A Pragmatist's View on Improving Organizations:

What The Heck Is It With All These Improvement Approaches

The pessimist complains about the winds; the optimist expects the winds to change; the realist adjusts the sails.
...William A. Ward, 1921- 1994, American author

In 2002, Quality Progress published How To Compare Six Sigma, Lean and the Theory of Constraints: A framework for choosing what's best for your organization' by this author. The Lean Enterprise Institute said of the article: "*Here is a good overview ... on the principles, effects, similarities, and differences among Lean, Six Sigma, and the Theory of Constraints.*"

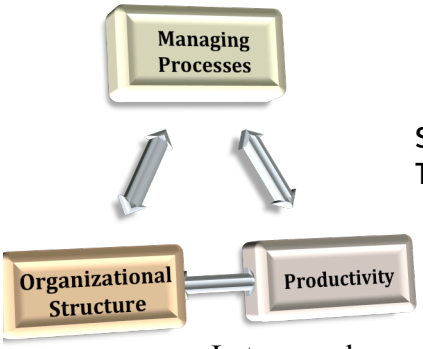
It is time for a refresher about how things are today. The original article described Lean, Six Sigma, and Theory of Constraints. This article adds four more approaches to improve your organization. Dr. Deming with his focus on managing processes and systems, Value Methodology with its focus on designing the product/service, and ISO 9000 and Baldridge Performance Excellence Program focusing on assessing elements of the entire organization.

Originally the improvement approaches were viewed using several categories.

- Theory Statement
- Application Guidelines
- Focus
- Assumptions
- Primary Effects
- Secondary Effects
- Criticisms

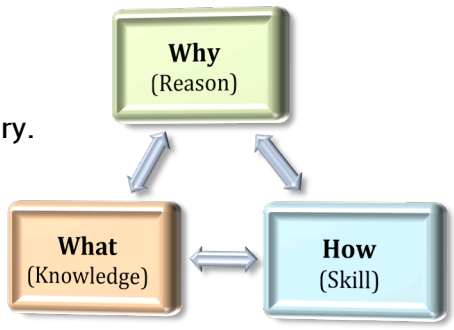
This article adds four more categories.

- Time For Business Results
- Scope Of Implementation
- Business Level Perspective
- What Question Is Being Answered



TAKING A LOOK AT YOUR ORGANIZATION

Strategy without tactics is the slowest route to victory.
Tactics without strategy is the noise before defeat.
...Sun Tzu, 400-430 BC (Zhou Dynasty),
Chinese Military Strategist, Author of "Art of War"



Let us explore various aspects of looking at an organization. Like a map, this look is only a model, a unique version of reality, created using factors chosen to be important to help visualize something that cannot be directly observed.

Principles & Theory For Managing

A Focus On Managing Processes & Systems
Dr. W. Edwards Deming

> Leadership is more than knowing the theory, but also is understanding the practical application of the principles. Theory without application delivers no benefit. Almost anyone can read a book and present principles. Yet it takes a knowledgeable and experienced person to understand and apply the theory.
> …Unknown

Human activities and efforts in any organization are guided by management practices. Governing how people interact within the organization, as well as, how people interact between the organization and the rest of the world. These practices may be consciously created and based on theory, or may have simply emerged as the organization grew and matured.

Unfortunately, most managers do not know they have a process/system to manage. Much less that there is a set of principles and theories by which to view those processes/systems. However, their job is to manage those processes/systems. Transforming management practices from reacting to results, to managing the application of theories and principles towards aim of their department and ultimately the containing organization.

Dr. W. Edwards Deming is credited with being the father of quality. Unfortunately in western society quality has a variety of definitions. Many have tried to codify quality. Regrettably the results look like a collage of ideologies glued onto a background called quality. Others see quality as something that can be managed from the outside, something for others to worry about.

When most people talk about quality, they think about the quality of a product or service. Quality at the level of what Dr. Deming talked about goes far beyond popular definitions. He was talking about the quality of the organization, quality of management, quality of decision making, quality of processes, quality of most everything. In Dr. Deming's realm of managing quality, definitions such as 'conformance to specifications' are of little practicality. Sure 'conformance to specifications' has its place, but not for managing processes or systems. Some people say Dr. Deming used knowledge about processes and systems to elevate the concept of quality to the level of optimization of the entire organization, both within the organization and how the organization fits into society.

