# Project Management Technique

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## This Issue

***People or Process.*** Part 2 of the People or process article, covering estimations, technology and troubled projects.

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***Book Synopsis:*** *Six Sigma Breakthrough Strategy* by Mikel Harry, Ph.D. and Richard Schroeder provide an overview of their Six Sigma philosophy to familiarize the reader with the concept.

## Next Issue

*Estimation-A study in the psychology and sociology of Projects.* Projects are heavily affected by how people interact; estimation processes are a great way to illustrate this.

***Critical Chain Project Management***, by Lawrence Leach. A thorough text on Critical Chain describing the details the theory, how to implement it and monitor a project's progress.

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# People

In the previous edition, the discussion focused directly on the people and how they become successful as Project Managers. In the continuation of the article, the topics will be more process focused. It will discuss what processes can help and where they fall short. Human biasing heavily affects estimation processes and the deployment of technology elements. As the pressure mounts, the project falls into more trouble and eventually turns red.

# People or Process: Part 2

## *Estimates*

Estimations are an integral part of any project. In industries with well-defined methods and technologies, books and databases are the source of estimates. The construction industry is an example where there are published estimates for the length of time to lay a concrete slab, erect a wall or put on a roof to name only a few. Various parameters are used to describe each job; costs and times are accumulated to provide a reasonably accurate number. Some numbers are so common that someone wanting a specific style of building can estimate its price on a square foot basis without ever looking at the cost of a given wall.

In other industries, the people that perform the tasks give the estimates. This is because in these industries, like high-tech manufacturing, Information Technology and healthcare, many of the tasks have never been done before. The comfort of historical data is missing. People use prior tasks knowledge and meld that with the oddities of the task being estimated to come up with an educated guess.

People in these situations loathe estimates. They fear them for good reason. They are always wrong; after giving them, managers treat them as quotes and reprimand subordinates for missing their estimates. Once estimates are placed in a schedule, the vernacular even changes to call them due dates and deadlines. If the task finishes early, the person is scolded for padding the estimate; if it is late, the reprimand is for that. Stakeholders and management need to understand that these are estimates and someone missing their "deadline" is a normal consequence of using estimates. Everyone being late is a problem, padding estimates is a problem, but being late on half of them is acceptable. For this reason, understanding the derivation of the schedule is critical to a manager's perception of it. If the estimates for the schedule are fairly certain, then there is significant pad in the schedule. In this case, most people should

complete their assignments on or ahead of schedule, but this is rarely the case.

Management's reaction to people missing an estimated completion date (either over or under) conditions the team member's style of generating estimates. The stricter management is about treating estimates as quotes, the more padding the estimates will contain and the more unrealistic schedules. Reprimanding people for missing a target date, will condition the team to add more time.

This habit of padding schedules creates a justifiable feeling that there is plenty of time to complete the task. People will take a lackadaisical approach to completing the assignment. Functional managers, knowing the tasks have padding, slip in extra non-project work. The resource, knowing this will happen, adds more pad.

The desire is that the task completes on or before the estimated due date. This should be the norm due to the padding. Instead, the resource's functional manager knows they have extra time and assign other seemingly urgent tasks. The extra work chews up the allotted time and the risk allowance for the original task. When the resource finally gets to work on the original task, they run into unexpected issues and the task becomes late. Even if the task could be finished early, people will use the additional time trying to achieve perfection. The attitude is that getting tasks done by their due date maintains the schedule. Tasks that are finished early bring proof that the timeline was padded. Management unleashes their wrath accusing people of padding their estimates; the same padding management used to slip in other assignments that are more urgent. This vicious cycle must be broken and estimates made in a uniform and realistic fashion.

Although unwritten, this is a process, albeit one with very negative consequences. People see a problem and build a process to make their jobs easier. The goal of the leader is to funnel this energy into making proactive processes and changing the behavior of the team and their management.

**Estimation Process**

A process for gathering estimates is needed, but there must be consistency in the number itself. Assume a task has been done three times in the recent past. The duration of the task in each instance was twelve, seven and eleven days. A new estimate needs to be made. The average is ten days and should be the estimate, however, most people dislike being right only 50% of the time. In addition, only once in the past was it done in less time than that, hence a higher number is chosen. Twelve hours appears safe. However, doing this causes two problems.

The first is that the project, if estimated like this, will have a twenty percent pad. A ten-month project becomes twelve. The cost will go up commensurate with its time to completion. Somehow, though, that extra buffer never appears in an early delivery, further justifying the choice of the higher number. Some of the factors causing this have been discussed above. However, this leads to the second point—individual behavior.

The second problem is that the person providing the estimate knows it can be done in seven days. Their confidence says it will only take ten. The knowledge of the padding sets up a psychology devoid of urgency; other tasks creep in and consume the time. Even if the task could be completed early, the rest of the scheduled time is taken to make the deliverable "perfect."

On the contrary, giving the person a stretch goal of seven days maintains pressure so they will complete the task in less than ten. The pressure keeps them focused on the task and they police their activities. They start as soon as they can and resist taking on other work that will interfere with them completing the task at hand.

