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The Financial Case for Improvement

Key Learning Points

1. Recognize how the finance department fits into an improvement project.
2. Explain why financial assessment and sign-off is necessary.
3. Describe how to work with the finance department to get the best project results.

COPQ

The costs of poor quality are those costs that would disappear if every task were continuously performed without deficiency every time.

The equation for COPQ is as follows:

- Actual Cost - Minimum Cost = COPQ

Caution: Minimum cost is not necessarily equal to standard cost. Standard costs often include allowances for defects, spoilage, or loss.

The Tip of the Iceberg

by Joseph A. De Feo

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Company X wanted to reduce operating costs by 10%. It began with a mission to have each executive identify where costs could be cut in business units. The executives created a list of 60 items, including things like eliminating quality

audits, changing suppliers, adding new computer systems, reducing staff in customer services and cutting back R&D.

For example, the executives removed functions that provided quality and services to meet customer needs. They bought inferior parts and replaced computer systems at great expense. They disrupted their organization, particularly where the customers were most affected, and reduced the potential for new services in the future.

After accomplishing this, most of the executives were rewarded for their achievements. The result? Their cost reduction goal was met, but they had dissatisfied employees, upset customers and an organization that still had a significant amount of expense caused by poor performance.

Misconceptions about the cost of quality

The financial benefit to the bottom line of an organization's balance sheet by improving the cost of quality with initiatives such as Six Sigma is not always fully appreciated or understood. This misunderstanding stems from the old misconception that improving quality is expensive.

This misconception is partially true. For example, if my organization provides a service to clients for a given price and a competitor provides the same basic service with enhanced features for the same price, it will cost my company more to add those features that the competitor already provides. If my organization doesn't add those features, it will lose revenue because customers will go to a competitor. If we counteract by reducing the price, we will still lose revenue.

In other words, the quality of my competitor's service is better. For my organization to remain competitive, it will have to invest in developing new features. This positively affects revenue. To improve quality, features have to be designed in—or in today's terminology, a new design must be provided at Six Sigma levels. Because of this historical misconception, organizations do not always support the notion that a Six Sigma initiative will affect costs other than add to them. They overlook the enormous costs associated with poor performance of products, services and processes—the costs associated with not meeting customer requirements, not providing products or services on time or reworking them to meet customer needs. These are the costs of poor quality.

If quantified, these costs will get immediate attention at all management levels. Why? When added together, the costs of poor quality make up as much as 15 to 30% of all costs. Quality in this complete sense, unlike the quality that affects only income, affects costs. If we improve the performance of products, services and processes by reducing deficiencies, we will reduce these costs.

To improve the quality of deficiencies that exist throughout an organization, we must apply breakthrough improvements. A Six Sigma initiative focused on reducing the costs of poor quality due to low sigma levels of performance and on designing in new features (increasing the sigma levels) will enable management to reap increased customer satisfaction and bottom-line results.

I have seen too many organizations reduce costs by eliminating essential product

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or service features that provide satisfaction to customers while ignoring poor performance that costs the bottom line and shareholders millions of dollars.

Another example Company Y approached its situation differently than did Company X, as described at the beginning of this article. The executives identified all costs that would disappear if everything worked better at higher sigma levels. Their list included costs associated with credits or allowances given to customers because of late delivery, inaccuracy or errors in billings, scrap and rework, and accounts payable mistakes caused by discount errors and other mistakes. When this company documented its costs of poor quality, the management team was astounded by the millions of dollars lost due to poor quality of performance within the organization.

This total cost of poor quality then became the target. The result? Elimination of waste, a return to the bottom line from planned cost reductions and more satisfied customers. Why? Because the company eliminated the reasons these costs existed in the first place. There were process and product deficiencies that caused customer dissatisfaction. Once these deficiencies were removed, the quality was higher and the costs were lower.

While responding to customer demands for improved quality in everything an enterprise does is becoming essential, organizations should not overlook the financial impact of poor performance. In fact, the cost of poor quality should be the driver of the project selection process for Six Sigma.

In other words, the cost of poor quality provides proof of why changes must be made. The need to improve an organization's financial condition correlates directly with the process of making and measuring quality improvements. Regardless of the objective you start with, enhancing features as well as reducing the cost of poor quality will impact the continuing financial success of an operation.

While there is a limit to the amount quality can be improved when cost effectiveness and savings are measured against the costs of achieving them, it's not likely this will occur until you approach 5- or 6-sigma levels. A business must pursue the next level of quality based on what is of critical importance to its customers. If customers demand something, chances are it must be done to keep their business. If they do not, there's time to plan-ahead.