What Dr. Deming was trying to do was adapt the principles and theories of managing to better fit the needs of humanity, and ultimately making the world a better place to live. He also carried his personal beliefs of humility, frugality, and pragmatism into this new vision.

In Dr. Deming's ideas, is the concept that learning is accomplished through review of virtues inside oneself, as opposed to the desire to understand and master the external physical world. Dr. Deming conducted this exploration using the following steps:

- Exploring the prevailing style of management, and underlying assumptions. Frequently shining a light on current faulty practices, explore the underlying assumptions and ramifications. Once any incongruities of old practices are understood, managers can better understand what the existing way of conducting business is really costing the organization.
- Understanding optimization of the organization using four areas of knowledge
    - Understanding Variation – What is variation telling us? What is economic control? Understand when it might be best to take action, and when it might be best not to take action.
    - Psychology – Understand people and their interactions with each other, circumstances, and systems.
    - Appreciation for a System – Understanding what is meant by interdependent components working together towards the aim of the system? What is the obligation of a component to the system?
    - Theory of Knowledge – Understanding knowledge in terms of how it is created and revised. Making choices of concepts or theories we use to interpret experiences and make predictions.
- Suggesting better practices based cooperation and interaction. During the exploration, what become visible to managers are the tangible financial and intangible benefits of; an energized workforce, cooperation within the organization, focus on contributions in the context of the entire organization, and much more. Once faulty practices are exposed, managers strive towards eliminating the faulty practices or minimizing their negative effect. Many times the only action that will help the organization is to just **stop doing** something, without putting anything else in its place.

The ultimate effect of exploration the *theories and principles for managing* is the creation of a humanistic management system using a wholistic approach to the organization.

Some secondary effects of exploring the principles and theories of managing are:

- Making better decisions
- Correcting processes, not people
- Preparing the organization for the economic environment of the future
- Provide inspiration and hope for a better future

My all time favorite excuse is "We are not going to address these issues because '**Deming Is Too Hard On Managers**'"

There are some criticisms of this approach. Taking a critical look at practices where you have a stewardship responsibility is tough. Many difficult truths are exposed. Managers are NOT personally responsible for the creation of specific faulty practices. Managers are the stewards of the practice, and have the duty and power to change them. However, changing practices is not a 'cook book' type of change, there is

no step-by-step method to follow. Change requires hard work and the confidence to try, learn from mistakes, then try again.

Learning Principles & Theories for managing does overcome one of the main criticisms of process improvement. Programs such as LEAN and Six Sigma do not prioritize limited resources on processes that will provide the best benefit for the entire organization. Process Improvement programs could be working very diligently on processes that are of little value or have no affect on the organization.

Productivity Improvement

A Focus On Improving Processes, Systems, And Products
LEAN, Six Sigma, Theory Of Constraints, & Value Methodology

Process Improvement methodologies are created to improve operational efficiency. Each provides a disciplined approach for improving how a product or service is produced and delivered. The primary technique is to expose incongruities, then redirect the focus of dedicated professionals in new directions.

Once incongruities are exposed and understood, people inherently strive to correct them. No one deliberately creates unnecessary work or bad quality. Most processes are created with the best of intentions, focusing on performing the task at hand, with the resources at hand, in the environment where they exist. However, over time, conditions change and many times the reasons for the original decisions are lost.

Here are some overviews of structured approaches to improving processes.

SIX SIGMA

Six Sigma focuses on reducing variation to solve process and business problems. Using a set of tools as part of a rigorous and structured investigation methodology to understand the fluctuation of a process, the process and outcome becomes predictable. If the outcome is not satisfactory, associated tools can be used to further understand the elements influencing those results.

Six Sigma includes five steps (commonly known as DMAIC):

- **Define.** Ask who the customers are and what are their problems. Identify key characteristics important to the customer, along with the processes that support those key characteristics. Identify existing output conditions along with the process elements.

- **Measure.** Focus on measuring the process. Key characteristics are categorized, measurement systems are verified, and data are collected.

- **Analyze.** Once data are collected, analysis is performed. The intent is to convert raw data into information that provides insights into the process. These insights include identifying the fundamental and most important causes of defects or problems.

