Improvement Methodology Integration

Working through the apparent conflicting claims of performance improvement programs

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Within the American business community a proliferation of process improvement champions are vying for leadership attention. Each champion advocating the adoption of their improvement methodology in your organization. Where do these champions come from and how did they become advocates of a specific improvement methodology? In many cases, a champion is created as the result of achieving great performance improvement in a number of situations, using a specific set of process improvement tools and techniques. These successes produce a valuable life changing experience. Almost all champions plead that if you would adopt their specific tools or follow a specific way of thinking all your business problems will be solved. After listening to multiple champions advocate their special methodology, how do you choose what will fit into your situation? What methodology fits the culture of your organization? Many process improvement methodologies appear to conflict with each other, or at least down play the contribution of other methodologies. This confusing montage of tools and philosophies creates the illusion of conflicting strategies. You have an instinctive feeling that no improvement program is complete, or will exploit the full potential of your concern.

On the other hand, as a manager you want to overcome a specific obstacle or achieve some performance goal. Which methodology overcomes the specific obstacle? Which one involves the least amount of pain to implement? Which methodology achieves the goal while creating the least amount of new obstacles? How to choose? As a leader you understand the need for an integrated and comprehensive improvement effort where managers and general beneficiaries would call upon various specialists to assess opportunities for improvement and help guide the change. Ideally, these specialists would provide multiple options inside their expertise and collaborate with other improvement fields to provide the optimal help for a specific situation. Generally, managers and leaders seek an environment where specialists use professional consideration, and a unified concern to provide assistance towards resolving a specific situation. Where managers and leaders would hear specialists in one area, or expertise, defer to another specialty for the benefit of the host organization. Right now, the blending of improvement tools and methodologies into the culture of your organization is left up to you, the leader.

This article is intended to explore a couple of the more popular programs. Identify some commonalties, primary and secondary effects of each methodology, unique and common assumptions, and create a model to help you understand these relationships. Since we are comparing multiple programs, with their nuances and implications, we will have to drive towards the fundamentals. As with most comparisons and contrast analysis, oversimplification is a reality we will have to accept. So to Champions of specific improvement methodologies, I apologize in advance.

Many improvement programs promote themselves by having a primary theory, with a series of application guidelines, and finally a host of antidotal stories about the implications. We will identify each program and what each wants businesses to understand.

The following chart describes the essence of each program. We will discuss each in slightly more detail, identify some underlying assumptions and explore some effects of using each methodology.

Improvement Programs			
Program	**Six Sigma-GE**	**Lean Thinking**	**Theory of Constraints**
Theory	Reduce Variation	Remove Waste	Manage Constraints
Application Guidelines	1. Define 2. Measure 3. Analyze 4. Improve 5. Control	1. Identify Value 2. Identify Value Stream 3. Flow Value 4. Pull 5. Perfection	1. Identify Constraint 2. Exploit Constraint 3. Subordinate Processes 4. Elevate Constraint 5. Repeat cycle
Focus	Problem Focused	Product Flow Focused	Systems Constraints

Six Sigma

Six Sigma touts that focusing on reduction of variation will solve process and business problems. By using a set of statistical tools to understand the fluctuation of a process, management can begin to predict the expected outcome of that process. If the outcome is not satisfactory, then associated tools are used for more understanding of the elements that influence that process. Through a rigid and structured investigation methodology the process elements are more completely understood. Through reducing the variation of multiple elements, the assumption is that the outcome of the original process will be reduced.

Initially Six Sigma experts begin by Defining the process. Who are the customers and what are their problems? Identify the key characteristics important to the customer, existing process, or subsequent processes. Existing output conditions along with process elements are identified.

Next is the focus on Measuring of the process. Key feature characteristics are categorized, measurement systems are verified, data is collected. Once data is collected, an Analysis is performed. The intent is to convert the raw data into information that provides insights into the process. What are the most important causes of the defects? Fundamental causes of defects or problems are identified.

The fourth step is to Improve the process. Solutions to the problem are chosen. How are the causes removed? Results of process changes are seen in the measurements. Then the changes can be judged whether they are beneficial, or if another set of changes is necessary. If the process is performing at a desired level then the process is put under Control. This last step is the sustaining portion of the Six Sigma methodology. The process is monitored to assure no unexpected changes occur.

When focusing on the primary area of variation reduction, other secondary effects are produced. Quality is improved. Process investigation produced the re-evaluation of the value added status of many elements. Some elements are modified, while others are discontinued. Elements are refined and improved. Mistakes and opportunities for mistakes are reduced. Variation is reduced resulting in a more consistent output.