**Reporting**

The requirements for estimation continue well past the project's inception. Understanding project progress is reliant on group and individual estimates. They are a reporting tool to the management and the customer—the good, the bad and the basis for recovery plans for consistently late tasks. Team members need to report on their status on a regular basis and the effect of that progress incorporated into the plans.

Process can help with this, too. People should estimate their progress based on the subtasks required to complete the task. They need to determine the tasks they have left and estimate the time required to do them. Written estimates are best. This will provide an opportunity for the Recovery Manager to see if the activity list is growing or if the time is getting longer for given subtasks. Although this appears to be micromanaging, it forces the person to think about the steps remaining. It is also a great way to discover the addition of frivolous tasks that are out of scope—gold plating.

## *Technology*

Technology has a huge effect on behavior. Many people enjoy working with something new and different; it adds interest to the workday, it is fun learning something new. In high-tech fields, this opportunity avails itself every day.

Anyone who owns a computer knows that technology advances so rapidly that shortly after purchase, faster hardware and newer versions of tools are available. In the project world, there is the addition of new paradigms and languages. Architects, designers and developers are in a continual state of learning new tools and techniques. This is one of the aspects of the job that technicians enjoy the most. With this, though, comes the concern that they must keep up with technology trends or their net worth will decrease or, worse, they become obsolete.

These conditions create an atmosphere where technologists want to adopt new technology to ensure they are up to date on the latest skills. This creates a conflict of interest in the project. Functional managers want their teams to be happy, technologists want to work with new technology, but technology costs money—to purchase, for training, to debug and to handle the myriad of risks associated with it. For the latter reasons, project management may disagree with the technologists on the role technology should play in the project. The struggle takes on a flavor of being personal.

Products that are new and untested can further pique the interest of the technical team. They will add excitement to the project, increase their knowledge and improve their résumés. Hence, estimates for the use of the tool or product are subconsciously over optimistic. In their zeal to use the new technology, the team overlooks its inherent risks. This is usually a fatal mistake as the new technology is sure to have as many, probably more, issues to resolve due to its lack of maturity.

Attempts by the project manager to intervene in this situation are met with the argument that implementation of the technology is the responsibility of the technical team and outside the purview of the project's management. However, it is a huge source of scope creep. Team members working out the details of an implementation may make a number of suggestions to the customer that increase scope. Experience shows that architects, requirements teams or developers working with the customer, suggest large numbers of features to add to the product. Even though done with the best of intentions, it has innocent disregard to the effect on the project as a whole. Making these suggestions and classifying them as implementation detail justifies circumvention of the scope management process.

An actual example may illustrate this point. A system had requirement that any time prior to commit the data entry person would be able to cancel their work. The designer working on the implementation asked if there should be a confirmation (i.e. "Are you sure you want to lose your work?"). While listening to the customer's concerns, the team member proposed printing the data entered so the end user has all the data in one place. (A previously built print module would be reused.) This will make it easier to reenter. This is a very noble and valuable offer. However, the request is more than a simple print function. It requires report design (always emotional due to layout preferences), unit test, system test modifications, training enhancements and additional maintenance. In addition, other logistical questions needed answers. Were there users that did not have print capabilities? Was there personally identifying information (names, addresses, phone numbers, tax identification numbers, etc.) that would violate company security rules? As it turned out, both answers were yes. In other words, this simple offer added significant scope to the project, which turned out to be unusable.

## *When a project gets in trouble*

This discussion has only covered a couple of the hundreds of contributing factors that trouble projects. Once in trouble, though, the project needs realignment. The famed quote by Fredrick Brookes is quite true, "How does a project get to be a year late? …one day at a time." All of the contributing factors compound to cause the delay. Project Managers optimistically feel that they can control and correct the situation. Others start to call attention to the problems and management ignores them.

Before recovering any project, the proper authority, ideally the Steering Committee, must declare that the project is in trouble and they make the commitment to fix it. This sounds obvious, but it is one of the harder actions to achieve. Pride, ego, emotion, denial and inertia get in the way. Project managers think they can correct the problems or their management comes in to help by assigning new tasks to do, processes to follow, spreadsheets to fill out and reports to generate. Eventually, the customer becomes aware of the situation and they go to Executive Management demanding action or the issues are so obvious that they can no longer be hidden. The avenue is dependant on who is paying the bill. On fixed-price projects, it is the vendor; on time-and-materials projects, it is the customer.

If the processes are working, managers will know well in advance and corrective action happens early. People, though, get in the way and continue to dilute the story as it goes up the ladder. No single person is to blame, even though the Project Manager should be validating the status. Others are part of this drift, if for no other reason than negligence. Only after senior management is aware can the problem be addressed.

A case study will help. A fixed-price project had been running for nearly three years. The project was on its third Project Manager. It was supposed to deliver in three months and executive management felt uneasy. They assigned an auditor to review the project's status at a detailed level.