- **Improve.** The fourth step is to improve the process. Solutions to the problem are developed, and changes are made to the process. Results are seen in the measurements. At this point the organization can judge whether the change is beneficial, or if another set of changes is necessary.

- **Control.** When the process is performing at a desired and predictable level, it is put under control. The process is monitored to assure no unexpected changes occur.

Focusing on variation reduction produces secondary effects beyond predictability of output. Product or service quality is improved. Productivity is increased. Elements are refined and improved. Mistakes and opportunities for mistakes are reduced.

Six Sigma is founded on two main assumptions:

- People in the organization understand and appreciate that numbers can represent features and characteristics of a process. They appreciate that a deeper understanding of data and data analysis can be used to produce improvements, and graphical representations of data can provide new and different perspectives of the process. Analytical types, such as engineers and scientists, generally respect this approach.
- Through the reduction of variation of all the processes, the overall performance of the organization will improve. While it is hard to argue against improvement, the economic reality of business is we want the most improvement for the least expenditure. Improving all of the organization's individual processes could actually have a detrimental effect on the company's ability to satisfy the customer's needs and provide product and services at the right time at the lowest cost. Realized savings to the system might be less than the cost of all the improvements.

An organization which improves things just because it can, may be improving the wrong things for the over all well being of the organization.

LEAN

Lean is sometimes called lean manufacturing, the Toyota Production System or other names. Lean focuses on flow from beginning to the end of the process. Frequently, Lean emphasizes the removal of waste, which is defined as anything not necessary to create the product or service.

One common measure to identify waste is touch time—the amount of time the product is actually being worked on, or touched, by the worker.

There are five essential steps in Lean:

- **Identify Value.** Determine which features create value, from the customer's standpoint. Value is expressed in terms of how the specific product meets the customer's needs, at a specific price, at a specific time. The value determination can be from the perspective of the ultimate customer or a subsequent process.

- **Identify the Value Stream.** Once value is identified, activities that contribute value are identified. The entire sequence of activities adding value is called the value stream. A determination is made as to whether activities that do not contribute value are necessary. Necessary operations are defined as being a prerequisite to other value added activities or being an essential part of the business. Finally, the impact of necessary non-value added activities is reduced to a minimum. An example of a non-value added, but necessary process is payroll. After all, people need to be paid. All other non-value added activities are transitioned out of the process.

- **Improve Flow.** Once value added activities and necessary non-value activities are identified, improvement efforts are directed toward making the activities flow. Flow is the uninterrupted movement of product or service through the system to the customer.

  Major inhibitors of flow are work in queue, approvals, batch processing and transportation. These buffers slow the time from product or service initiation to delivery. Buffers also tie up money that can be used elsewhere in the organization and cover up the affects of system restraints and other wasteful activities. The only time when buffers might be useful is to keep the constraint or bottle-neck process up and running.

- **Allow Customer Pull.** After waste is removed and flow established, efforts turn to letting the customer pull product or service through the process. The process becomes responsive to providing the product or service only when the customer needs it—not before, not after.

- **Work Toward Perfection.** This effort is the repeated and constant attempts to remove non-value activity, improve flow and satisfy customer delivery needs.

While Lean focuses on removing waste and improving flow, it too has some secondary effects. Quality is improved. The product spends less time in process, reducing the chances of damage or obsolescence. Simplification of processes also results in a reduction of variation.

The Lean methodology also makes some assumptions:

- People value the visual effect of flow
- Waste is the main restriction to profitability

- Many small improvements in rapid succession are more beneficial than an in-depth analytical study
- Process interaction effects will be resolved through value stream refinement

Lean involves many people in the value stream. Transitioning to flow thinking causes vast changes in how people perceive their roles in the organization and their relationships to the product.

THEORY OF CONSTRAINTS

ToC focuses on system improvement. A system is defined as a series of interdependent processes. An analogy for a system is the chain: a group of interdependent links working together toward the overall goal. In the chain example, the constraint is the weakest link.

The performance of the entire chain is limited by the strength of the weakest link. In manufacturing processes, ToC concentrates on the process that slows the speed of product through the system.