Some elements constrain the flow of product or services. Flow is defined as the time from input of raw material to the output of a saleable item. Improvement of the process that restricts flow, results in reduced variation and improved quality, as well as improves the volume of the process output. Thus the organization has less money tied up in in-process inventory. The time from when money is expended for input material, to the time when the company sees a profit is reduced. The company can respond to customer needs more quickly.

Six Sigma process is founded on a number of assumptions.

- First, people in the organization must understand and appreciate that numbers can represent features and characteristics of a process. People need to appreciate that a deeper understanding of data and data analysis can be used to produce improvements; that graphical representation of data provides new and different perspective of the process. Analytical types, such as Engineers and Scientists, respect this approach.
- Another assumption is that through the reduction of variation of all the processes, overall performance will be improved. While it is hard to argue that improvement may not be appropriate, the economic reality of business says we want the most improvement for the least investment. An entire organization improving their individual processes may 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. The realized savings to the system will be less than the sum of all the improved components. You may create an organization improving things just because they can; however they may be improving the wrong things for the business.

Lean Thinking

Lean Thinking is sometimes called Lean Manufacturing, the Toyota Production System, or other Lean acronyms. Lean focuses on the removal of waste. Waste is defined as anything not necessary to produce the product or service. One common measure is 'touch-time' - the time the product is actually being worked on, or touched by the worker. Frequently, Lean Thinking's focus is manifested in an emphasis on FLOW.

The essential steps of Lean begin with the determination of what features create value in the product. Determination is made from the internal and external 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. Product is evaluated on what features add value. The value determination can be from the perspective of the ultimate customer or a subsequent process.

Once value is identified, activities that contribute value are identified. The entire sequence of value-added activities is called the Value Stream. Activities that do not contribute value to the product or service are assessed as to whether or not the activity is necessary. Necessary operations are defined as being a prerequisite to other value-added activities, or being an essential part of the business. An extreme example of non-value added, but necessary process is payroll. After all, people need to be paid. Necessary, non-value added activities are reduced to a minimum impact on the process. All other non-value added activities are transitioned out of the process.

Once value-added activities and necessary non-value activities are identified, improvement efforts are directed towards making the activities Flow. Flow is defined as the uninterrupted movement of product or service through the system, to the customer. Major inhibitors of flow are work-in-queue, batch processing, and transportation. These buffers slow the time from when the product or service is initiated to when it is delivered to the customer. Buffers also tie up money that can be used elsewhere in the organization. Buffers also cover up the affects of system restraints and other waste activities.

After waste is removed, and flow established, efforts turn to letting the customer Pull product or service through the process. Pull makes the process responsive to providing the product or service only when the customer needs that specific product or service. Not before, not after.

The last step is called Perfection. This effort is the repeated and constant attempt to remove non-value activity, improve flow, and satisfy the customer delivery needs.

While Lean focuses on removing waste and improving flow, some secondary effects become apparent. Quality is improved. The product spends less time in-process and reduces the chances of damage or becoming obsolete. Simplification of processes results in reduction of variation. By looking at all the activities in the value stream the system constraint is removed and performance is improved.

This methodology also makes some assumptions.

- First that many small improvements are more beneficial than in-depth analysis of processes.
- That people value the visual effect of flow.
- That waste is the main restriction to profitability.
- That many small improvements in rapid succession are more beneficial than analytical study.
- People in operations respect this approach.

Another assumption is that 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 role in the organization and their relationship to the product.

Theory of Constraints

Theory of Constraints focuses on system improvement. A system is defined as a series of interdependent processes. The analogy of this philosophy is the chain. A chain is defined as a series of interdependent links working together for the overall goal. The performance of the entire chain is limited by the strength of the weakest link. In manufacturing processes Theory of Constraint focuses on the process that slows the speed of product through the system.

Theory of Constraints focuses on five steps. The first is to identify the constraint. The constraint is identified through various methods. The amount of work-in-process ahead of a process operation is a classic indicator. Another example is operations where multiple products are processed simultaneously or batch processes.

Once the constraint is identified the process is improved or otherwise supported to achieve the most capacity out of the existing process, without major expensive upgrades or changes. The vernacular used for this step is to exploit the constraint.

After the maximum use of the constraining process capacity is assured, other processes are paced to achieve maximum output of the constraint. The subordinate processes are paced to 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, or else they would be the constraint.

If the output of the overall system is not satisfactory, then further improvement is required. Major changes to the constraint are now contemplated. Changes can involve capital improvement, reorganization, or other major expenditure of time or money. This is called Elevate the Constraint. This step is intended to take whatever action is necessary to eliminate the constraint.

