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INDUSRY VISIONARIES

Real-Time Strategic Empowerment for Improved Profitability

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Executive summary

Traditional continuous improvement (CI) approaches for industrial operations have targeted management and professional staff in team-based problem-solving processes. However, these processes often fail to resolve a large number of minor root causes, which in aggregate significantly limit performance. This paper explains how providing frontline personnel with relevant, strategic real-time performance measures empowers them to make CI changes in their day-to-day activities to improve overall performance and profitability.

Introduction

Over the past few decades industrial companies have begun to realize the value of empowering employees with the information, decision rights, and processes that enable them to drive improved bottom-line business results. Whether the empowerment comes in the form of tools such as balanced score cards, statistical process control (SPC), total quality management (TQM), Six Sigma, or lean manufacturing, the consequential improved results from higher levels of empowerment have encouraged industrial managers to consider new and more effective approaches to workforce enablement.

Although most empowerment processes and approaches have yielded good results, they have typically targeted management and professional staff. Within most industrial companies there has been a resistance to empowering frontline personnel. Perhaps this is due to residual cultural resistance from the early days of the Industrial Revolution, when frontline laborers were unskilled and uneducated and often viewed as dangerous to the industrial operation if given too much freedom. In fact, in many ways engineers utilized automation technology to limit the interactions and decision rights of operators, protecting the plant from the laborers.

"Today's frontline employees have the potential to be high-value performance managers."

The characteristics of today's frontline personnel are very different. The basic academic level of many frontline employees is much higher: most operators and maintenance workers have graduated from high school and some even have college degrees. Additionally, once they have been on the job for a few years, they attain an experiential education not previously available. They watch the plant operate day in and day out through automation system interfaces, with a wealth of real-time information at their fingertips. They understand the plant from a perspective never before possible. Yet management and engineers still tend to treat them like the unskilled and uneducated laborers of past generations.

Today's frontline employees are no longer the laborers of the past. They have the potential to be high-value performance managers. The time has come to effectively tap into this resource and realize the improved profitability that is within reach.

Empowering frontline personnel

Empowerment has worked, but the approaches used to this point have left considerable room for improvement. Most empowerment programs have been based on one of a variety of continuous improvement (CI) processes — e.g., SPC, TQM, Six Sigma, or lean manufacturing — which approach the objective through team-based problem solving. Typically, management determines major areas of improvement that need to be addressed by the CI teams. Each CI team is assigned an area of improvement and analyzes how to approach it by executing a Pareto analysis. A Pareto analysis is based on determining the fundamental root causes of the identified problem and prioritizing them according to the historical frequency of occurrence. The CI teams are assigned a high-frequency root cause to tackle and work out through a structured and repeatable problem-solving process. The root causes of less-than-desired performance are resolved one at a time from the highest frequency root cause down through the point of diminishing returns, at which management determines that it is not worth the expense and effort of assigning a CI team (**Figure 1)**. Usually there are several root causes that are not addressed because the benefit of resolving them is considered less than the cost of assigning a CI team. At this point another area of improvement is assigned to the team. A Pareto analysis of that problem is performed, and the CI teams go to work on the high-frequency root causes of that issue.

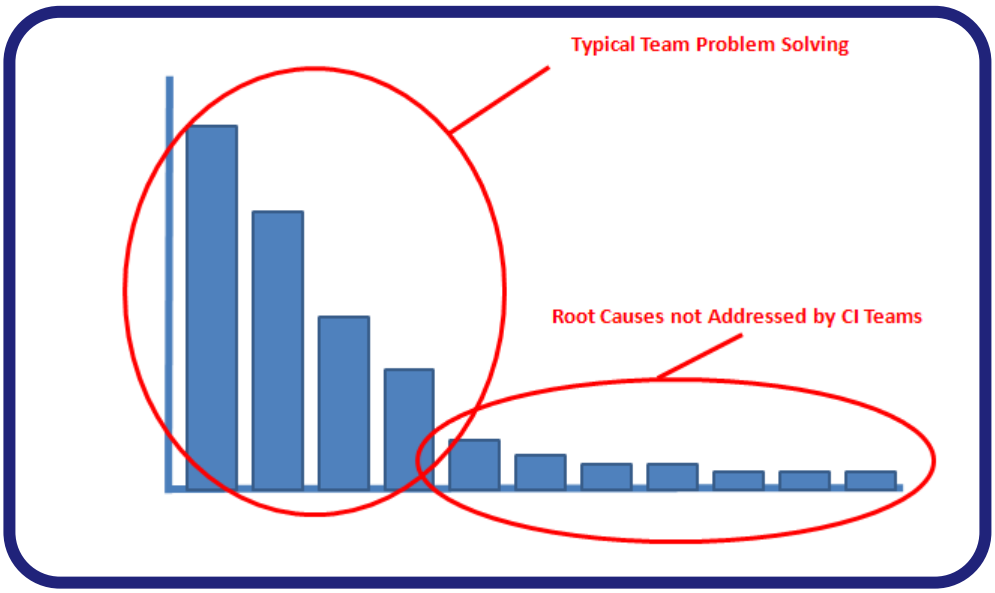

Figure 1
In a Pareto analysis approach, continuous improvement (CI) teams f resolve root causes of performance issues until the cost of resolving the problem outweighs the benefit.