Driving bottom-line performance

If you accept the reality that customers and the marketplace define quality, look at Figure 1, which describes my basic message on how to grow the bottom line. If you have the right product or service features and lower your deficiencies, loyal customers are developed. With a competitive price and market share strongly supported by fast cycle time, low warranty costs, and low scrap and rework costs, revenue will be higher and total cost lower. The substantial bonus that falls to the profit column comes, in effect, from a combination of enhancing features and reducing the costs of poor quality.

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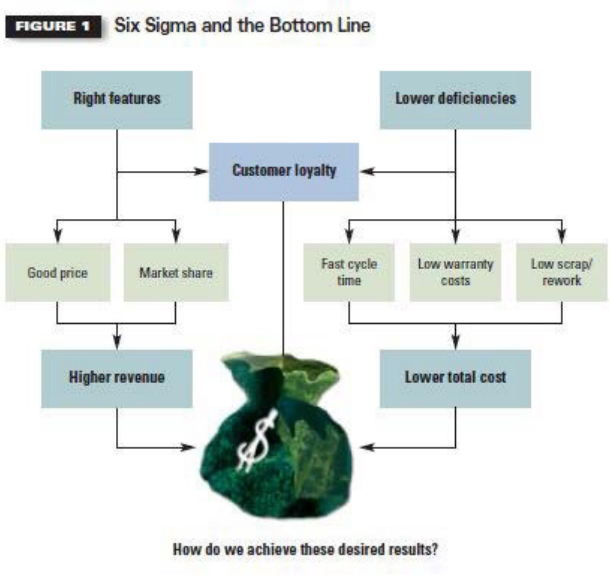
Figure 1



Before getting into specific ways to identify, measure and account for the impact of costs of poor quality on financial results, let's take a quick look at what to do first if you are trying to understand how the costs of quality can drive a financial target. If, for example, your organization sets a target to save $50 million, there is a simple methodology to determine how many improvement projects it will take to reach that goal. The organization can then manage the improvement initiative more effectively if it puts some thought behind how much activity it can afford. The answer will help it know how many experts or Black Belts are needed to manage the improvements and how much training will be required. The methodology includes the following six steps:

1. Identify your cost reduction goal of $50 million over the next two years—$25 million per year.

2. Using an average return of $250,000 for each improvement, calculate how many projects are needed to meet the goal for each year. For this example, we would need an incredible 200 projects (100 per year).

3. Calculate how many projects per year can be completed and how many experts will be required to lead the team. If each project can be completed in four months, that means one Black Belt on two projects per four months. Hence, one Black Belt can complete six projects in one year. We will then need about 17 Black Belts.

4. Estimate how many employees will be involved on a part-time basis to work with the Black Belts to meet their targets. Assume four per Black Belt per four months. We would need about 200 employees involved at some level each year, possibly for as little as 10% of their time.

5. Identify the specific costs related to poor performance, and select projects from this list that are already causing your organization to incur at least $250,000 per deficiency. If you haven't created this list, use a small team to identify the costs and create a Pareto analysis prior to launching any

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projects.

6. Use this method and debate each variable among the executive team to ensure the right amount of improvement can be supported. All organizations make improvements, but world-class organizations improve at a faster rate than their competition.

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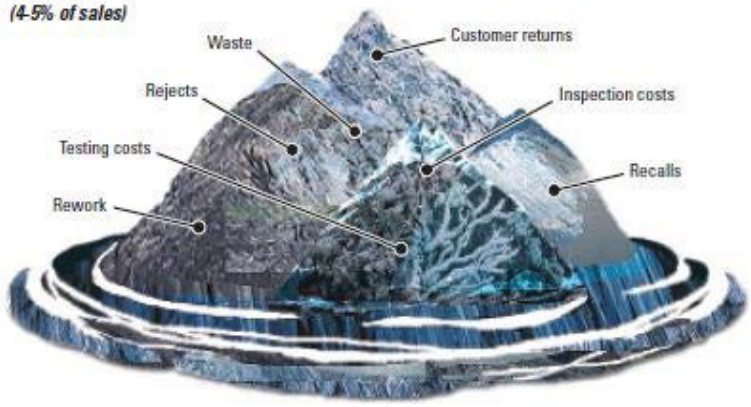
Where to find costs of poor performance

To put targets of opportunity into perspective, look at the traditional costs of poor quality and, even more critically, the hidden costs of poor quality, as shown in Figures 2 and 3. It is the hidden costs that must be quantified to get a complete picture of losses due to poor performance. These costs of poor quality could disappear entirely if every activity were performed without deficiency every time.