ToC utilizes five steps:

- **Identify the Constraint.** The constraint is identified through various methods. The amount of work in queue ahead of a process operation is a classic indicator. Another example is where products are processed in large batches.

- **Exploit the Constraint.** Once the constraint is identified, the process is improved or otherwise supported, to achieve its utmost capacity without major expensive upgrades or changes. In other words, the constraint is exploited.

- **Subordinate Other Processes to the Constraint.** When the constraining process is working at maximum capacity, the speed of other subordinate processes is paced to the speed or capacity of the constraint. Some processes will sacrifice individual productivity for the benefit of the entire system.

  Subordinate processes are usually found ahead of the constraint in the value stream. Processes after the constraint are not a major concern—they are already producing under capacity because they wait for output from the constraining process.

- **Elevate The Constraint.** If the output of the overall system is not satisfactory, further improvement is required. The company may now contemplate major changes to the constraint. Changes can involve capital improvement, reorganization or other major expenditures of time or money. This is called elevating the constraint or taking whatever action is necessary to eliminate the constraint.

- **Repeat.** Once the first constraint is broken, another part of the system or process chain becomes the new constraint. Now is the time to repeat the cycle of improvement. The performance of the entire system is re-evaluated by searching for the new constraint, exploiting it, subordinating and elevating the process.

By focusing on constraints, this methodology produces positive effects on the flow time. Reduction of waste caused by the constraint increases throughput and improves throughput time. When the constraint is improved, many times variation is reduced, and quality is improved.

ToC also focuses on flow much like Lean. However, ToC overcomes one criticism of most process improvement programs: the use of mass improvement programs and the one-size-fits-all approach to improvement. With the mass improvement approach, a company hopes that by refining and improving each process independently to maximum output without regard to other processes, the entire system output will improve. TOC focuses on one constraint at a time, sequentially improving additional constraints as they appear.

ToC methodology operates on several assumptions:

- As in the case of Lean, the organization places a value on the speed at which its product or service travels through the system. Speed and volume are the main determinants of success.
- Current processes are essential to produce the desired output.
- The product or service design is stable.

VALUE METHODOLOGY - Product Improvement

Originally called Value Analysis by Lawrence Miles (the creator) as a way to remove 'unnecessary costs.' He started by asking a few deceptively simple questions:

- What is it?
- What does it do?
- How much does it cost?
- What else will do that?
- What does that cost?

These are very easy questions to ask, but very difficult for a group of people to agree on common answers.

When the U.S. Navy adopted his methodology, they called it Value Engineering. In the 1960s, Charles Bytheway added to the field when he developed a graphical method of analyzing the dependencies between sequential functions. In the early 1980s, J.J. Kaufman expanded the basic concepts of both men's work, broadening the application beyond the physical sciences into the area of resolving business problems and capturing business opportunities. J.J. Kaufman calls this Value Management.

Value Methodology takes multi-disciplined project representatives through a structured investigation. These activities transcend corporate cultures, and use language that goes past symptoms, to the heart of the issue. This approach

A Story

A sheet metal part is attached to the exterior of a missile. This part had the longest lead-time, and the highest scrape rate of all other parts.

LEAN worked on the processes for 6 months, reducing lead time and rejects by 50%.

Value Methodology worked on it for three days, then eliminated the part.

The VE team found that the sheet metal piece was a shield protecting the sensors from the airstream during initial testing. Once the tests were completed, the missile went into production, the sensors were removed, however the metal shield was retained.

essentially separates INTENT from METHOD, creating **clarity of thought.** Then a METHOD is selected based on INTENT.

The foundation of the investigation focuses on the FUNCTION of the item under study. Mapping the relationship of a single base function to multiple secondary functions, using How/Why relationships in verb/noun statements. In addition to understanding how functions relate to each other, functions can be assigned items like costs, responsibility, departments, and other business information.

Value Methodology challenges assumptions about how the product or service satisfies the needs of the customer. Deming said the customer doesn't know what they need, the customer can only choose from what the producer offers. Value Methodology looks at the customer needs as something the customer wants **done**, the customer wants an **outcome**. Customers do not want a **feature;** they want a **function**. It is the function that creates a **benefit** for the customer.

