

Selecting Projects where Six-Sigma can add value

اختيار أنسب المشروعات التي تحقق فيها Six-Sigma قيمة مضافة

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SIX-SIGMA PROJECTS

Juran defines project as “a problem scheduled for solution” (Juran and Gryna, 1988). While Snee defines Six-Sigma project as “a problem scheduled for solution that has a set of metrics that can be used to set project goals and monitor progress”. (Snee, 2001)

Then Six-Sigma projects revolve around one or more key areas: cost, schedule, and quality. Six-Sigma projects must align with the organization business strategies.

Projects may be developed using a top-down approach beginning by the senior leaders, or bottom-up approach beginning by process owners.

Another way to look at projects is to divide them to three types:

- 1- **Business level projects** that focus on key aspects of business success such as market share, employee retention,...etc. It may include mergers or acquisition of a businesses unit to achieve a strategic goal. This type may stretch for years.
- 2- **Operational level projects** focus on metrics related to specific functional area seeking to improve yield, labor costs,...etc, usually ends within a fiscal year.
- 3- **Process level projects** have small defined scope and designed to finish with 3-6 months dealing with cycle time reduction, defect reduction, process improvement,...etc.

Leadership council must ensure the alignment of all projects with the organization strategies and the continuity between the different types of projects. Process level projects add up to fulfill an operational level projects. Few operational level projects add up in one business level

projects. This smooth integration is not so smooth in practice, caution selection of projects are always critical.

After the approval of leadership council and the Master Black Belt, each project must be authorized and funded by a sponsor working closely with Black Belt to define scope, objective and deliverables of the project using the “Project Charter”.

The Project Charter is a tool that facilitates the consensus upon the elements of the charter among team members, and keep the team always forced.

SOURCE OF PROJECTS

Top-down projects always align with business strategy and customers needs. General needs must be broken to several **Black Belt projects** with a limited duration.

The main sources for top-down projects include:

1. Key customer requirements
2. Key cost of quality opportunities such as scrap reports, rework costs, schedule slippages ...etc.

Regarding bottom-up projects, a sponsor is needed to overcome the cons of this type.

Pros.

1. Dealing with a known problem ensures team members commitment
2. Six Sigma provides ideal opportunity for team members to demonstrate their skills to the co-workers, which is a motivating factor

3. Process level projects provide an immediate return

Cons.

1. May lack focus or do not contribute to the bottom line such as TQM projects
2. Projects may overlap or conflict with business goals

Jack Welch (previous GM of General Electric) insisted that best projects are those solving a customer's problem. Keeping the organization customer focused helps to fully understand customer needs and requirements and look to any change or designated improvement in terms of customer value enhancement. Maintaining this focus enables organization to respond to ever changing market conditions and gain a competitive edge.

Six-Sigma Project Types

All Six-Sigma projects are not created equal. Effectively managing a Six-Sigma deployment heavily depends on how well management, stakeholders and Champions understand the types of projects they are selecting and how well they ensure the projects are moving along at a reasonable pace. It is essential to understand different types of projects have varying levels of complexity. Though project characterization is a topic itself, I would still like to define some major project categories here.

- Training projects

These projects should take as long as it takes to complete training. This should be a fairly logical piece of information, but it may also be the source of the six month myth. Black Belt (BB) training generally runs five to six months. No one should be surprised if these projects take that long to

complete. Once BBs are out of training, the speed of the project treadmill varies. Occasionally, BBs will complete a training project in less time than the designated training period. If this happens regularly, the Champions should review the project selection process for adequacy.

- Optimization projects

Projects that have adequate levels of control and adequate technology are called optimization projects. They should move along quickly. There is little difference between short- and long-term capability with these types of projects, and they have good process potential. However, such conditions do not occur serendipitously. The process experts know which variables are dependent and which are independent, and these projects typically focus on adjustments to known variable relationships.

- Control projects

These are similar to optimization projects, but there's a larger difference between their short- and long-term capability. This difference indicates variation is creeping into the process over time. BBs can complete these projects in a short period because they involve identifying the sources of variation and implementing controls.

- Technology shift projects

These are projects in which there is little shift between short- and long-term capability, but the technology used in the process is simply inadequate for the job. They can be completed in a wide range of timeframes. If the shift is to a known technology, the project can move quickly. If an unknown technology is involved, it will take longer. The worst condition that may be encountered with this type of project is a

technology shift with inadequate control. Such projects are long-term and typically require containment of process defects through improved control and improved capability with appropriate technology. When processes are implemented with so little consciousness, it is highly probable the process owner does not know the leverage variables.