Once the constraint is broken, the system constraint is moved to another location in the system, or process chain. Now is the time to repeat the cycle of improvement. Performance of the entire system is re-evaluated. Searching for the new constraint process, exploiting the process, subordinating and elevating.

By focusing on the constraint this methodology produces positive effects on the flow time of the product or services through the system. Reduction of waste in the constraint creates the effect of increasing throughput, and improving throughput time. When the constraint is improved, variation is reduced, and quality is improved.

Constraint focus does not require intimate knowledge of data analysis. Involvement by a great number of people is not needed to understand elements of the system. A few people with the power to change things are all that is necessary. The effort can be localized with minimum involvement of the workforce.

Theory of Constraint overcomes one criticism directed toward most process improvement programs, i.e. that many programs use a mass, peanut butter, approach to improvement. Hoping that by refining and improving each process individually and independently to maximum output, the entire system output will improve.

Theory of Constraint methodology operates on a number of assumptions.

- Similar to lean, the organization places a value on the speed at which their product or service travels through the system.
- Speed and volume are the main determinant factors for success.
- Current processes are essential to produce the desired output. The product or service design is stable and the customer needs are satisfied with that design.
- Current product configuration fulfills the functional requirements of the market and the customer.

Workers, the value added workers, do not need to have an in-depth understanding of this improvement methodology. If an improvement idea presents itself on non-constraint processes, does not cost much, or does not affect the constraint, then the improvement may be allowed. Otherwise suggestions by the workforce are not considered. Organizations that benefit from hierarchical structure and centralized knowledge value this approach.

Now that we have explored three popular methodologies in some detail, we can construct a matrix for comparing them, capturing some of the main points of each methodology.

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Focus	Problem Focused	Product Flow Focused	System Constraints
Assumptions	A Problem Exists Analysis is valued System output improves if variation is reduced	Waste removal will improve business performance Many small improvements are better than systems analysis	Emphasis on Speed and Throughput Uses Existing systems Process Interdependence
Primary Effect	Uniform Process Output	Reduced Flow Time	Fast Throughput
Secondary Effects	Less Waste Fast Throughput Less Inventory Fluctuation - Performance Measures Improve Quality	Less Variation Uniform Output Less Inventory New Accounting System Flow - Performance Measure Improve Quality	Less Inventory/Waste Throughput Cost Accounting Throughput - Performance Measurement System Improve Quality
Criticisms	System Interaction Not Considered Processes Improved Independently	Statistical Analysis Not Valued	Minimal Worker Input Data Analysis Not Valued

Common Assumptions

All process improvement theories and methodology make a few of the same assumptions. Improvement methodologies begin by taking the product or service configuration at face value and improving the processes or system. The design of product or service is essentially correct and most economical.

Also, it assumes that the product or service is satisfying the functional need of the customer. These assumptions may not be valid and require exploration.

After extensive refinement of the existing processes or system, many improvement methodologies begin to look at the product or service design. However, each views functional needs and design through the tools and methods of their respective improvement methodology.

A couple of techniques used to help connect the product or service design to the customer needs are Quality Functional Deployment and Value Management. Both bring marketing, finance, operation, design, customer and suppliers together to systematically explore how the product performs the function the customer needs. An interesting part of this investigation is that cost can be associated with function. When marketing and customers know the cost of specific features, they make informed choices about the configuration of the product or services.

Another assumption made by improvement programs is that a management culture is in place that will support and nourish change. Improvement methodologies address the area of management theory as a secondary issue.

During implementation of improvement theories, one major obstacle continues to show up, mainly the use of policies, either formal or informal. In any organization many activities are performed that are not directly attributable to the improvement of products or services. Many activities are driven by policies whose purpose has been lost over time. Policies and procedures will be changed as a result of these improvement activities. A management structure to support the changes is crucial.

All change programs challenge the existing status of how things are done. Policies and procedures are questioned, asking what purpose does a specific policy serve and is that purpose still valid in today's environment. Another major obstacle include things like how people are rewarded for process or business performance improvement. Of particular interest is how managers are measured and promotions gained.

Beneath these issues is the general theory of management in use by the organization. One technique to assess an organization's management theory is to search for the underlying assumptions supporting each policy. This will provide a starting point to determine if the current policy is still supporting something of value in today's environment.

The management theories of Dr. W. Edwards Deming may help organizations challenge current management practices and assumptions, not by suggesting incremental improvements, but pointing to a new way of managing. Through this line of study, leaders create a greater depth and understanding about how management can influence the social and economic well being of an organization. In addition, assumptions outside the scope of improvement methodologies are challenged.

