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# Improving the Profitability of Industrial Operations: Realizing the True Potential

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## Executive summary

With industrial business variables such as energy and material costs fluctuating dynamically, just optimizing the efficiency of operations is no longer sufficient to maximize profitability. Measuring business performance in real time and empowering personnel with real-time information to make better decisions are the first two steps in controlling profitability. This paper addresses the third step — identifying the constraints to profitability — and outlines a systematic step-by-step approach to removing those constraints and ensuring maximum profitable output from the production process.

# Introduction

highly stable over extended periods of time to fluctuating frequently in real time. This transition has resulted in a situation that industry has previously never had to deal with: the manufacturing and production processes may be in control and operating efficiently, while the profitability of the operation is out of control. For example, a plant operations team may actually reduce the overall energy consumption, but the cost of the energy consumed actually increases because it is consumed during high price periods. Controlling the efficiency of industrial operations is no longer sufficient. The real business objective is to maximize the profitability of the business. And maximizing profitability is becoming a daunting real-time challenge.

A system to control profit in real time comprises three steps **(Figure 1)**, as follows:

1. The first step to improving the profitability of industrial operations is to measure the profitability and the profit drivers, in the time frame in which it varies — real time. For further discussion of measuring business variables in real time, see the Schneider Electric white paper "Dynamic Performance Measures: The Need to Measure Industrial Business in Real Time."

2. The second step is using the real-time measures of profitability and profit drivers to empower the operations staff with the real-time information they require to make better and more profitable decisions. See the Schneider Electric white paper "Real-Time Strategic Empowerment for Improved Profitability."

3. The third step is to identify the bottlenecks or constraints in the production process that are preventing maximum profitability, and free those constraints. The result will be increased profitability.

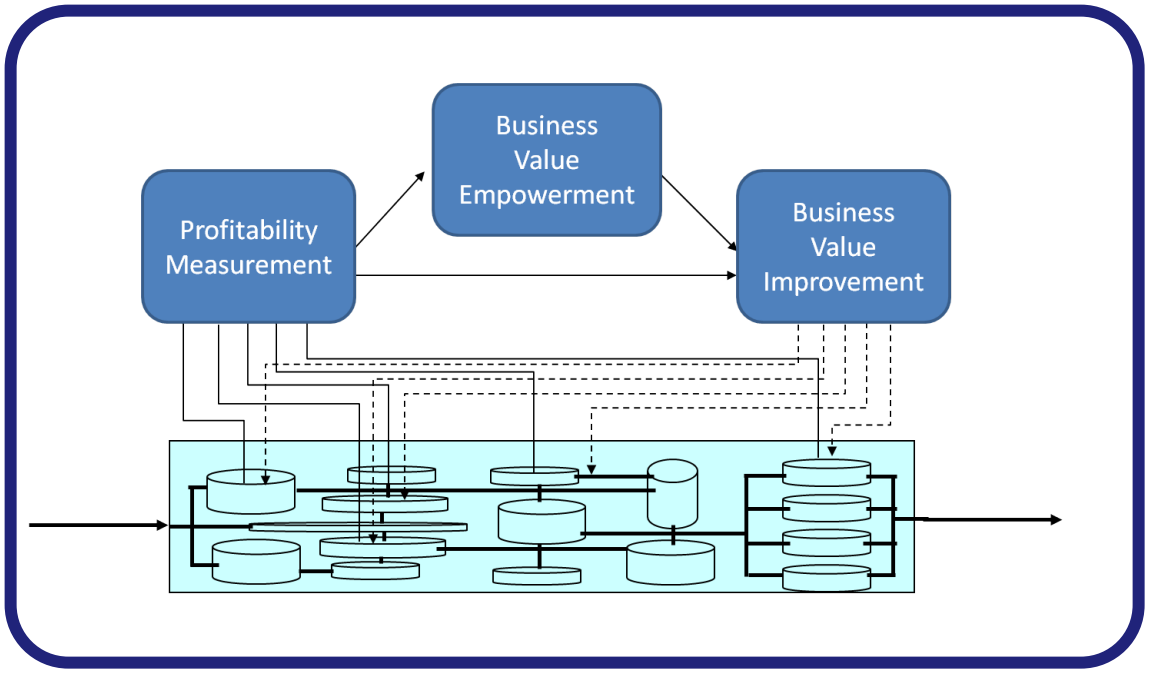


**Figure 1**
*Real-time profit control systems comprises (1) measuring profitability and profit drivers, (2) empowering operations staff with real-time information to make better decisions, and (3) identifying and removing roadblocks to profitability*