- Design projects

These projects take a long time to come to fruition because we have culturally allowed design activities to meander lackadaisically until they hit some sort of production deadline. Nothing in the Six Sigma methodology will alter this behavior unless the design cycle time becomes the project. John Lupiensi, quality director at Motorola Automotive, says, “When culture and strategy clash, culture invariably wins out.”¹ Industries with very short development times, such as the computer industry, are the only exception.

COMPREHENDING A PIPELINE

Believing you can manage a Six-Sigma project pipeline without recognizing the differences between projects is as delusional as thinking all projects take six months to complete. Companies involved in Six-Sigma frequently turn to elaborate, and often expensive, software to manage their Six-Sigma programs.

Unfortunately, the Six-Sigma initiative needs to be led, not managed. Software also acts as a crutch for managers who are not involved but wish to appear so. Such management software packages are typically no different than any other form of automation. If you automate a bad process, it is still a bad process.

The first step in managing the pipeline, therefore, is to have a queue of projects waiting for BBs to complete. In a profession that loves metrics such as equipment utilization, leaving a BB with anything less than three projects—one in the define and measure stages, one in the analyze and improve stages and one in the control stage—is the equivalent of not running a process when it should be run. The queue should contain projects that are categorized, based on the best available data, into the previously mentioned project categories.

Figure 1 Project queue



Source: Quality Progress - The project pipeline – May 2003

The projects should be matched up with the results the company expects. If the company doesn't have expectations, then you should view the project as the rest of the organization will. For example, if you are consuming company resources, it is likely the Six Sigma program will not garner much support. It will be viewed as a black hole for company resources.

A constant flow of results will generate the best support from the organization. These results need to be viewed as an integrated and contributing part of the company. BB projects should always involve teams of people, not just BBs. These teams are resources that belong to the balance of the organization. If you expect the organization's support, you have to support its goals and objectives.

Project Mix

As projects are assigned to various BBs, Champions should analyze the mix of projects. If the pipeline is full of control type projects, a lot of projects will be finishing up quickly. This is not an ideal situation because a lot of fast projects could throw the organization into chaos as it tries to digest all that change.

Volume overload could cause some completed projects not to be implemented, negatively affecting the overall health of the Six-Sigma program.

In addition, loading the company down with a lot of technology projects can cause everything to be completed either all at once or not at all. You should aim to have a balanced program that contains a mix of all types of projects.

As you develop and define projects, you should collect data on how long the projects actually take to complete and then categorize the projects. Just as BBs use data to analyze and deliver results, Champions, stakeholders and Six-Sigma managers should develop their own data to determine the mix they are putting into the pipeline. Data by category and by phase should be available to the leadership team so the team members can make decisions on assignments and evaluate whether the projects are progressing at a normal pace.

Data Analysis by Classification

The data collected can be statistically analyzed. It can be stratified at various levels for a micro analysis or combined to present a larger overall picture of the Six-Sigma program. This analysis does not require a highly sophisticated piece of software; you can easily analyze the data with a pivot table and an Excel spreadsheet.

As a project progresses through the five typical phases—define, measure, analyze, improve and control— you can measure in days how much time each phase took. Tighter resolution would not make sense. After several projects have been run, each phase will have its own mean, standard deviation and variance.

These statistics will help you evaluate whether a project is progressing normally. Recognizing more than the average length of time allows you to understand how long a project will likely take. Using the statistics from each phase and summing the means, you can calculate an overall average length of time for that type of project.

Summing the variances and taking the square root of the variance allows you to calculate a standard deviation for the overall classification. With a mean and standard deviation, you can establish a basic probability for how long a project should take to complete.

If we were to collect data for all the projects in a deployment for a year, for example, the summary statistics could be collated in a table. This would allow us to analyze the project data. If we were managing a relatively mature product, we might be looking at a majority of optimization projects that can be completed on an average of 13 days with a distribution of three to 23 days. As the leader of the Six-Sigma program, I would then need to have a larger queue of projects waiting because I am expecting quick results. If I follow the proposed project loading, then I would expect the BB to complete the define and measure phases in one to nine days (an average of three days with a standard deviation of 1.7 days).