The basic application is a series of divergent and convergent activities. As each step refines the thinking, reduces the volume of ideas, and focus understanding, allowing for an objective and integrated solution. Here are the main areas of emphasis with a few examples of tools:

1. **Identify Opportunity**
   a. Search (divergent) – Questionnaires, Brainstorming, Issues & Concerns, Nominal Group Techniques
   b. Select (convergent) – High-Cost Drivers, Management Focus, Impact, Pareto & Histogram Charts, Decision Analysis
2. **Develop Understanding**
   a. Investigate (divergent) – Cause & Effect Diagram, Target Costing, Flow Charts, Quality Function Deployment
   b. Analyze (convergent) – Function Analysis Systems Technique, Cost Analysis, Life-Cycle Cost, Impact Changeability
3. **Create Alternatives**
   a. Speculate (divergent) – Imagineering, TRIZ, Brainstorming, Experts
   b. Evaluate (convergent) – Gut Feel Index (GFI) - Delphi, Paired Comparison, Design of Experiment, Multi-voting
4. **Seek Acceptance**
   a. Develop (divergent) – Cost Analysis, Affinity Diagram, ROI/ROA/IRR, Break Even Analysis, Regression Analysis
   b. Present (convergent) – Strategy, Proposal Development, PowerPoint, Flip Charts, Milestones
5. **Achieve Results**
   a. Implement (divergent) – Project Management, Leadership, Requirement Definition, Responsibility Assignment Matrix
   b. Verify (convergent) – Check Lists, Control Charts, Audits

Some criticisms of Value Methodology are:

- It is perceived by participants as difficult and overly structured. While following the methodology is arduous and highly structured, the results are usually astounding. An often quoted study says that people use about 15% of their mental capacity in a typical day. However, during a VM workshop the percentage is much, much higher. This high level of a mental activity is not experienced often and can be quite draining.
- The level of investigation and solution is highly dependent on the people in the room. For example, if the VM project is run by Engineers, the solution will be an engineering solution. So composition of the group is important.

All process improvement methodologies are short-term efforts, producing quick financial results. However, as the business environment changes, the new results may be lost, necessitating the process improvement activities be repeated.

Organizational Structure

Assessments

ISO 9001 and the Baldrige Performance Excellence Program (formerly known as: Malcolm Baldrige National Quality Award) are standards used to assess the organization's structure and elements. The dictionary defines standards as *principles of conduct informed by notions of honor and decency*. Standards are agreed upon, prescriptive, and imposed on the organization from the outside. ISO 9001/Baldrige could be considered a disciplined SWOT analysis on the organization's structure or elements.

Both approaches involve how an organization is structured towards the customer, processes and continual improvement. The differences between ISO 9001 and Baldrige Criteria involves their respective points of view. ISO 9001 is directed *external* from the organization. The core emphasis being detailed, documented, and technically oriented focus on a system to reliably produce products or services that meet customer based requirements. The Baldrige Criteria is *inward* focused and directed towards a broad system, addressing business aspects across the organization, using criteria centered on marketing, financial analysis, strategic planning structure and other activities. The Baldrige Criteria makes the assumption that a properly structured organization will produce a quality product and enjoy a successful market.

Another difference between these two assessment approaches is who is the first or primary benefactor? With the Baldrige Award it is the internal organization, with secondary benefactors being those closely associated with the organization – stakeholder, suppliers, customers, and more. With ISO 9001 the main benefactor is the outside world (customers, suppliers, regulators, and others). With the internal organization being a secondary beneficiary.

Will pursuing one registration/award program support gaining the other? Baldrige criteria are oriented towards a corporate context and overall business success, and ISO 9001 is

focused on meeting applicable product and service requirements. ISO 9001 certification would help in obtaining the Baldrige Criteria award, while the reverse is of limited value.

Here is a chart showing some more distinctions between the ISO 9001 and Baldrige.

	ISO 9001 Tactical Approach	**Baldrige** Strategic Results
Original Intent	Assure Consistent Processes	Facilitate Knowledge Transfer
Original Use	Auditable Quality Assurance Requirements – Operational Processes	Framework For Evaluating an Organization's Management System
Focus	Conformance	Improvement
Evaluation	Audit - Pass/Fail	Maturity Model
Improvement Strategy	Corrective Action – Recurrence Prevention	Continual Improvement Using PDSA Learning Cycle
Performance Element	Conformance to Contractual and Statutory Requirements	Sustained Improvements in Business Results

Criticisms: Baldrige Criteria uses language of principle by which the organization is to be judged. Presented in the form of questions to be considered and answered. While this might be beneficial from a creative or potential perspective, the lack of specificity can be seen as lacking discipline.