The first observation was that most team members were unwilling to go onsite since the customer was overseas. The audit started at the customer site with the two or three people that were onsite. The team member's animosity toward one another was overwhelming. There appeared to be three cliques of people on the project. Few people were on speaking terms with the Solution Architect.

The customer was very upset with the lack of progress. They felt the project was far from completion and was missing required functionality. Investigation showed that there were only twenty-five change requests; most (including the largest) were no charge. Neither the auditor nor the team could see the Statement of Work since it contained commercial data. Management was solely responsible for evaluating and providing dispositions on change requests.

The Program and Project Managers referred to the problems as personality conflicts that were under control. They sincerely felt the project would deliver on time, regardless of the contradictory data.

From the conflicts in the group, it was easy to see where the system would have trouble. Any place where team communication had broken down, there would be a defect in the interface design. This approach bore fruit. Every interface investigated based on this criterion was faulty.

It required escalation to get access to the Statement of Work. The auditor determined that many of the features being developed were either out of scope or the change

request to cover them had no monetary value. Scope had been added at numerous levels. Features had been added at the technical level to use more of the products that were sold. At the Project Management level, concessions were made agreeing to more scope to compensate for the project being late. It is a common affliction of people to think that adding scope will appease the customer instead of delaying the project further and adding more cost.

### *Conclusion*

A client once said, Project Managers must take "a very practical approach to issues that doesn't gloss over what is often the key driver of success: people." The examples above bear this out. Processes can be in place, but people implement those processes in a manor of their choosing. For reasons that range from trying to please the customer, to false expectations, to doing "what feels right," the project gets in trouble and the people do what they think best to correct it without exposing the issues. The project drifts further from its intended goals.

People who can keep this in check rely on processes to show them the problems. However, these processes are failing because people are involved. People need to observe and correct the behavior. In the case studies above, executive managers started realizing that the issues existed after the projects were in serious trouble. In the latter, management was alerted by too many rumors from people inside the team. The Program and Project Manager never admitted defeat, they continued to attempt to hide the failures in the team. They, and over half of the team, were replaced. The project was in such trouble that it was restarted and the supplier lost millions of dollars, only able to save their reputation. In the first example (see Part I), the Project Manager alerted them, but was eventually replaced. The project finished with a profit.

Ignoring the issues with people and dispensing with old fashion hands-on management is the demise of many projects. Being a leader and building a strong team will give the project the highest odds for success.

# Guest Author: Pamela Churchill

### *Project Management – Getting Back to Basics*

All of us manage projects in one way or another, both professionally and personally. If you do anything that has a timeframe, a cost in effort, and a desired outcome both in terms of expectations and satisfaction, then it will probably help to review the basics. Project Management requires that you understand what you hope to achieve, and have a way to respond when it appears that your goals may not be met. When alligators surround you, it is hard to remember that your initial objective was to drain the swamp, but if you have a solid foundation, then you have a better chance of recovery and success.

Project Management is the process of completing a project on time, within budget, according to the specifications and to the client's satisfaction by following a plan to manage the resources efficiently and respond to diversions from the plan in a timely and effective manner. Let's break each of these elements down.

1. **Process –** In order to finish it successfully, view the entire project, (pre-bid, bid, mobilization, performance, closeout and post mortems) as a system of interconnected activities. Milestones measure a point in time and achieving them is cause for celebration. However, measuring progress only at the point of the milestone means there is no time to respond if you are off track. The sooner you know about something, the more time you have to correct it. Apply knowledge gained from prior projects, and constantly monitor progress to buy yourself time for the unexpected.
2. **Completing a project** – The project is not done until you have completed all the deliverables to the client, and completed a review of your job to learn from your mistakes, such as choosing the wrong type or size of job, estimating poorly, dealing with a difficult client, or not performing competently. Job closeout begins on the first day of the project. Every day, you work your plan with the goal of completing the project successfully. Keep your eye on the forest when you are lost in the trees. One of the best examples of how projects can go awry is a picture I saw of a city truck parked in a median so that the workers could erect ballasts around the median. They had completed the task so that no vehicle could enter the space. Unfortunately, for them, they forgot to move the truck. There it sat, surrounded by ballasts. More costs were incurred, and closeout delayed, even though the actual scope and deliverables were met.
3. **On time, within budget** – Set a schedule and stick with it. Know whether your costs are appropriate for progress made. If you do not know what you are trying to accomplish, how are you going to know when you are off track? In construction, it is not a matter of whether or not something will go wrong, it is a matter of when and how badly. If you are closely watching performance then you are much more likely to catch problems early, apply solutions, and stay on track.
4. **According to the specifications** – The contract documents are the Bible for the project. Hopefully, anything and everything is taken care of in the specifications so that you know what is needed when on the job. If something is NOT in the contract documents, or if there is a conflict between documents, the time to catch it is before the bid, or before you have committed yourself and lost leverage. By reviewing contract documents thoroughly, you have a much better chance of running a project smoothly because you eliminate the need to stop to hash out details on the fly. Check and fix specification issues, up front and you will not be at risk for fixing those problems when time or cost are affected.
5. **To the client's satisfaction** – The time frame, the budget, and specifications comprise the objective elements

of the project. A large part of the experience is subjective, which means that you could be successful in achieving all the objective goals, and have a client that never wants to see you darken his door again. Since each job is a marketing opportunity, it is important that the client sees you as competent, cooperative and creative. This does not mean giving away features. It means knowing your contractual obligations and knowing how flexible you can be about going beyond that without decreasing profit. Profit margin decisions need to be discussed at the highest level in an organization. Do not give away what is not yours to give.