Table - Statistics Summary

	Optimize		Control		Technology shift		Technology shift/control	
Project phase	Mean	Variance	Mean	Variance	Mean	Variance	Mean	Variance
Define	1	1	2	2	2	2	2	1
Measure	2	2	4	2	4	2	3	3
Analyze	2	2	10	4	28	3	26	7
Improve	6	2	7	3	8	2	23	4
Control	2	4	14	6	19	4	12	6
Total	13	11	37	17	61	13	66	21
Standard deviation		3.3		4.1		3.6		4.6

Source: Quality Progress - The project pipeline – May 2003

I would need to be prepared to launch a second project in the one- to nine-day time frame as the first project moves on to the analyze and improve phases. I would expect the project to move through those phases in a 2 to 14-day period (an average of 8 days with a standard deviation of 2 days). As you can see from the data, it would be easy to end up with two projects in the analysis and improving phases simultaneously due to the differences in the widths of the distributions.

You would not have the BBs launch another define and measure project until one of the analysis and improving projects moved to the control phase. If I go to the other extreme of the technology shift/control type projects, the data tells us the project will take an average of 66 days. The distribution of completion times will be between 52 and 80 days. This is a huge difference from optimization projects. We will need fewer projects in the pipeline to keep the BB's time effectively utilized. The projects will be consuming more resources because they involve more time and activity so the payback should be higher.

A more effective scenario might be to assign a BB a project that will run longer term and fill in the balance of his or her workload with shorter

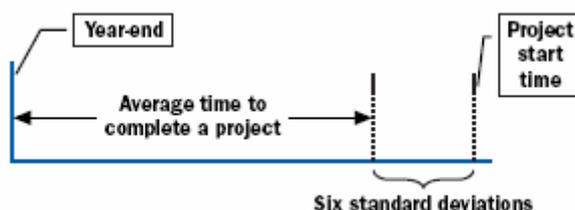
term control and optimization projects. In the long run, it could keep the BB more energized than allowing him or her to get bogged down in several slow moving projects.

The data will also allow you to understand your BBs' capabilities. Frequently they are given a goal to complete five projects per year. If a BB were to be assigned five optimization projects and each project ran to the high end of the distribution, the BB would be assigned about 115 days of work for the year. That is a sub-optimized process.

Five technology shift/control projects, on the other hand, would end in frustration because those five projects would take an average of 330 days to complete. This option is also unacceptable.

These times have been calculated on a ± 3 standard deviation analysis, but they can be completed using any number of standard deviations. There should always be a queue of projects for each BB. If a BB were to complete a project early, say at -5 standard deviations, there wouldn't be an issue if the queue were in place. The interval can be adjusted to suit the situation.

Figure – Back calculating a Project's start time



Source: Quality Progress – The project pipeline - May 2003

Other Uses of Pipeline Data

As project data becomes more accurate, it becomes more useful in terms of planning. When you generate the Annual Operating Plan (AOP), it can help determine the probability of completing various projects scheduled for the coming year. If you use the time data and classifications, a more accurate picture based on start times of when a project will be completed emerges.

This data is useful in establishing staffing requirements as well. If headcount will be used in several long-term projects, it could cause shortages in BB availability for the shorter projects. The data may also be useful in determining the project mix for the various BBs.

As improvement targets are established in terms of dollars saved, the database can be augmented with financial data. This will give you access to the added dimension of dollar savings over a particular period. If the targets require dollars saved by year-end, for example, the start times may be back calculated from the savings requirements (assuming savings do not begin until the project is completed). If the end date is known, using the mean and standard deviation will allow you to understand not only when it should begin but also the probability of whether it will end when scheduled.

Data Analysis by Black Belts

The Champion can use the database during project reviews. Project data can be analyzed to evaluate whether a project is progressing normally. If you evaluate the project's current time using the mean and standard deviation, you can calculate a z value. This value will reflect the

probability the project is progressing as normal. The question then becomes: Is the project taking too much or too little time?

However, you need to be cautious when using this type of analysis. If the manager's intent is to force all projects into a particular distribution, then the projects should be in a different area. The data is useful to leaders as a management tool. They flag events that are different from what occurs in a normal project. A leader, as opposed to a manager, can use the data to formulate questions during a review, including:

- This project seems to be running long term. Is there some type of roadblock I can help you with?
- This project was completed very quickly. Was it really a Six Sigma project? Should we evaluate how we are selecting Six Sigma projects?
- The improve phase of this project is running a little long. Should this project have been classified as a technology shift project rather than a control project?