ISO 9001 is focused on specifying certification standards and requirements to be met. While this process documentation and compliance may be viewed form outside of the organization as benefiting both the organization and the customers, the approach is prescriptive.

Application approach of both assessments is similar.

1. **Create a self-assessment**
   Typically an internal group of employees gather to review the requirements of the assessment program. Then the group looks at the current organization through the lens of the requirements. Essentially creating a SWOT (Strengths, Weaknesses, Opportunities, Threats) analysis.

   Baldrige Based Criteria include:
   - Leadership: stewardship, governance, social responsibility, and interactions throughout the organization and the environment in which they exist.
   - Strategic Planning: establish and deploy approaches to opportunities, challenges, advantages, key systems, key objectives, and key measures.
   - Customer Focus: learning about current and potential customers, determine satisfaction and engagement, product offering, and relationship building.
   - Measurements: measure and analyze the organization using performance, comparative; customer data. Knowledge management.

- Workforce Engagement: capability and capacity, working climate, performance, engagement, and learning and development.
- Operations Focus: product/service and process design, process management, and effective management for the future
- Results: key measures for products, processes, customers, workforce, leadership, financial, with levels and trends, and comparisons to the best.

ISO 9001:2008(E) criteria include:

- Quality Management System: General and Documentation Requirements
- Management Responsibility: Planning, Responsibility-Authority-Communication, Management Review
- Resource Management: Provision of Resources, Human Resources, Infrastructure, Work Environment
- Product Realization: Planning of Product, Customer Related Processes, Design and Development, Purchasing, Production and Service, Control of Monitoring and Measuring Equipment
- Measurement, Analysis and Improvement: Monitoring and Measurement, Control of Nonconforming Product, Analysis of Data, Improvement

2. **An outside review**
   With the Baldrige Criteria the reviewers are a team of industry experts trained to evaluate the written application in correlation with the criteria.

   With ISO 9001:2008(E) the assessment is reviewed by certified auditors.

   In both assessments a feedback report is returned to the applicant, highlighting consistencies between the criteria/requirements and the written report.

3. **An 'on-site' visit**
   Assessors/examiners travel to company location(s). Through observation and first hand inquiry, they verify and validate assertions made in the written report.

4. **Award**
   If the findings are consistent and acceptable to a determined level of compliance an 'Award' is issued in case of the Baldrige assessment, or 'certification' is awarded in the case of ISO 9001.

Criticisms of the process:
A) Awarding of ISO 9001 certification is 'licensed' to local authorities. Frequently, the authority is a consulting organization, or has a consulting arm specializing is helping company's become certified. This leads to situations where compliance to standard and awarding of the certification is tied to how much money the company under review pays the consulting organization, with only a minimal regard to how well the company is in compliance with the standard.

B) The Baldrige Award status does not need to be renewed, each application is a one time occurrence. While to maintain ISO 9001 certified status, the company must be recertified every few years.

CONCLUSION

*The Power of **AND**, the tyranny of **OR***

Improvement of an organization is not a matter of selecting one path or another, but of balancing efficient production, effective product design, humane management practices, and an organizational structure. Each area has unique characteristics, which on their own can make great contributions to an organization. However, when working together, these areas propel the organization to a whole new level of performance, and prepare the organization to adapt to future environments.

Caution: there is a popular belief that people outside the area will 'see the light' and change if you show them the results of improvement. This is a myth. Don't believe everyone will automatically accept and adopt any methodology once it is 'proven' through improved performance. The system will adapt, nothing more. And even then, the system will only adapt enough to alleviate the pain that the improvement effort is causing.

One way to balance the why, how, and what, is to support all approaches simultaneously. Start with pilot projects in each area, then grow and expand those efforts. Pilot projects may not be related, however keep the projects in close communication with each other. As the learning cycle evolves and grows, the efforts will strengthen themselves. As communication increases between each approach, interdependencies become visible and a bond is created.