# Theory of constraints analysis

One of the key concepts in a traditional optimization approach has been to have an objective function bound by a number of well-defined constraints to the objective. Eliyahu Goldratt introduced the concept of Theory of Constraint (TOC) analysis in several his books (*The Goal, Theory of Constraints*) in the 1980s, which forward the idea of focusing on alleviating the constraints of an optimization problem as the primary method for improving the optimization results. Although the TOC concept is straightforward, putting it into effective action is a challenge. At the highest level, the process for performing an effective TOC analysis involves four basic phases after ensuring that the correct measures of performance are in place:

1. Gather the data necessary to understand how the operation is currently performing and how it has performed in the past
2. Analyze the data to identify the bottlenecks to performance improvements
3. Determine the actual potential performance of the operation if the bottlenecks are opened or removed
4. Determine the profitability impact of the operations performance improvements

*"Real-time variability of profit drivers requires a real-time perspective to be built into the TOC analysis."*

Although this general process works quite well in industrial operations, the transformation of the industrial profit drivers to real-time variability imposes a very difficult challenge to the effective execution and sustainability of the TOC approach. That is, both the objective and constraints are changing at high frequency. This challenge requires a real-time perspective to be built into the TOC analysis.

To fully appreciate the current situation, it is helpful to develop a model of the components of profitability that currently experience real-time variability **(Figure 2)**. The good news is that not all components of profitability fluctuate in real time. In fact, the three components of operational profitability that tend to change in real time are production value, energy cost, and material cost. It is essential to control these to optimize the profitability from the operation.

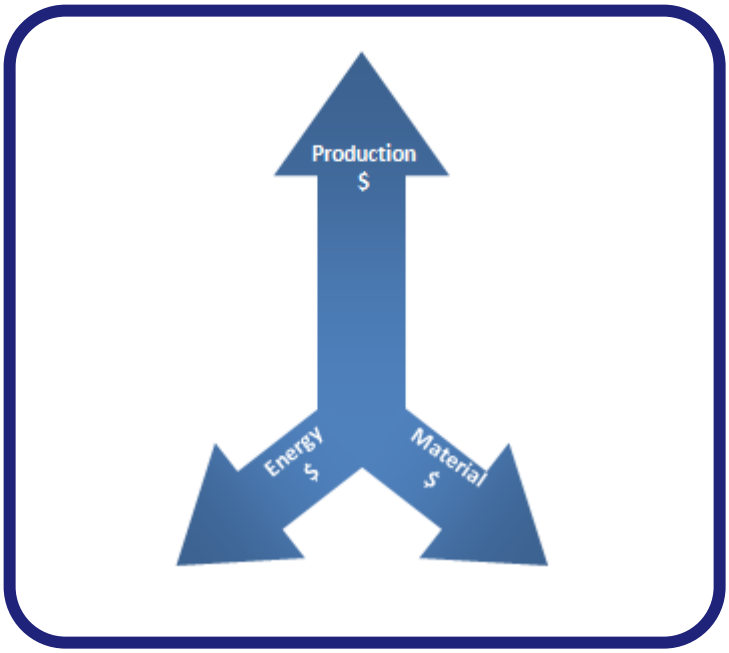


**Figure 2**
*This real-time profit model reflects the three components most likely to fluctuate in real time: production value, energy cost, and material cost*