The database can also be evaluated from the standpoint of the individual BB's overall performance. All BBs can have their various types of project data calculated and compared to the database. This type of analysis can be used to identify BBs who have a particular talent for certain types of projects. Rather than forcing BBs into areas in which they may not excel in an effort to round them out, apply a "break all the rules" mentality and use the BBs where they perform best. If, in the project selection phase, a project that requires a technology shift and a control shift is identified, identified, the data can be used to pair up BBs with the skills needed to accomplish these tasks.

Control your program results BBs are schooled to solve problems with data and find leverage in decision making through the use of statistics. This same discipline can be used to lead the Six Sigma program. Leadership should understand program results are the “y” in the basic problem solving equation, $y = (f)x$. Projects are the independent variables otherwise known as x’s. We control the program results by quantifying and analyzing the x’s or projects.

Applying basic analysis techniques can also serve as flags for leadership so they can realize when a project requires intervention. It can also help a company with project assignments and AOP analysis.

The data collection and analysis discussed here are presented in the context of a Six Sigma pipeline, but these tools will work in other applications as well. They are directly applicable to sales pipelines and situations in which the same types of steps are used repeatedly, such as in new product launches.

STEPS TO PROJECT SELECTION

Six-Sigma initiatives encounter many paths of resistance, including project selection and the maintenance of a continuous flow of value added projects. Follow these three steps to establish a sound method of selecting projects:

1. Identify a project selection steering committee.
2. Institute a project selection matrix.
3. Schedule fixed customer and project evaluation meetings.

1. Project Steering Committee

Think of the steering committee as the initiative's backbone that sends signals to the rest of the body. It should be made up of the decision makers and drivers of the organization and should include the entire executive board or a portion of it. Executive involvement shows there is top-down management support for the initiative, and all facets of the business and the voice of the customer are represented.

An executive board typically consists of the CEO, CFO, legal counsel and heads of manufacturing, marketing and sales, R&D, IT and HR. With all the areas of the business included in the decision/steering process, the roadblocks can be easily broken down once all members of the board agree to the initiative. Top management's overt demonstration that it is the main driver of the initiative will grow support on appearance alone and will help the executives enable the teams and practitioners to overcome roadblocks and seemingly insurmountable resistance.

An additional benefit was that the executive board members gained the potential to increase two-way communication in the organization and promote recognition of team accomplishments. This visual perception is a nice benefit of the executive board's involvement in driving the initiative, but the true value added advantage occurs with the removal of obstacles and the increased communication in the organization I have seen members of the executive board be reluctant to the point of apathy on a Six Sigma initiative, but once a few small successes in other areas start to grow into big accomplishments, the reluctant executives begin to take notice of the tangible benefits.

People in areas such as finance, marketing and HR believe Six Sigma is for manufacturing and R&D and only they need to support the initiative. But successful projects will help the reluctant groups see how Six Sigma can be applied in their areas.

The executive board indirectly represents the voices of both internal and external customers. For a business to be successful, its managers must listen to the voice of each type of customer and prioritize the importance of the different voices. The different areas of the business are represented on the executive board and, therefore, allow the honest voices of all the internal and external customers to be heard. The voice of the customer, whether internal or external, will drive project selection and create a steady supply of projects.

External customer voices include feedback on warranty issues, delivery promise times, order completeness, parts in specification and defect free products; internal customer voices include feedback on incorrect orders, replenishment, testing accuracy and defect free products. The negative voices are signs the business may not be running as efficiently as it can and will give direction to what may minimize or eliminate customer issues.

2. Project Selection Matrix

The project selection matrix should be completed by using information gathered from customers about their experience, and should be driven by the steering committee. The matrix is a simple but concise way to assess worth of a project based on the voice of the customer. It consists of customer issues, projects and a ranking metric. To begin a project selection matrix, the steering committee must make sure some basic data is gathered.

Usually before the first steering committee meeting, a homework task should be assigned by the committee chair (ideally the CEO). The day before the meeting, each committee member should compile a list of all projects and all internal and external customer issues or deficiencies.

The initial matrix may be big due to the input from multiple departments and many outstanding issues, so the data should be set up on a spreadsheet. At this point, the committee should not fill in the ranks because it hasn't come up with a ranking method.

The committee should then set up the ranking system on a scale of 0 to 10. The first rank order system will be the one used in the customer importance area. Establish the criteria so the lowest number represents issues that are less bothersome for the customer, and the highest number represents issues critical in maintaining customer satisfaction. The next ranking system will involve establishing and defining the relationship of projects to customer issues.