Figure 2

FIGURE 2 Traditional Cost of Poor Quality

When quality costs are initially determined, the categories included are the visible ones, as depicted in the iceberg below:



Three major categories of costs of poor quality exist in organizations:

1. Appraisal and inspection costs.
2. Internal failure costs.
3. External failure costs.

Appraisal and inspection costs

Appraisal and inspection costs are costs associated with inspection—checking or assuring that deficiencies are discovered before customers are affected. Examples include:

- Testing products or checking documents before providing them to customers.
- Reviewing documents and correcting errors before mailing.
- Inspecting equipment or supplies.

- Proofreading reports or correspondence.
- Auditing customer bills prior to sending invoices.
- Retooling due to poor design.

Discovering deficiencies at this stage avoids serious failure costs later and helps develop more effective and efficient inspection methods. There will always be some costs in this category because some level of auditing will be needed to assure consistent performance. The point is to avoid excessive costs.

Internal failure costs

Failure costs within an organization are attributed to the repair, replacement or discarding of defective work the customer does not see. Examples include:

- Replacing metal stampings that do not meet specifications during production.
- Repainting scratched surfaces.
- Making up for unplanned computer downtime.
- Replacing components damaged when being moved from one station to another.
- Rewriting parts of a proposal.
- Working overtime to make up for slippage.
- Correcting database errors.
- Stocking extra parts to replace defective components.
- Scrapping products that do not meet specification.
- Spending excess accounts payable time to correct supplier invoice errors.
- Engineering change notices to correct errors in specifications or drawings.

These costs may affect customer service indirectly.

External failure costs

External failures affect customers directly and usually are the most expensive failures to correct. External failure costs may result from:

- Satisfying warranty claims.
- Investigating complaints.
- Offsetting customer dissatisfaction with a recovery strategy.
- Collecting bad debts.
- Correcting billing errors.
- Processing complaints.

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- Expediting late shipments by purchasing more expensive means of transportation.
- Replacing or repairing damaged or lost goods.
- Housing stranded passengers from cancelled flights.
- Paying interest or losing discounts for late payments to vendors.
- Providing on-site assistance to customers when field problems occur.
- Providing credits and allowances to clients for lack of performance or late deliveries.

Efforts to correct external failures usually focus on regaining customer confidence or lost sales. Both are debatable costs that may or may not be fully calculated.

Interpreting the costs of poor quality

The costs of poor quality at this stage are determined by educated estimates used to guide organizational decisions. They should not be part of a monthly financial analysis, although understanding these costs may affect the way financial and cost accounting data are compiled and interpreted.

The precision required to identify the costs of poor quality varies depending on how data are used. When used to help select an improvement project, data need not be as precise as those used in developing new budgets for a process after it has been approved.

When you are evaluating projects, data on poor quality help identify, charter and support projects with the greatest potential for reducing costs. Black Belts and teams may select some projects because of the impact on customers or internal culture, but data must show where costs are highest so focus can be concentrated on the vital few.

The amount of cost reduction provided by a remedy is another indicator of project effectiveness. When planning for a remedy, a task force should develop supportable estimates of costs that will be eliminated by the remedy and use those estimates to develop a budget for the revised process.

There are four major steps in measuring the costs of poor quality:

1. Identify activities resulting from poor quality.
2. Decide how to estimate costs.
3. Collect data and estimate costs.
4. Analyze results and decide on the next steps.

Identify activities resulting from poor quality

Activities are categorized as resulting from poor quality only if they exist solely because of deficiencies assessed when doing appraisals, inspections, and internal or external cost estimates.

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A project team usually begins by measuring the obvious costs of a problem's primary symptom, such as discarded supplies, customer complaints or erroneous shipments. After a flow diagram of the process in question has been created and further analysis has been conducted, additional activities are usually identified as those required, for example, to dispose of and replace returned items.

Efforts to identify remedial activities are generally more global since the focus is on costs of poor quality throughout an organization. These efforts are best undertaken by one or a small number of analysts working with a team of mid-level and senior managers experienced in key areas.