The problem of maximizing profitability might be much simpler if there we no constraints to the three profitability vectors, but unfortunately there are **(Figure 3).** There are many constraints to profitability in industrial operations, including the physical equipment, safety, environmental concerns, and worker practices. Although each can cause bottlenecks, the two that tend to provide the tightest constraints today are safety (people, equipment, and environment) and worker practices. These also can change in real time, which presents a very dynamic optimization problem. Therefore, the key to maximizing profitability is to conduct a TOC analysis to determine the bottlenecks and the value of eliminating the bottlenecks. Once this is done, a set of solutions to overcome the constraints should be developed. Finally, the solutions should be expanded to enable real-time, ongoing adaptation to continuously maximize profitability.

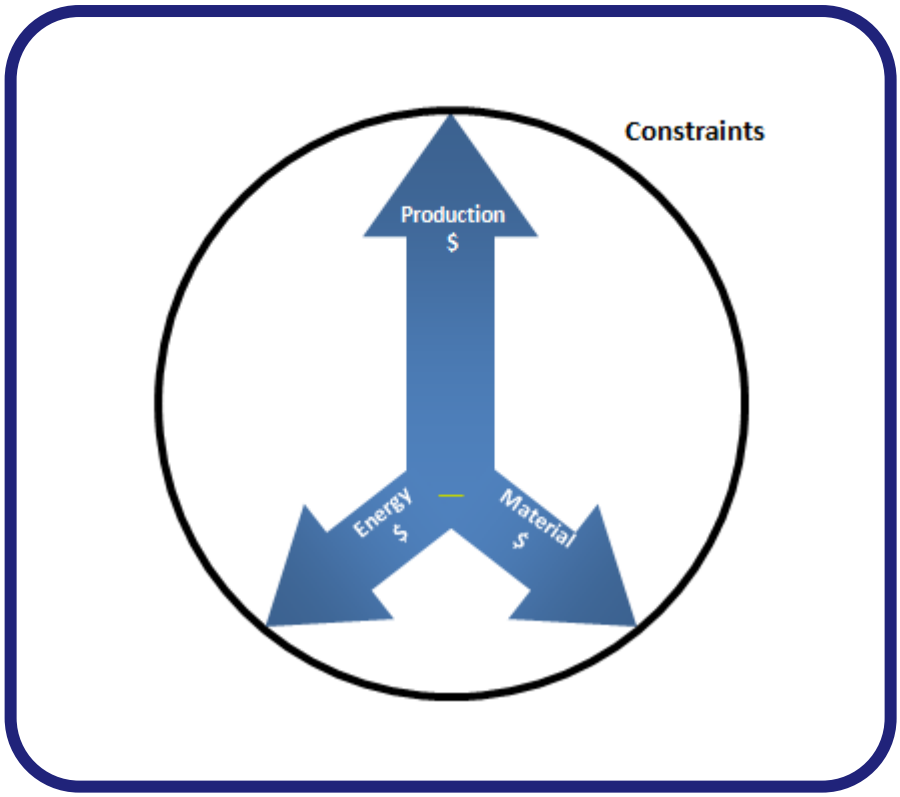


**Figure 3**
*Constrained real-time profitability model reflects constraints on the three vectors*

## Developing a business value improvement process

Developing a real-time business value improvement process is essentially conducting a series of TOC analyses within a formal structure. **Figure 4** shows a process for conducting the kind of detailed TOC analysis required to continuously improve the profitability of an industrial operation. This successive process allows the profitability of the operation to be improved and evaluated in a stepwise manner, which typically aligns with most capital budgeting processes and allows management to be sure they are getting the expected value from the solutions without the need for huge one-time capital outlays.