Figure -Part of an organization-wide Spread sheet

	Missing parts ordered	Late delivery	Damaged orders	Wrong orders	More parts than ordered	On hold too long	
Customer issues							
Customer importance	8	5	7	10	3	3	

Project	<i>Project ranking based on correlation to customer issues</i>						Project ranking metric
Order fill process flow optimization	5	8	3	3	5	0	146
Replenishment cycle time reduction project	5	8	5	0	0	0	115
Customer service feedback reporting	5	3	3	8	0	5	171
Delivery vendor certification	0	10	8	0	0	0	106
IT upgrade and process integration	7	5	0	8	8	3	194

Customer importance	Relationship to customer importance
0	Not important
3	Slightly important
5	Important
8	Very important
10	Critical

Project rank	Relationship to customer issue
0	No correlation
3	Very little correlation
5	Some correlation
8	High correlation
10	Complete correlation

Source: Quality Progress – Three steps to project selection - November 2002

Once the data have been gathered and the ranking systems established, each committee member should individually rank the customer issues and projects. The average for each field can then be used to complete the project selection matrix, and the group should decide how many decimal places, if any, to use.

The committee should use common sense to rank the issues. If a ranking looks skewed, the committee should investigate that individual rank and come to a consensus. The project ranking metric comes from multiplying each project ranking number by the customer importance number and adding the values for that particular project. For example, order fill process flow optimization is expressed as $(5 \times 8) + (8 \times 5) + (3 \times 7) + (3 \times 10) + (5 \times 3) + (0 \times 3) = 146$. The steering committee has set the project priority after the project ranking metric is established for each project. The higher the number, the more the project impacts customer issues.

Establishing a project selection matrix takes the guesswork out of selecting Six Sigma projects. It focuses on all outstanding internal and external customer issues relative to all departments within the business. The process provides a simple and straightforward way to gather the appropriate data from all areas of the business, establish a ranking system and rank the areas, thereby producing a priority list of projects.

3. Customer and Project Evaluation Meetings

The next critical step for any Six Sigma initiative is to ensure a continuous supply of value added projects that reflect the needs of the customer. To do this, the committee should hold regular meetings to address project status, new customer issues and project reprioritization.

Steering committee meetings should occur monthly to keep the focus on the Six Sigma initiative and the projects that address customer issues. The meetings should begin during the first six months of the initiative and continue to build team dynamics, gain a working understanding of the

project selection matrix process and emphasize to the organization the committee's dedication to Six Sigma.

Once the initial six month period is over, the committee will need to assess the best meeting time intervals. Due to the length of most Six Sigma projects— three to five months—meeting on a quarterly basis is an efficient way to assess customer needs, project status and new projects.

Three things should be addressed after the committee begins meeting:

1. The ongoing status of active projects.
2. New customer issues.
3. The establishment of a new project priority list.

The status report of all active projects should include successes, roadblocks, project improvements and project savings. This format shows the merits of a particular project and puts the responsibility for removing the roadblocks on the committee. Remember, this is an executive update so the status report should take only two to five minutes, unless there are questions or inquiries proposed by the committee.

After each project leader has presented the status of his or her team's project, the committee should bring up any new customer issues that have arisen since the last meeting. All new customer issues should be added to the matrix and each member of the committee should rank the customer issue and the relationship to the projects listed.

In the example in the next Figure, the head of marketing and sales said her sales force was receiving feedback from the field about excessive multiple billing.

The steering committee did not have a project that had a strong influence on the issue, so it decided to add one to optimize workflow and reduce errors in the accounts receivable department. The CFO became the project Champion and selected the appropriate team to tackle the issue.

