials, example problem mechanisms, tracking charts, graphs and other helpful methods for industrial problem solving, are available for review and downloading at www.power traintooling.com. He can be reached at (440) 897-5560, or by e-mail at tkusnerik@ameritech.net.