6. **Following a plan –** Without a clear plan, you are less able to determine when you run into problems. It's a slippery slope–bit by bit you lose a little ground which doesn't seem like much at the time, but when you add it up, you're suddenly at the bottom of the hill with no idea how you got there (no big incident to blame it on) and no time to reclaim lost turf.

7. **Manage the resources efficiently** – Resources on a job are money, people, equipment, material, and other things like general and administrative expenses and consumables. You, or a designee, have to be looking out for all of these areas. Costs can stack up when there are no controls on them. If no one shuts off the cylinder rentals, money floats out the door.

**Respond to diversions from the plan in a timely and effective manner –** If you have a good grip on your plan and review it on a regular scheduled basis, you will know when something is wrong. If you immediately find out what is causing the problem, then you have accomplished the first of the four-step recovery plan: recognize the problem. Then you implement a solution, monitor the success of the solution, and make changes as needed. You may be able to blame someone, but you still need to solve the problem. That is why you are the project manager.

Pamela Churchill, principle at Shoebox Accounting Services has a long history of fighting heroically to prevent projects from going horribly wrong and developing systems to prevent companies from throwing away profits. Please contact her at pchurchill@Q.com to share horror stories, or for an opportunity to discuss your needs in strategic planning, trusting your numbers, improving productivity, and so much more. Call 503-890-1662 to set up a free 15-minute consultation to get your mind pointed in the right direction and be more successful. Diverging opinions are also welcome!

# Book Synopsis

***Six Sigma: The breakthrough Management Strategy Revolutionizing The World's Top Corporations***, written by Mikel Harry, Ph.D. and Richard Schroeder, discusses the genesis and usage of the Six Sigma techniques they developed. It provides an overview of the philosophy as well as numerous case studies to familiarize the novice reader with the concepts and to underscore the technique's usage.

**Chapter 1: Why Six Sigma**

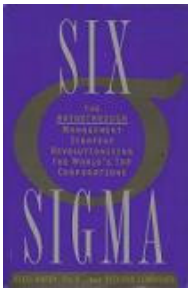
Six Sigma is a profitability program as opposed to a quality program. The goal is to increase profits by reducing defects in very specific areas of the product. This is critical to its implementation. All Six Sigma activities must have a measurable financial return.

Six Sigma is a measurement of quality and the higher the sigma number the better the quality. The term Six Sigma comes from the statistical procedures used to track defects. A process at six-sigma is producing product that has a defect level of less than 3.4 defects per million opportunities. Companies with quality levels below three-sigma do not survive for two reasons:

1. Their cost of quality is too high;
2. Customers will not tolerate the low quality.

At three-sigma the cost of poor quality is 25-40% of revenue, at four-sigma it is 15-25%, at five-sigma it is 5-15% and at six-sigma it is less than one percent.

Companies implementing the philosophy can expect a one-sigma shift per year until they reach 4.8 sigma. At this point, the company needs to shift to a paradigm of Design




***Six Sigma: The Breakthrough Management Strategy Revolutionizing The World's Top Corporations***

By Mikel Harry, Ph.D. and Richard Schroeder

2005

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For Six Sigma (DFSS). The effects of implementing Six Sigma techniques as company moves from 4.8 to 5.0 sigma are:

- Margins improve twenty percent;
- Capacity increases twelve to eighteen percent;
- Headcount decreases twelve percent;
- Capital reduces ten to thirty percent.

As already mentioned, to attain six-sigma would yield a product that has only 3.4 defective units in a million opportunities.

To give a perspective on the difference between a standard quality and Six Sigma, one can think of cleaning a carpet at normal quality levels. A 1,500 square foot carpet at standard quality levels (3.5 Sigma) would leave a four-square-foot area dirty. At six-sigma, an area only the size of a pinhead would remain dirty.

In Six Sigma, there is a specific definition of quality. A defect is anything that blocks or inhibits a process or service. Therefore, the inability to complete a form with critical information is a defect since it stops the processing of the form.

Historically, Six Sigma had its origins in the late seventies at Motorola. At that time, Motorola was spending between five and twenty percent of its revenue on correcting poor quality ($800-$900 million per year). Over four years of implementing Six Sigma the company saved $2.2 billion.