Although this approach to group problem solving is effective, there are a number of root causes that are never addressed by the CI teams but still lead to issues that limit the performance of the operation. To maximize performance, the organization must have a means of addressing all root causes of underperformance. Since using CI teams to address them has been deemed impractical, another approach is required.

As CI approaches began to gain popularity a few decades ago, three basic components to any effective CI program were identified (**Figure 2**). First was management's commitment to continuous improvement. Without such a commitment from leadership, the program typically fails. The second component is the previously discussed CI team problem solving. The third component is individual problem solving while doing daily work. Most CI programs have focused on the first two components because there were many large opportunities for improvement and developing the infrastructure and processes for problem solving in daily work was difficult. The result is that this third component of CI has seldom been effectively implemented. It is this third component that should be utilized to address the root causes that the CI teams do not address. Although the individual potential value of addressing each of these minor root causes may be quite small, the cumulative value of addressing them all can be significant.

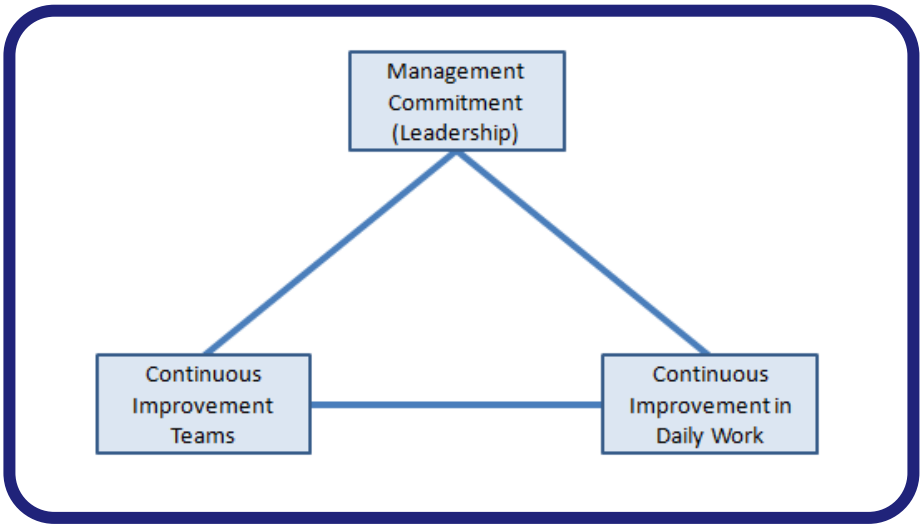

Figure 2
Three components of effective CI program are (1) management's commitment, (2) CI team problem solving, and (3) individual problem solving. This third approach has been underutilized.

"Empowering personnel means providing them with relevant performance measures and letting them figure out how to modify their normal activities in a manner that improves performance."

In industrial operations, addressing these minor root causes through CI in daily work is a matter of empowering the frontline workers so that they understand how their day-to-day actions drive the performance of the operation. Since there are typically many minor root causes, measuring each cause and providing every measure to every frontline person tends to be ineffective because it leads to confusion. But root causes of performance problems are derived through analysis of what is suppressing performance. CI approaches are ultimately intended to improve the performance measures of the operation by eliminating root causes that limit performance. Performance measures are measures of what the performance of the operation is, while root cause measures are measures of how the performance can be improved. Empowering personnel to be able to effectively undertake CI in their daily work involves providing them with the performance measures associated with the part of the operation for which they are responsible and letting them figure out how to modify their normal activities in a manner that improves performance.

Developing an environment for CI in daily work therefore requires developing performance measures of the operation. See the MCAA white paper, "The Need to Measure Industrial Business in Real Time." These measures must be provided to the frontline personnel in a manner that contextualizes them to the specific functions and tasks for which those personnel are responsible, and within a time frame that allows them to make better decisions as they perform their daily tasks and activities — real time. The performance measures must also be aligned with and prioritized according to the manufacturing and production strategy of the operation. This strategic alignment and contextualization can be effectively developed by following a structured, top-down strategic analysis process, such as a Vollmann decomposition process (**Figure 3**).