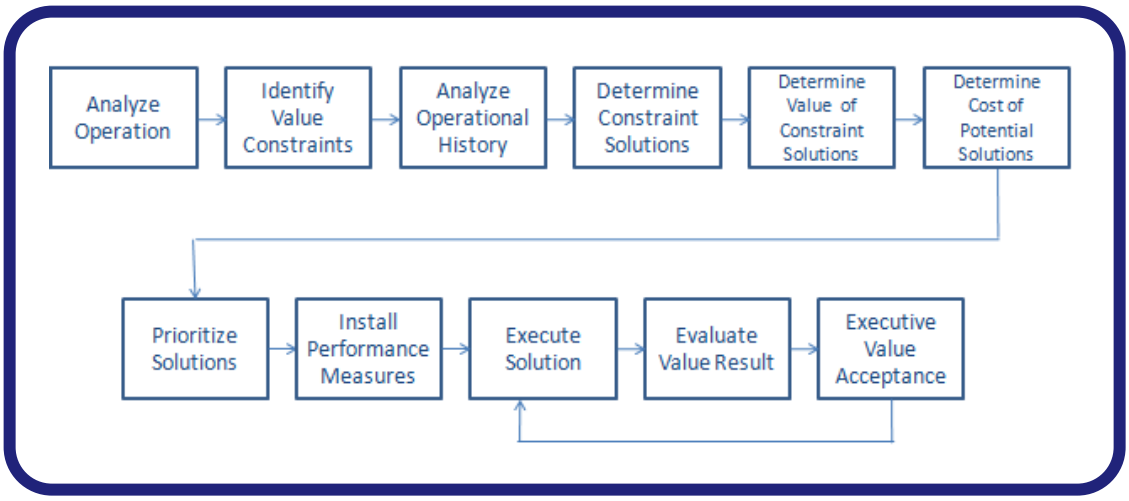


**Figure 4**
*Developing a business value improvement process entails conducting a step-by-step TOC analysis, one constraint at a time*

The first step is to conduct an analysis of the current operation. This is accomplished by performing a detailed "walk-through" of the process, including process flows.

Next the potential value constraints are identified through an analysis of the process flows.

The historical data for the operation is then analyzed to determine historical performance and identify which of the potential constraints is actually constraining performance.

For each identified constraint, a solution to "free" the constraint is determined, and the potential cost and value to be derived from the solution is identified.

With the cost/value analysis completed, the potential solutions are prioritized based on both cost constraints and potential value to be generated.

The dynamic (real-time) performance measures for the site are installed (if they have not been already) and are connected to the process historian. This enables a performance baseline to be established prior to the solution being implemented.

The solutions are then implemented one at a time in priority order.

The value improvement for each solution is determined through analysis of the change in the values of the dynamic performance measures.

The improvement results are reviewed with management prior to moving to the next performance improvement solution. .

This business value improvement process is designed to alleviate the constraints on the profitability of industrial operations one constraint at a time. As has been previously pointed out, though, both the objective functions and constraint functions experience real-time variability that adds a dimension of dynamic complexity to the continually resolving constraints and maximizing profitability. Experience has demonstrated that this dimension is at least initially best dealt with by the empowerment component of the overall "Measure – Empower – Improve" profit model (**Figure 1**). That is, personnel are in the best position to deal with the dynamic changes in the profitability model when they are provided with the real-time profit feedback that enables them to adjust and tune the solution to the dynamics of the business. Once the dynamics are well understood, an automatic closed-loop approach may be developed to assist the operations personnel. In this sense the business value improvement process is a real-time TOC process.

# Conclusion

Measuring the business in real time and empowering plant and operations personnel with the information they need to understand the impact their actions have on the profitability of industrial operations are but the first two steps in an overall real-time profitability control system. The third step is to take specific and systematic actions that “free,” or remove, the constraints to profitability. This enables maximum profitable output from each part of the production process and eventually the production process as a whole.

This can be initially accomplished through the effective application of the business value improvement process — a succession of stepwise TOC analyses. Once the improvement solutions are implemented, the real-time business dynamics can be accommodated first through real-time operations feedback and then, perhaps, through automatic closed-loop business control approaches. In either case, the net result will be significant and sustainable profitability improvements that typically provide 100% ROI in a few short weeks with ongoing sustainable positive cash flow for years. The challenge of real-time industrial business dynamics is daunting, but the solution is at hand.

# 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.