Six Sigma is implemented on a product or service, as opposed to the entire company. The implementation continues until the philosophy is pervasive in the company. All aspects of every operation in a process are analyzed to determine what can be improved. All measurements are objectively reviewed to ensure they are Critical to Quality (CTQ). If they are not they are removed. Any action critical to quality is measured or monitored.

**Chapter 2: The Yellow Brick Road**

There are eight fundamental steps in applying the strategy. These are: recognize, define, measure, analyze, improve, control, standardize and integrate. The four core phases are:

1. Measure – Understanding of how and why something is being measured;
2. Analyze – Statistical analysis of the measurements to determine the source of problems;
3. Improve – Change key variables to improve deficient areas;
4. Control – Ensure the issue does not reoccur.

A Six Sigma business initiative makes everyone accountable for profitability.

**Chapter 3: Being Better is Cheaper**

The classical method of measuring the cost of quality is called the Cost-of-Poor-Quality (COPQ). It is thought of as a leading indicator of problems. Conventional usage of this system, though, does not take into consideration many factors in the costs of poor quality and must be expanded to include all sources. These include: scrap, rework, supplier scrap and rework, inspection, testing quality audits, internal cost and maintenance of test equipment, cost to the customer, warranty cost, compliance adjustments, returned material, quality planning, process planning, process control and training. Six Sigma adds the following: increased maintenance, processing scrap, lost sales, customer dissatisfaction, downtime, engineering and product costs, development errors, bill of material inaccuracies and raw material rejection.

**Case Study: One Company's Experience: General Electric 2000**

General Electric laid the groundwork for Six Sigma prior to the 1997 implementation. Their goals were to:

1. Build trust, allowing employees to speak critically;
2. Empower the employee since they know the intricacies of their job;
3. Eliminate unnecessary work;
4. Allow employees to work across company boundaries to identify and fix problems.

This philosophy was spread through the company. It was also applied in services to decrease order-processing errors, improve call-processing response and increase the services in the fleet delivery business.

In 1997, they implemented Six Sigma with a total investment of $250 million in Black Belt training. The same-year return on investment was $300 million; in 1998, it increased $500 million, with the subsequent three-quarter savings of a billion dollar.

**Chapter 4: Benchmarking: Discovering Who is Really the Best**

Benchmarking is essential to know where the processes being analyzed sit in relationship to other processes. It helps focus the effort on the processes having the most room for improvement. Benchmarks can be obtained from inside the company, outside the company and even interdisciplinary. Start by looking at how a process works inside the company. The possibility is that different groups within the company have a significantly different performance. This will point to areas where a team can start analyzing and improving the process. When working with other companies one can use either similar or cross discipline processes. For instance, a company selling pagers has the same sales demands as one selling a variety of styles of sweaters. The key is to compare process-to-process.

Benchmarking needs to be quantitative. By looking at the *opportunities* for defects, one can do cross-process comparison. This equilibrates the analysis since a more complex product has more opportunities for defects. It is unrealistic trying to compare a complex product to a less complex one. However, looking at opportunities for defects normalizes the comparison. For instance, comparing two products, one with 600 opportunities for failure and another with only forty-eight, can be difficult. When looking at the opportunities for failure, if the products had final yields of 85% and 96.8%, respectively, the processes are equivalent since the average yield per opportunity is the same at 97.97% (3.5 sigma)—$0.85^{1/600}$ and $0.968^{1/48}$.

**Chapter 5: Changing What Companies Measure: Six Sigma Credo**

Most companies use final yield to diagnose problems. Looking at the outcome of the product or service is too late to identify the problems. The testing must be done at the process level. One must analyze the items that are critical-to-quality, relate them to processes and analyze those areas. The customer defines what is critical-to-quality. They know the items that are of value to them. The customer does not care about throughput at a given step, they care that the process step produces a defect-free product. Therefore, instead of counting parts through a step, count defects. Producing defective product has no benefit to anyone.

Too many companies focus on the technology of the product and forget to optimize the product for manufacturability. Good examples are the CD-ROM, faxes and video cameras all developed in one country with a focus on the technical achievement. Manufacturability (hence the long-term profit) was developed in another companies where process

was the focus. These companies reaped the benefit of continued sales.

**Chapter 6: Unmasking the Hidden Factory**

In simple terms, the hidden factory is the processing that happens due to defects. Much of this eludes tracking processes since the negative connotation of doing rework conditions people to bypass tracking systems.

To change this, the philosophy behind process monitoring must change. It starts with changing the metrics. Simply looking at final yield fails to produce the quality picture. For instance assume two units are produced, the first having no defects and the second having two defects. Using conventional final yield metrics the yield is 50%. However, the actual defects-per-unit is one. Statistically the two defects could have been either or both units. Therefore, the number of opportunities for defects should be measured. This results in the number of opportunities as being two for two units. Measuring the yield in this manner shows the actual capability.

Using the final yield to measure quality hides the work that is done to fix the defects. Exposing that work uncovers the real cost of the defects.

Six Sigma relies on three basic metrics: throughput yield, rolled throughput yield and normalized yield.