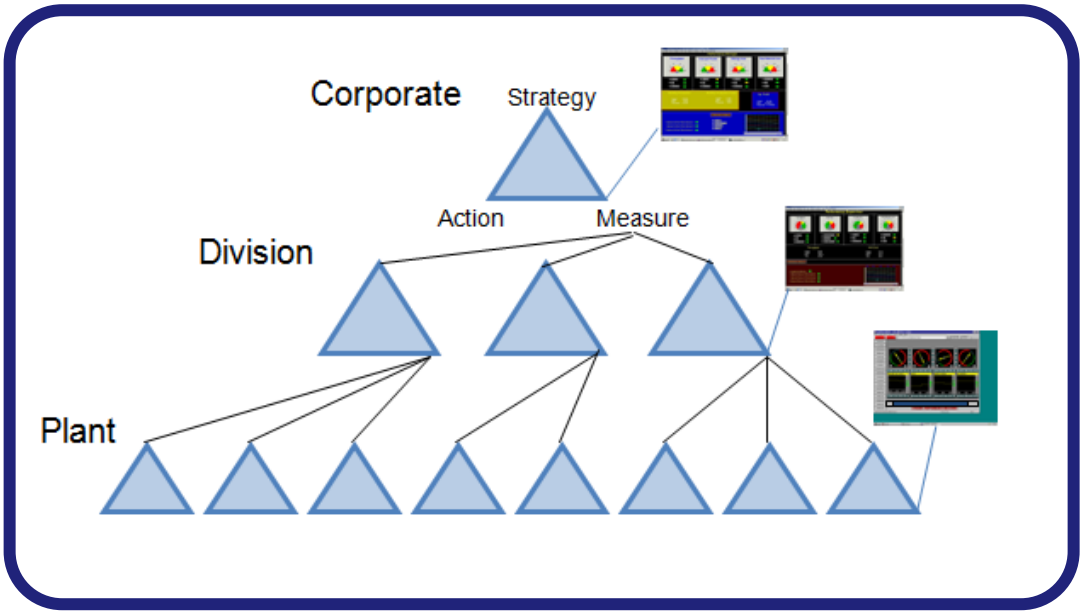

Figure 3
A Vollman decomposition process assists in determining strategic performance measures at successive levels of an organization

The decomposition starts at the highest level and works down. A Vollmann decomposition process is based on the Vollmann triangle, which is a simple strategy analysis tool for each level of the organization. The top point of the Vollmann triangle represents the strategy of the organization under analysis. Typically, a well done strategy has a strategy statement and a set of strategic objectives. It is the strategic objectives that provide the basis for the decomposition. Any well done strategic objective will be actionable. The second point of the Vollmann triangle is the action plan for each strategic objective. If the action plan is done well, each action step should be clearly measurable. The third point of the Vollmann triangle is measuring the action steps. Measures that decompose out of strategy in this manner are referred to as strategic performance measures.

Once the highest level has been evaluated using the Vollmann triangle, the decomposition process continues moving down successive levels of the organization — from the corporate level down to the division level, for example. At each subsequent level the strategic performance measures are analyzed, a strategy for improving the measures is developed, the action plan for the strategy is formulated, and the strategic performance measures are identified. This process continues right down to the plant level and below, to the process areas and units of the operation. This decomposition results in a set of prioritized performance measure algorithms that can be modeled in the automation system. This is accomplished by using the sensor-based information from the production process to feed the models in real time. These prioritized models of the strategic performance measures are commonly referred to as the dynamic performance measures (DPM) of the operation.

"The simpler the presentation of real-time performance information, the easier it is for the personnel to become effective using it."

Empowering frontline personnel using the DPM needs to be carefully done. In order to determine the best way of presenting the DPM to the operators and maintenance personnel, their academic and experiential training levels need to be considered. The simpler the presentation of real-time performance information, the easier it is for the personnel to become effective using it. Simple dashboards and scorecards have proven to be quite effective. More-experienced operators may be able to handle more DPM simultaneously, perhaps as root cause key performance indicators (KPI). Since DPM tend to fight each other as the operation runs, it is important that the recipient of the DPM data clearly understands which the higher-priority measures are. For this reason, and because the operators are driving the plant in real time, experience has shown that four or fewer DPM on a single display to be most effective.