Don't be afraid of making mistakes. They will happen. And don't be afraid of having to rework a previous improvement effort when new knowledge becomes available, or when one effort is influenced by another effort, for that happens too. For example, when a process is redesigned because of a product change, or when a product is redesigned because of a process improvement, keep the aim of the organization in view. Realize every improvement is another step in fulfilling that aim.

Many people are concerned about how improvement projects are funded. The first few pilot projects may require new funding. However, the amount is normally small and the risks low. As projects evolve and grow, some of the money saved from previous process improvement projects can be used to pay for efforts in areas where results take a while to become visible.

> In one state government, the Governor set up an agreement with various state agencies, where half of the money each agency saved through improvement projects remained in

> the control of the local agency. However, after three years, the annual savings were absorbed into the agencies baseline budget. The caveat was that the money the individual agencies controlled could only be spent on new improvement projects or for betterment of local constituents. All the state agencies agreed to spend their improvement savings on computers for the local school systems. After a couple of years, every school in the state had computers and Internet access; even a two-room school in a very remote part of the state. This agreement gave people a voice in how they would change their work environment and how the gains would be shared. Improving the local schools also gave the local workforce something tangible to work towards that had special meaning to them.

Imagine what a similar agreement would look like in your organization.

Changing is hard work, with many frustrations and setbacks. However, the rewards are even greater.

It's a brave new world! Let us work together, communicate, collaborate, and most importantly– have fun!

Bibliography

Akiyama, Kaneo, Function Analysis – Systematic Improvement of Quality and Performance, Massachusetts, Productivity Press Inc., 1991

Deming, W. Edwards, The New Economics for Industry, Government, Education, second edition (Cambridge, Massachusetts: Massachusetts Institute of Technology, 1994).

Dettmer, William H., Goldratt's Theory of Constraints: A Systems Approach to Continuous Improvement (Milwaukee: ASQ Quality Press, 1997).

Curt W. Reimann and Harry S. Hertz, Understanding The Important Differences Between The Malcolm Baldrige National Quality Award And ISO9000 Registration, Production and Operations Management, Volume 3, Issue 3, pages 171–185, September 1994
http://onlinelibrary.wiley.com/doi/10.1111/j.1937-5956.1994.tb00118.x/abstract

ISO 9000:2005(E) Quality management systems – Fundamentals and vocabulary, Third Edition 2005-09-15

ISO 9001:2008(E) Quality management systems – Requirements, Fourth Edition 2008-11-15, Corrected Version 2009-07-15

GOAL/QPC, *Value Methodology*, Salem NH, 2008

Goldratt, Eliyahu M., *The Goal: A Process of Ongoing Improvement*, second edition (Great Barrington, MA: North River Press, 1994).

Goldratt, Eliyahu M., *It's Not Luck* (Great Barrington, MA: North River Press, 1994).

Hopper, Kenneth and William Hopper, The Puritan Gift – Reclaiming The American Dream Amidst Global Financial Chaos, I.B.Tauris & Co. Ltd., London, 2009

Kaufman, J. Jerry. Value Management, Crisp Publications, Inc., 1998

Miles, Lawrence D, Techniques of Value Analysis and Engineering, 3rd ed., Washington D.C., Eleanor Miles Walker, Executive Director, Lawrence D. Miles Value Foundation, 1989

Moncur, Laura, Motivational Quotes, Quotation #31007 by Marya Mannes

Rother, Mike, and John Shook, *Learning to See – Value Stream Mapping to Add Value and Eliminate MUDA*, Massachusetts, The Lean Enterprise Institute, 1999

Stebner, Marlo. VM Overview, unpublished

Stebner, Marlo, Personal Communication

United Stated Department of Commerce, National Institute of Standards and Technology (NIST), Baldrige Performance Excellence Program. Criteria for Performance Excellence 2013-2014.

Willette, Gail L.; Richards, Robert Ray, ISO 9001 : 2000 and the Baldrige criteria for performance excellence - a comparison. June 2004, DOI: 10.2172/919125 http://prod.sandia.gov/techlib/access-control.cgi/2004/042721.pdf

Womack, James P., and Daniel T. Jones, Lean Thinking: Banish Waste and Create Wealth in Your Corporation. (New York: Simon & Schuster, 1996).