Throughput yield (TPU) looks at the defect per opportunity at an operation level. An operation producing five defects on a hundred units has a throughput yield on 95%, regardless if all the defects were in one unit or five.

Rolled throughput yield (RTY) is the theoretical yield of getting a defect-free product through the entire manufacturing process. A process with three steps, each step with a throughput yield of 90%, 97% and 98%, has a rolled throughput yield of 86% (0.90 x 0.97 x 0.98).

Normalized yield is the single yield number that would be required at each step to produce a given rolled throughput yield. Mathematically, it is the $(RTY)^{1/(\text{number of steps})}$, or in the previous example $(.86)^{1/3} => 95\%$.

**Case Study: One Company's Experience: Polaroid Flashes Back**

Polaroid applied Six Sigma analysis techniques to find issues in processes without needing to apply statistics.

To correctly identify the critical-to-quality features, they hired outside firms to acquire unbiased data from customers. The result was to point at process improvements that resulted in removing variation in the in-process test equipment and the need for camera flash calibration.

By observing technicians, they were able to observe small variations in procedures that resulted in quality differences in the product. For instance, one technician poured powdered chemicals directly into a vat as opposed to others that would pre-mix the powder and pouring the slurry into the vat. The former method allowed power to stick to the vat walls or to be sucked into the ventilation system. These variations in concentration affected the consistency of performance of the film, frustrating customers. The company created consistent processes and measurements to assure a reliable output. This baseline was used to judge improvements.

**Chapter 7: The Breakthrough Strategy**

The breakthrough strategy is an eight-phase process, in four broad groups, these are:

1. Identify. Look at the affect of the process on the cost or value. In these phases, the critical-to-quality elements are defined. This contains the Recognize and Define phases.
2. Characterize. Assess the process and determine the issues. The phases in this group are Measure and Analyze.
3. Optimize. Determine how to fix the problem. It contains the Improve and Control phases.
4. Institutionalize. Tie the entire business into the new process. This will affect all levels of the business, not just the process. This includes the Standardize and Integrate phases.

The eight phases in these groups need to be implemented at the three basic levels of any company—business, operation and process levels.

<u>Business Level (Applied to Business Initiatives):</u>

1. Recognize: Recognize the state of the business. The goal is to deliver defect free material on schedule at lowest possible cost.
2. Define: Define what needs improving. Relate customer satisfaction to business systems.
3. Measure: Determine a measurement to support the plan. This is a non-trivial task of determining what to measure, how to measure it and gaining executive commitment to attack the problem. It may require redesigning for manufacturability.
4. Analyze: Analyze the gaps between various benchmarks to determine where gains can be made.
5. Improve: Improve the systems.
6. Control: Implement controls on systems that are critical-to-quality.
7. Standardize: Proceed system-by-system inside the company and determine best in class processes. Once the prior steps are done, apply these processes to other systems.
8. Integrate: Apply the best-in-class processes throughout the business.

<u>Operational Level (Applied to Projects):</u>

1. Recognize: Align operational issues to business issues. Look past masking conditions that make operations look better than they are. Identify the predictive measurements.
2. Define: Define the projects for Six Sigma. The factors that influence this selection are financial, degree of connection to the critical-to-quality items, the degree of connection to the efficient and effective running of the business and the expected time to resolve the issues.
3. Measure: Perform quantitative measures.
4. Analyze: Analyze performance with respect to the goals—how did the project perform to expectations.
5. Improve: Improve the Six Sigma project management system. Track project performance (project to project)

and determine the areas for improvement.

6. Control: Control the inputs to the project management system and perform project audits.
7. Standardize: Move toward the best in class systems,
8. Integrate: Apply the best-in-class processes throughout the business.

Procedural Level:

1. Recognize: Recognize the problems and relate them to the operational issues.
2. Define: Define the procedures that contribute to the operational functions. Classify the problems into the groups: Product, service-related and transactional problems.
3. Measure: Select the critical-to-quality items, define a performance standard and validate the measurement system.
4. Analyze: Analyze the data for trends and patterns. Discover variation relationships and estimate operation tolerances.
5. Improve: Define what needs to be improved. Establish the process capability, define performance objectives and identify the variation sources.
6. Control: Quantitatively validate the system, determine the process capability and implement process control.
7. Standardize: Identify best-in-class processes.
8. Integrate: Apply the best-in-class processes throughout the business.

**Chapter 8: Measuring Performance on the Sigma Scale**

Problems are either sporadic or persistent. Most companies are good at responding to sporadic problems. The spike in issues readily points to their source. Persistent problems are harder to discover and are often hidden behind other elements such as design flaws, tolerances, vendor quality, process, training, employee cleanliness or tool maintenance. The goal is to find the vital few. As with many things, the 80:20 rule applies. Eighty percent of the defects are caused by 20% problems. The key is to find the 20% of the problems.

