RECENT TRENDS IN SIX SIGMA

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SUMMARY

This paper discusses trends recently seen in Six Sigma deployment. These trends represent a maturity in the industry, and provide examples of how the quality profession has embraced what were once best practices and accepted them in common usage.

INTRODUCTION

Six Sigma is a management strategy for improving a business. While the strategies and techniques are fairly well established, the growth and maturity of Six Sigma deployments has created some interesting, albeit expected, trends in the business environment.

TREND ONE: EMPHASIS ON CYCLE TIME REDUCTION

Six Sigma deployment revolves around Six Sigma Projects. Projects are defined that will concentrate on one or more key areas: cost, schedule, and quality. Projects may be developed by senior leaders for deployment at the business level (a top-down approach), or developed with process owners at an operational level (bottoms-up approach). GE CEO Jack Welch considered the best projects those that solved customers' problems. (Slater) In all cases, projects are directly linked to the strategic goals of the organization and approved for deployment by high-ranking Sponsors.

The Project Sponsor, being a leader in the organization, works with the Project Leader (either a Black Belt or Green Belt) to define the scope, objective and deliverables of the Project. The Sponsor ensures that resources are available for the Project members, and builds buy-in for the Project at upper levels of management as needed. All of this is documented in a Project Charter, which serves as a contract between the Sponsor and the Project Team.

The scope of a Project is typically set for completion in a three to four month time frame. Management generally sets criteria that Projects must deliver a minimal annualized return, such as $150,000. The structure of these projects and its Charter keeps the project focused. The Project has a planned conclusion date with known deliverables. And it has buy-in from top management. These requirements, together with the Six Sigma tools and techniques, ensure project success.

A trend that is not necessarily new, but perhaps becoming more widespread, is the emphasis on Cycle-Time reduction. It seems there are several reasons for this:

- Late Shipments result in penalties
- Excessive Cycle Times lead to downtime for downstream processes
- Cycle Time reduction improves capacity, reducing the need for increased labor, equipment or facility costs
- As Projects move into Administrative and Support areas, cycle time is a natural metric

The interest in Cycle-time reduction might also be traced to awareness: as Black Belts are trained in tools for cycle-time reduction, they notice opportunities that were once thought of as 'the way we do things around here'. Some of the tools used by Six Sigma Project Teams for Cycle-time reduction include Process Mapping, Lean Thinking, and the Theory of Constraints. While Process Mapping may be well understood, there is less awareness of the application of Lean Thinking and Constraint Management.

LEAN THINKING

(This material adapted from Keller, 2000). Lean Thinking is a methodology for improving cycle times and quality through the elimination of waste. It is also known as Lean Manufacturing, when used in manufacturing applications, and the Toyota Production System, due to its origins. The more recent label of Lean Thinking, used by authors James P. Womack and Daniel T. Jones in the title to their excellent work on the subject, implies its application across a broad range of businesses.

The goal in Lean thinking is the elimination of *muda*, Japanese for *waste*, defined as any activity that uses resources and does not create value. Taiichi Ochno of Toyota defined the following types of waste (Womack and Jones added the last):

1. Errors requiring rework
2. Work with no immediate customer, either internal or external, resulting in work in progress and finished goods inventory
3. Unnecessary process steps
4. Unnecessary movement of personnel or materials
5. Waiting by employees as unfinished work in an upstream process is completed.
6. Design of product or processes that do not meet the customer's needs

The implementation of Lean thinking results in a departure from batch scheduling and a movement to continuous flow of single units of product. Lean Thinking seeks to eliminate waste with application of the following five steps:

1. Specify *Value*
2. Identify *Value Stream*
3. Make the Value Stream *Flow*
4. Replace Push Scheduling with *Pull* Scheduling
5. Achieve *Perfection*

Creating Flow incorporates several Lean concepts: Just in Time scheduling, Kanban cards, Kaizen, and 5S. 5S comes from the Japanese words used to create organization and cleanliness in the work place: (Seiri (organization); Sieton (tidiness); Seiso (purity); Seiketsu (cleanliness); Shitsuke (discipline)). These have been translated into the following Americanized 5S's (ReVelle):

1. Sort: eliminate whatever is not needed.
2. Straighten: organize whatever remains
3. Shine: clean the work area
4. Standardize: schedule regular cleaning and maintenance
5. Sustain: make 5S a way of life

LEAN EXAMPLES

The assembly of a satellite consumes a large amount of floor space. When in-process inventory lies in wait for material or labor, there is waste. This waste is manifested as inventory carrying costs and delays to customers. It also presents safety hazards to employees, as the bulky satellites are difficult to navigate around without risk of injury to personnel or damage to the satellite. Any of these factors alone have the potential for millions of dollars in loss.

A Six Sigma Project was defined to revise the layout of the assembly area, as well as to implement a Pull-type scheduling system for the assembly process. These efforts improved the flow of material through the area, decreasing the instance-day count of partial assemblies. This not only decreased the potential for injury and damage, but also circumvented (or at least delayed) the need for additional floor space to handle increased capacity requirements.