Figure - Updated Project Selection Matrix

Customer issues	Missing parts ordered	Late delivery	Damaged orders	Wrong orders	More parts than ordered	On hold too long	Multiple billing
Customer importance	8	5	7	10	3	3	3

Project	Project ranking based on correlation to customer issues							Project ranking metric
Order fill process flow optimization	5	8	3	3	5	0	1	149
Replenishment cycle time reduction project	5	8	5	0	0	0	0	115
Customer service feedback reporting	5	3	3	8	0	5	5	186
Delivery vendor certification	0	10	8	0	0	0	0	106
IS upgrade and process integration	7	5	0	8	8	3	5	209
Accounts receivable process optimization	0	5	0	2	4	0	9	84

Customer importance	Relationship to customer importance
0	Not important
3	Slightly important
5	Important
8	Very important
10	Critical

Project rank	Relationship to customer issue
0	No correlation
3	Very little correlation
5	Some correlation
8	High correlation
10	Complete correlation

Source: Quality Progress – Three steps to project selection -November 2002

Whenever the committee adds new customer issues and rankings, it may end up reprioritizing all the projects, or it may need to select a new project to meet the needs of the new customer issue. When the committee is reassessing the matrix, it should remove the issues solved with project completions or other outside influences from the matrix. Just because a project is on the matrix does not mean it has to be active. The purpose of the matrix is to provide a systematic way to allocate money and resources to address crucial customer issues and needs.

In the end, the steering committee will drive project selection by influencing different projects related to customer issues. The pain and anguish of project selection is removed by listening to the customer and having the steering committee made up of the executive board to drive the projects and remove barriers.

The fact the committee will meet on a regularly scheduled basis, review the status of all active projects, incorporate all new customer issues and reevaluate the project selection matrix allows the business to have a steady supply of value added projects feeding customer needs.

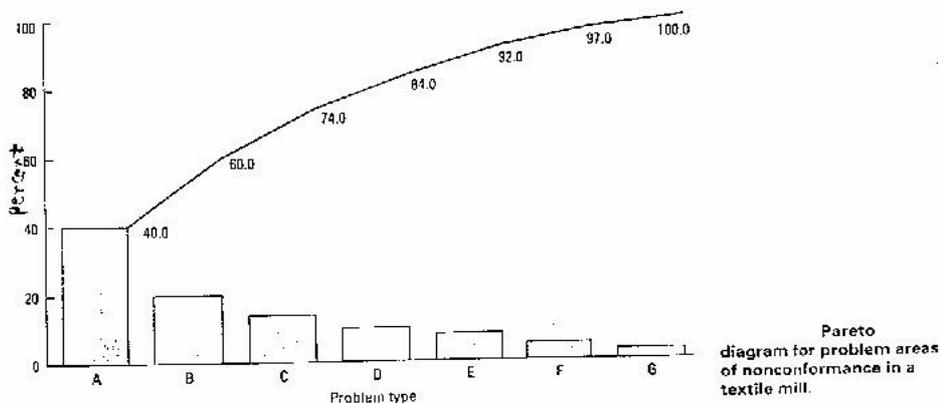
Another way Selection based on cost-benefit analysis

Six Sigma projects should be selected based on cost-benefit analysis such as Pareto Priority Index (PPI):

$$\text{PPI} = \text{Dollar savings} * \text{Probability of success}$$

$$\text{Implementation cost} * \text{Completion time}$$

This index is very simple to calculate, but it ignores intangible (non



financial) benefits.

Source: Quality Progress – How to scope DMAIC projects - January 2003

CRITERIA FOR PROJECT SELECTION

The best selection criteria is based on selecting the project that best meet your current needs, capabilities and objectives.

- Impact on business criteria:

This criteria relates to various impacts on business such as: impact on payable customers, impact on business strategy, impact on core competencies, financial impact, does the problem follow a trend, is it urgent or does this project block other projects or improvement initiatives.

- Feasibility criteria

Refers to the means of deploying the project such as: required resources, availability of expertise and knowledge required, the complexity of developing /implementing the solution, time frame, key groups support, and the likelihood of success.

- Impact on organization criteria

Projects can add to the organization in terms of incremental upgrade to the knowledge gained, and help remove the barrier between department facilitating cross-functional processes.

LESSONS LEARNED

1. Make sure that the time is right.
2. The enthusiastic commitment of top management is essential.
3. Develop an infrastructure.
4. Commit top people.
5. Invest in relevant hands-on training.
6. Select initial projects to build credibility rapidly.
7. Make it all pervasive, and involve everybody.
8. Emphasize Design for Six Sigma (DFSS).
9. Don't forget design for reliability.
10. Focus on the entire system.
11. Emphasize customer critical to quality characteristics.
12. Include commercial quality improvement.
13. Recognize all savings.
14. Customize to meet business needs.
15. Consider the variability as well as the mean.
16. Plan to get the right data.
17. Beware of dogmatism.
18. Avoid nonessential bureaucracy.
19. Keep the toolbox vital.
20. Expect Six Sigma to become a more silent partner