When identifying processes, start by placing bounds on the measurements of the CTQ items. The maximum allowed value of a measurement is the upper specification limit (USL) and the minimum is the lower specification limit (LSL). The target is somewhere in the middle. Due to normal process variation, the measurement will wander between the upper and lower limits. An industrial standard is to use 1.5 sigma as the upper and lower limits for these values. Variation is the amount of wander the central value. The top three sources for variation are design issues, vendor material variation and poor process capability. The tolerances for a process are often unrealistic. Humans are bad at defining tolerances and often make them tighter than the process will allow. This is the issue with attaining the five-sigma level of quality. The level of five-sigma is difficult to attain. As a company moves past this "five-sigma wall," they must implement a philosophy to Design For Six Sigma (DFSS). DFSS focuses on manufacturability and not features and functions. New designs geared for manufacturability make the tolerances more realistic.

The design needs to be tolerant to process variation, be capable of high-yields and efficiently use resources. Decreasing the process complexity is crucial to improving yield. For instance, an item that is processed in twenty three-sigma steps will have a rolled throughput yield of 25%. The unit taking fifteen three-sigma steps will have a yield of 35%. A 30% yield increase from a 20% decrease in complexity.

As one looks at areas for improvement (overhead, labor, material and design), their impact is unequal. Improving design has a much greater affect than changes in labor. Design may only be 5% of the actual cost of the product but it has a 70% influence on the overall cost. Therefore, a 30% savings through design simplification will decrease the product cost by 20%, the same reduction in labor cost will decrease the cost 1.5%.

**Case Study: One Company's Experience: How General Electric Used Six Sigma to Design a Multimillion-Dollar Product**

A good example of the monetary returns that can be realized can be seen in the redesign of one of GE's CAT scanners. The goal of the redesign was to improve performance and decrease maintenance costs. Various teams focused on different elements of the design and processes targeted on the critical-to-quality items. The CTQ items were the x-ray tube life, improved image quality and increased uptime. The team simplified the circuit design, improved the process for manufacturing the x-ray tube and changed the tungsten element size. These changes resulted in a machine that leapfrogged the rest of the industry.

**Chapter 9: Implementations and Deployment**

Implementing Six Sigma requires a corporate commitment. Grass roots efforts will fail. The success depends on a sincere top-down approach that interweaves employee accountability, benchmarking, stretch goals, education, feedback of successes and Champions and Black Belts that promote the process. The team must be focused on specific areas of improvement, such as cost savings, creating a desirable product, process simplification or fixing problems at their root cause.

Organizational aspects will also need to be considered. These include:

1. Selection and quantity of Black Belts;
2. Project selection process;
3. Quality metrics;
4. Integration of Six Sigma with other initiatives;
5. Accounting procedures;
6. Training processes.

The roles and responsibilities of the organization need to be defined. In broad terms these are:

- Executive management – Inspire, fund and drive;
- Senior Champion – The person responsible for corporate management of Six Sigma;
- Deployment Champion – Business unit level person responsible for deployment;

- Project Champion – Responsible for selection of projects;
- Deployment Master Black Belts – Responsible for the long range technical vision;
- Project Master Black Belts – Coordination and training of project black belts;
- Project Black Belts – Execution and onsite experts on the projects;
- Process Owners – Line managers that own that own the project's processes;
- Project Green Belts – People well versed in Six Sigma that work on a process;
- Team Members – Individuals with a fundamental understanding of Six Sigma to gather and analyze data.

For example, in one company, the implementation started with a briefing of all executive and senior management on the goals. This meeting provided a basic understanding of Six Sigma, set the goals and guidelines and defined the team. The assigned Champion created a deployment plan that defined a clustered deployment. The targeted business units designated Project Champions and they were sent to training. This group of Project Champions defined customized plans for each business unit and executed the projects.

Prior to starting other initiatives that effect process, the Six Sigma efforts should be completed. This will minimize the rework in the new initiative.

There is also non-process related planning to complete. For instance, retention of Black Belts is critical. Their work is difficult and they must be compensated for success based on the value returned to the company.

Suppliers must also follow the Six Sigma method. Reviewing the earlier discussion, vendor variation is a major source of process variation. The only way to control the supplier variation is through Six Sigma.

**Chapter 10: The Six Sigma Players: Champions, Master Black Belts, Black Belts and Green Belts**

A Six Sigma implementation must be driven from an inverted pyramid with the customer at the top and the executive leadership at the bottom. Executives must drive the initiative and make it a corporate goal. Champions report to executive leadership and mind the day-to-day work at that level. Deployment Champions drive the Six Sigma initiative in given areas and work at the project level to identify where Six Sigma will be of value and have the most impact. Master Black Belts help Champions identify the projects and train the Black and Green Belts. They also organize people, design experiments, structure and coordinate projects and meetings, teach and coach. Black belts are hands-on people that are statistical specialists for the project. Green Belts incorporate Six Sigma into the day-to-day activities, help deploy the Six Sigma technology and do small improvement projects.