Real-time strategic empowerment of frontline personnel tends to create great value for industrial businesses. Perhaps this is because of the nature of empowerment as real-time feedback control. Early in the Industrial Revolution, frontline workers were used to close the feedback control loop for basic process control of flows, levels, temperatures, and pressures by using gauges as empowerment dashboards and manual valves as their control device. This empowerment approach enabled industrial plants to run efficiently. Today's real-time strategic empowerment approaches apply the same theory to real-time business variables. Frontline personnel can once again perform the role of controller in the business control loops and by doing so bring those loops into control. This manual feedback control of industrial business variables helps to increase operational profitability through the effective application of control theory. The operators use this real-time feedback to perform the activities they have always performed, but they will have gained understanding of how their actions impact the performance of the plant and can learn to make more effective actions. The action may be nothing more than changing a set point for a temperature, but now they understand how that value impacts profitability. They essentially learn to perform.

It is interesting to note that humans employ real-time feedback control in learning. Learning concepts, such as trial and error, are truly just specific applications of feedback control theory. Perhaps this convergence of control theory for process control, profit control, and human learning is why implementing real-time strategic empowerment is so effective. Not only does it help drive continuous improvement of business variables, but it also drives learning in the operators and maintenance personnel. Over time these frontline workers develop a new craftsmanship around controlling both the efficiency and profitability of the operations within their domains of responsibility.

As an example, **Figure 4** shows the performance of a steam station prior to empowering the frontline personnel with real-time strategic performance information. The x-axis represents the downstream demand for steam, which was highly variable and out of the control of the steam station operators. The y-axis represents the cost per pound of steam. This control chart shows that the cost of steam is completely out of control over the demand rate.

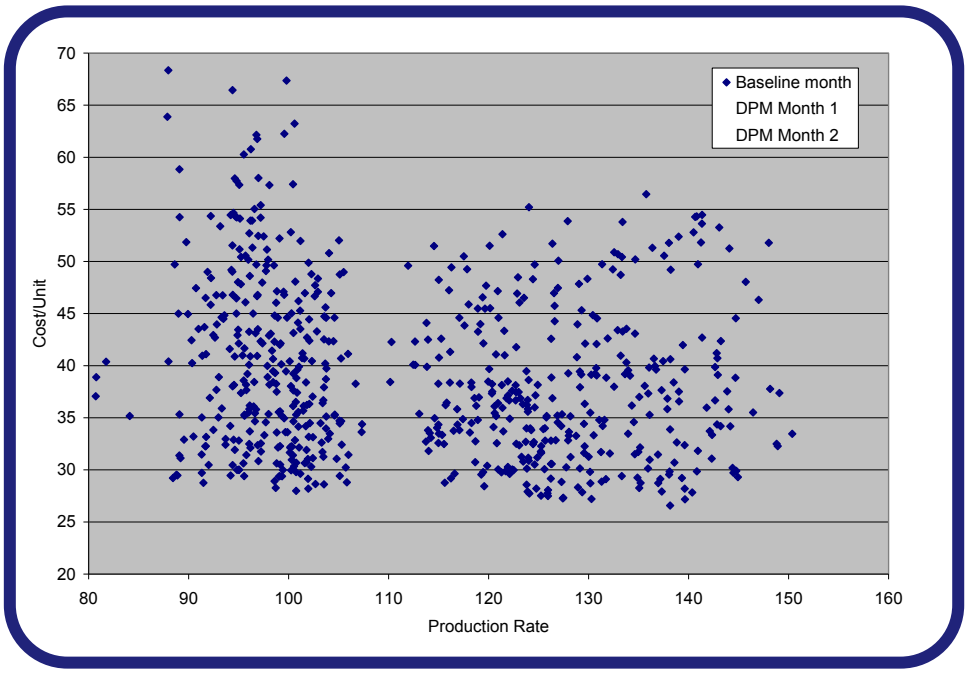

Figure 4
Single-month performance of a steam station, vertical axis showing cost per pound of steam and the horizontal axis showing downstream demand for steam. Note that cost is out of control.

After completing a monthly performance baseline, real-time strategic empowerment dashboards were developed for the frontline personnel in the steam station and the personnel were trained on how to use this information. Some change management activities were also deployed to help make the personnel comfortable with the new tools. **Figure 5** shows the results across the two subsequent months. The magenta dots represent the first month of real-time strategic empowerment. Although the cost is still somewhat out of control over demand, it is clearly improving. The yellow dots represent the performance the second month. Cost had moved from almost completely out of control to in control as the frontline operators learned how their actions impacted performance. This was worth millions of dollars in improved profitability each year.