Even below a theory of management is a system of organizational morals and values. Is the purpose of the organization's existence the benefit of mankind, is it for the benefit of the nation, economic or otherwise, or is it for the wealth of the stockholders? In a pure capitalistic value system the

benefit is for the personal wealth of the owner. How are the needs of several beneficiaries balanced and where does the organization draw the line for acceptable behavior?

Do not get caught in the trap of thinking a company's purpose is to make money. Money, or profit, is the resultant of good management towards satisfying a societal need. Also, some companies are created not to make a profit.

The issues of theory of management and organizational morals and values are beyond the scope of this article. These issues were brought out to point to other areas needing consideration when looking at process or system improvement programs.

Many champions will counter the management theory and organizational support concerns by saying that by implementing their methodology, focusing on their tools, methods and theories, the organization will change or be changed to support the new way. Some improvement advocates make statements that, by using their tools and techniques, a management methodology will emerge. The assumption is that through total submersion of the organization into a specific or respective methodology, a resulting theory of management, and possibly, a business strategy will be developed.

Conclusion

To help work through the apparent conflicts of different improvement programs, use a model that identifies a hierarchy of cause and effect relationships. First, identify the primary theory. What is the core emphasis of the program or methodology. This core emphasis is usually one or two words. Six Sigma is variation reduction, Lean is waste reduction, and Theory of Constraints is constraint reduction.

Secondly, identify the relationship between the primary theory and the primary focus of the tools and methodology. This relationship best describes how the primary theory manifests itself into tangible results. This is an if/then type of relationship. For example, Six Sigma – if we focus on reducing variation then we will have more uniform process output; Lean – if we focus on waste removal then flow time will improve; Theory of Constraints – if we focus on constraints then we improve throughput volume.

The last level of this model is identified by describing secondary affects. The secondary effect can be described by using an if/andif/then or if/andif/result type statement. While the primary theory to primary focus relationship is usually one-to-one, the secondary effects are many. Six Sigma's focus on variation and uniform process results in less waste, less throughput time, less inventory, etc. Lean Thinking's focus on waste and flow time results in less variation, uniform output, less inventory, etc. Theory of Constraints's – focus on constraints and increased throughput results in less inventory, different accounting system, etc. When attempting to identify tertiary results the technique becomes overly complex.

Each improvement methodology appears to be driving to a common place of tools and concepts. However, different methodologies start the journey from different perspectives. At the secondary effects level of our model, the results from each methodology start to look similar. Many of the secondary effects of one methodology look similar to the primary effect or focus of another methodology.

Extending the fundamental philosophy through their primary and secondary effects, we might conclude that each method strives to achieve similar results. Even along the journey, each methodology incorporates the primary affects of other improvement programs. Can we infer that after extensive time and effort in implementing a single methodology, the end result would be similar no matter which path was taken? I believe this is a valid conclusion.

Where does that leave us? As a manager, how do you select an improvement methodology or program to overcome your obstacles?

Selection of the process improvement methodology is dependent on the culture of your organization. Given the conclusion that many popular programs will end up in the same place after a number of years of use, the main issue left to explore is the speed of acceptance into your organization. If your organization values analytical studies and values the relationship between data and charts/analysis, then Six Sigma is a perfect program to start. If your organization values visual change, and places a high value on time, right now time, then Lean Manufacturing might be the way to go. If your organization values a systems approach where total participation is not desired, and values the separation between worker and management, then TOC might be a good way of starting.

To recap, when working through the apparent conflicting claims of performance improvement programs, concentrate on the primary and secondary effects of their philosophy. Once the values of a specific improvement program are identified, the blending of those values with the values of the organization becomes the primary concern.

Lastly, never stop learning. Each improvement methodology contributes valuable concepts, ideas and techniques to your organization. Your challenge is to use the strengths to help your organization.

Deming, W. Edwards, The New Economics For Industry, Government, Education, 2nd Edition, Massachusetts Institute of Technology, Cambridge, Massechusetts, 1994

Dettmer, William H., Goldratt's Theory of Constraints: A systems Approach to Continuous Improvement, ASQC Quality Press, Milwaukee, Wisconsin, 1997

Goldratt, Eliyahu M., The Goal: A process of Ongoing Improvement, 2nd Edition, North River Press, Great Barrington, MA, 1994

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

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

Kaufman, J. Jerry, Value Management: Creating Competitive Advantage, Crisp Publications, 1998

Pande, Peter S., Robert P. Neuman, Roland R. Cavanagh, The Six Sigma Way; how GE, Motorola, and other top companies are honing their performance, McGraw-Hill, 2000