**Chapter 11: Six Sigma Black Belts**

The Black Belt is the workhorse of the Six Sigma project. They characterize and optimize key processes, identify and execute projects. They spend their time in the Measure-Analyzer-Improve-Control cycle. In addition, they:

- Mentor individuals in Six Sigma processes;
- Provide formal training in new strategies and tools;
- Coach people in the project;
- Bring in new strategies and tools;
- Discover new opportunities for Six Sigma;
- Identify new business opportunities;
- Execute and take financial responsibility for the project.

A fully trained Back Belt should work on six projects and recover about one-million dollars a year. There should be approximately ten Black Belts to each Master Black Belt. Using the aforementioned financial goal, the company should train a Black Belt for each million dollars in revenue.

Training is in four phases centered on each of the Measure-Analyzer-Improve-Control phases. This will be one week of training in each area, followed by three weeks of project work in applying the lessons learned. The emphasis of their education is on tools—statistics, quantitative benchmarking, process control and designing experiments.

The characteristics of a Black Belt are:

- Highly respected;
- Understand the product, process and customer;
- Results oriented understanding the impact on the bottom line;
- Driven;
- Sponsored by a company executive;
- Expert is the given field;
- Excellent communications skills at all levels of the company;
- Inspires others;
- Challenges others to be creative;
- Capable of consulting, mentoring and coaching;
- Inventive and challenges conventional wisdom;
- Critical thinker;
- Understands mitigation;
- Accepts responsibility;
- Accepts criticism well.

**Case Study: One Company's Experience: Allied Signal's Journey to Six Sigma**

Allied Signal provides a number of lessons learned:

1. The leadership of the company must own Six Sigma;
2. Implementation is never ending. Staff turnover requires that new people are continually indoctrinated into the Six Sigma process;
3. Retain Black Belts, use their expertise, avoid placing them on non-Six Sigma;
4. Suppliers must be trained;
5. There is no such thing as operator error, it is all process error;
6. Management must be committed to the project;
7. Focus must be on the bottom line.

**Chapter 12: Six Sigma and the Service Industry**

Service positions are the largest part industry. In the United States, it accounts for 79% of all jobs. Even in manufacturing companies, 90% of the positions are service related. Service jobs have the same hidden factories that must be corrected. One can relate Six Sigma to any service by choosing a form to be analogous to a product and the people handling those forms to be the process steps. Drawing this parallel, the same rules can be applied.

One company found that 90% account receivables delinquent invoices were in excess of $10,000. They assigned delinquency reason codes to show that 80% of those fell into four classes. Root cause analysis showed that there were four sources of problems. Errors in the Purchase or Sales Order were the genesis of many errors. In a three-month project, that implemented an audit process and one computer program change, the number of delinquencies dropped by 50%, or $3.5 million in collections.

**Chapter 13: Project Selection Guidelines**

The company's strategic goals and directions set project selection. It is immaterial if the selection in top-down or bottom-up as long it meets those criteria. All projects must focus on critical-to-quality items and have at least one element of the business' key objectives. The financial return is important, but early projects should small enough to be manageable. Look for the low hanging fruit and prioritize the projects on:

1. Value;
2. Resources required;
3. Effect on sales.

**Chapter 14: The Psychology of Six Sigma**

The key to success is recognition, reward, enabling people to do the right thing and empowering the Champions, Master Black Belts and Black Belts.

At GE, Jack Welch handwrote notes to acknowledge people's successes. He stressed that for people to have a bold approach there would be failures. Lack of occasional failure meant that people were being too timid in their approach; one must take risks to make the big return.

**Chapter 15: Preparing as Organization for Six Sigma**

Results change a culture, a culture does not change results. As culture changes, people become uneasy at losing their comfort zone. Because of this, many will criticize the new processes. This is good since it defuses their fear. Exploiting successes is critical to spread the comfort of a new culture.

Executive sponsorship must be at the highest levels of the company. Executives should:

- Be cheerleaders celebrating the successes,
- Help heal the wounds of failure;
- Expedite the adoption of the new culture;
- Educate employees on the reason and need for change.

**Analysis of the Book:**

The book is a great introduction to Six Sigma, even if it is trying to sell the company's services. It is manufacturing oriented but has plenty of service examples. The case studies cover manufacturing and service applications giving the reader a thorough understanding of how it can be applied in either discipline.

As with any major corporate initiative, it is unreasonable as a project manager to pick up the book thinking of implementing it in a project. The scope of the implementation is much larger. On the other hand, if you are in executive management, this is the book to start you down that road. It does provide information on smaller changes that can be measured to improve the reaction time of the project. For instance, using Six Sigma techniques to monitor and streamline processes that are primarily internal to the project (i.e. change requests, open action items, etc.) can provide significant benefits.

# Resources and Templates

eCameron's website contains a large variety of reference materials on Project Management subjects. These include templates, processes and further discussions on a variety of topics. Please feel free to browse our site at http://www.ecaminc.com
Or contact: Todd C. Williams, Phone: 1.360.834.7361 e-mail: todd.williams@ecaminc.com Twitter: http://twitter.com/backfromred

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