Another examples of Cycle-time reduction include the improvements made to the software approval process by a Six Sigma team, resulting in a 40% reduction in the time to generate an approval. The improvement process forced a re-evaluation of the value stream, resulting in improvements to the quality of the service. Not surprisingly, the personnel performing the approvals reported a significant improvement in their own morale, as well as the morale of their internal customers.

CONSTRAINT MANAGEMENT

Constraint Management is based on the Theory of Constraints, developed by Goldratt and popularized in his book *The Goal.* The Theory of Constraints provides a set of tools and principles for optimizing systems, in recognition that optimizing each process within a system can actually de-optimize the system. If the system is viewed as a chain, then the *constraint* is the weak link that prevents the system from reaching its goal. Improvements to other parts of the chain do not make the weak link any stronger.

Each independent chain within a system can be limited by only one constraint at a time. There are many types of constraints (Dettmer):

- Market: such as insufficient market demand for product or service
- Resources: personnel, equipment, or facilities.
- Material: either insufficient quantity or quality of available material
- Supplier: unreliable due to schedule or quality.
- Financial: cash flow.
- Knowledge/Competence: insufficient skills of work force or insufficient information available for your work force to effectively do their jobs.
- Policy: management or tradition.

Dettmer points out that policy constraints are perhaps the most prevalent, and are not entirely due to management decree: phrases such as "We don't do it that way" are examples of policy by tradition.

Constraint theory provides five focusing steps for improving the system:

1. Identify the constraint
2. Exploit the constraint
3. Subordinate everything else to that decision
4. Elevate the constraint
5. Repeat the analysis

Once the constraint has been identified, if it can be removed, then step 1 may be repeated. In fact, the system should be periodically re-evaluated to determine if the constraint has changed. Some constraints can be exploited, so that you get maximum value from the constraint. For example, if the constraint is a piece of equipment, you might change your product mix, or manufacturing requirements, to achieve the highest return from that piece of equipment. Once the constraint has been fully exploited, all other processes must be subordinate (or secondary) to that decision. Resource allocation and improvements should be directed to the constraint, since capacity or quality improvements to other processes will not improve (and could degrade) the system performance. Once all other processes have been subordinated, then elevate the constraint by considering alternatives to remove (or more precisely: move) the constraint. Then, evaluate where the new constraint occurs so it can be identified, exploited, subordinated and elevated.

The Theory of Constraints can be applied to Six Sigma Projects in several ways: as applied to Project Management, and as applied to System Improvement and Optimization. When applied to Project Management, the methodology is commonly referred to as Critical Chain management.

TREND TWO: SMALLER BUSINESS DEPLOYMENT

As more organizations deploy Six Sigma Projects throughout their business units, Projects increasingly involve their suppliers. This creates an awareness of the Six Sigma methodology at the supplier-level. Some organizations even take it upon themselves to train their suppliers on the techniques, so that the resulting improvements in cost, schedule and quality improve their ability to do the same.

As the Six Sigma market grows, so does the availability of organizations to assist in deployment and integration. This availability of technical expertise allows smaller businesses to realistically consider Six Sigma deployment with minimal economic investment. While some consulting organizations still charge a million dollars or more for deployment, there are plenty of organizations willing to work for more reasonable rates.

TREND THREE: INTEGRATION WITH OTHER INITIATIVES

Although there has been much confusion about the Six Sigma methodology, there has been recently more acceptance of it as a Management Initiative. Six Sigma is primarily a management program. It is a new way of doing business, and a new way to run your business. It will change the way you operate. It has to, in order to achieve the levels of improvements necessary to move beyond the common Three Sigma levels of performance for most businesses.

As a Management Initiative, it can serve as a framework for other improvement strategies, including Lean Manufacturing, Quality Improvement, Statistical Process Control, Cost of Quality, and countless others. The question arises: Which processes should have the highest priority for improvement? When improvement plans are tied to specific Six Sigma Projects, Management can set priorities for the projects as part of their Six Sigma Sponsorship and oversight roles. By defining a clear set of criteria for project deployment based on customer and

financial concerns, Management focuses the improvement efforts towards those projects with the highest potential.

How does Six Sigma relate to ISO 9000? A common Six Sigma improvement cycle is known as DMAIC (pronounced Dah-MAY-ick), which is an acronym for Define-Measure-Analyze-Improve-Control. This last step, Control, involves, amongst other things, implementing a plan for sustainability of the improvements evidenced during the Analyze phase. These control plans, and their policies, procedures or work instructions, may be managed via the ISO 9000 Control System.

CONCLUSION

There are many Six Sigma practices or techniques that are familiar to us in the quality profession. As such, we can tend to take the approach for granted, and not realize the implications of its success. Six Sigma as a Management Practice has the capability of transforming the quality profession, as we know it. These trends represent an evolution of best practices to common use, as predicted by the Kano model.

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