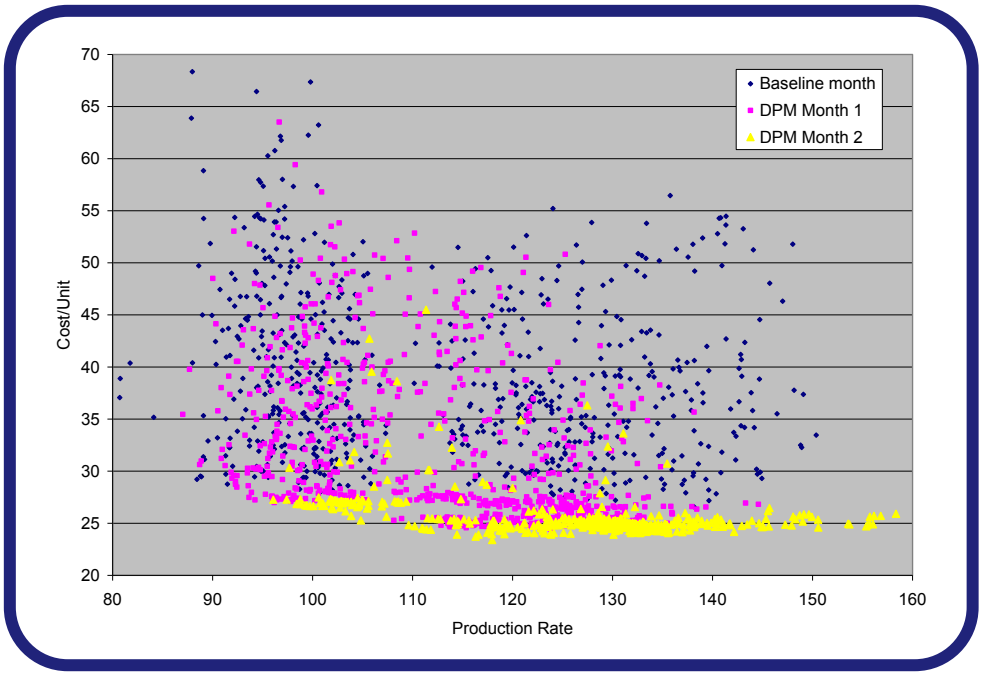

Figure 5
Two-month performance of the same steam station after real-time strategic empowerment initiatives. Yellow data from second month reflects costs now in control.

A side benefit of real-time strategic empowerment is that the morale and interest level of the employees increased as they understood the positive impact they were having on results. As the empowerment moves up the organization — aggrandizing the frontline dynamic performance measure up through the various organizational nodes utilizing a reverse Vollmann cecomposition approach — both the strategic alignment and performance of the operation increase.

Conclusion

Industrial companies have come to recognize the value of empowering employees with the kind of real-time information that enables them to make better decisions in their day-to-day activities which can lead to improved bottom-line business results. Traditionally, empowerment programs have revolved around team-based problem-solving continuous improvement (CI) approaches targeting management and professional staff. Altough such processes have achieved good results, they usually leave unresolved many individual root-cause issues that individually are not cost-effective to address via dedicated CI teams but in aggregate signicantly limit performance and, therfore, profitability.

An underutilized solution is to empower frontline personnel to address these minor root causes through CI in their daily work activities. Empowering frontline personnel to be able to effectively undertake CI in their daily work involves providing them with the performance measures relevant to the part of the operation for which they are responsible and letting them figure out how to modify their normal activities in a manner that improves performance. When frontline workers understand how their day-to-day actions drive the performance of the operation, the business realizes greater value.

Real–time strategic empowerment from frontline personnel up through the entire profit-impacting organization has proven to drive superior results for industrial companies. There is no reason to delay. The technologies to underpin strategic empowerment exist. It is truly time to break the traditional culture that is a residual of the Industrial Revolution and empower personnel from the frontlines right through the executive management.

About the author

Dr. Peter G. Martin has been a member of the MC&A Hall of Fame since 2018. He is VP of Innovation and Marketing and an Edison Master at Schneider Electric. He has worked in industrial automation for over 40 years in training, engineering, product planning, marketing, and strategic planning. Peter holds multiple patents for dynamic performance measures; real-time activity-based costing; closed-loop business control; and asset and resource modeling. He is a published author, was named one of Fortune magazine's "Hero of U.S. Manufacturing" and one of InTech magazine's 50 most influential innovators of all time in instrumentation and controls. He is an ISA Life Achievement Award recipient, an ISA Fellow, member of the Process Automation Hall of Fame, recognized for his work in integrating financial and production measures that improve the profitability and performance of industrial process plants. Peter has a bachelor's and a master's degree in mathematics, a master's degree in administration and management, a Master of Biblical Studies degree, a doctorate in industrial engineering, and doctorates in biblical studies.