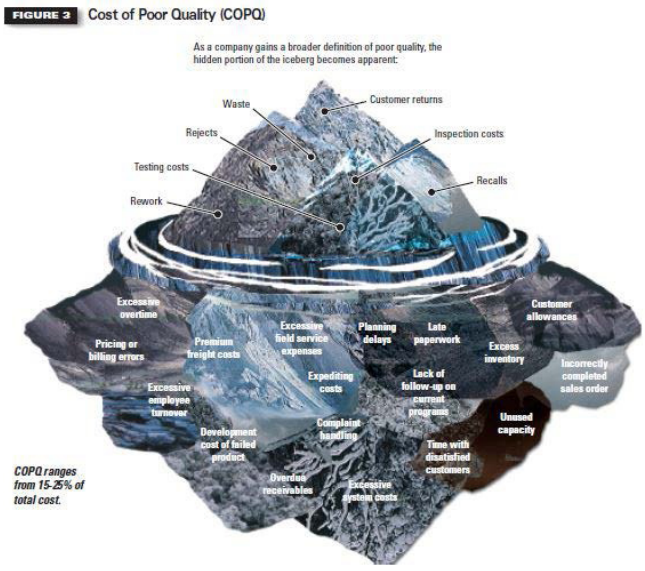
The task force usually launches its efforts by identifying major organizational processes and their customers. For each process, the task force brainstorms major activities associated with poor quality and expands the list through carefully constructed interviews with individuals representing different levels within the most critical functions. At this point, the objective is to prepare a list of activities related to poor quality, not estimate costs.

Project teams and task forces find it easier to explain what they are looking for if they have a full list of typical examples associated with poor quality. The examples described earlier fall into major categories of poor quality costs. Using key words such as rework, waste, fix, return, scrap, complaint, repair, expedite, adjust, refund, penalty, waiting and excess usually stimulates a healthy response, too.

Decide how to estimate costs

When a specific activity related to poor quality is identified, two strategies help estimate its costs: total resources and unit costs. These strategies can be used individually or together. An example of the total resource approach is how an operational unit calculates the human resource time to process customer complaints and the dollar value of that time. This approach requires two pieces of data: total resources consumed in a category and the percentage of those resources consumed for activities associated with poor quality.

Figure 3



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An example of the unit cost approach is when a project team calculates the annual cost of correcting erroneous shipments. To find that cost, the team should estimate the cost of correcting an average erroneous shipment, count how many errors occurred in one year, and then multiply the average cost by the annual number of errors.

Data for calculating the total resources used in a category might come from a variety of sources such as accounting, time reporting, other information systems, informed judgment, special time reporting, special data collections and unit costs. These sources are described "Calculating Resources Used."

Collect data and estimate costs

Procedures for collecting data on costs of poor quality are generally the same as those for any good data collection:

- Formulate questions to be answered.
- Know how data will be used and analyzed.
- Determine where data will be collected.
- Decide who will collect it.
- Understand data collectors' needs.
- Design a simple data collection form.
- Prepare clear instructions.
- Test forms and procedures.
- Train data collectors.
- Audit results.

To estimate the costs of poor quality, it is sometimes necessary to collect personal opinions and judgments about relative magnitudes of time spent or costs. Even though precise numerical data are not required for such estimates, it is important to plan carefully. The manner in which opinions are solicited affects responses.

Sampling works when the same activity is performed often in different parts of an organization. All field sales offices, for example, perform similar functions. If a company has 10 field sales offices, estimates from one or two would provide a reasonable value for calculating overall costs of poor quality.

Analyze results and decide on the next steps

Collecting data on costs of poor quality helps make decisions such as: • Selecting the most important quality improvement projects.

- Identifying the most costly aspects of a specific problem.
- Identifying specific costs to be eliminated.

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The results

Of note is that every organization that has adopted Six Sigma and integrated the discipline throughout its operations has produced impressive savings to the bottom line. More customers were satisfied and became loyal, and revenues, earnings and operating margins improved significantly.

For example, Honeywell's cost savings have exceeded $2 billion since it implemented Six Sigma in 1994. At General Electric, the Six Sigma initiative began in 1996 and produced more than $2 billion in benefits in 1999. Black & Decker's Six Sigma productivity savings rose to about $75 million in 2000, more than double the prior year's level, bringing the total saved since 1997 to over $110 million.

A more revealing insight into the cost of poor quality as a function of Six Sigma performance levels is the following:

• When ±3 sigma of the process that produces a part is within specification, there will be 66,807 defects per million parts produced. If each defect costs $1,000 to correct, the total cost of poor quality is $66,807,000.

• When an organization improves the process to within ±4 sigma, there will be only 6,210 defects per million at a cost of $6,210,000.

• At ±5 sigma the cost of defects declines to $233,000 per million, a savings of $66,574,000 more than the savings at a pro cess capability of +/- 3 sigma.

• At the near perfection level of ±6 sigma, defects are almost eliminated at $3,400 per million parts produced. (See Figure 4.) After all data are collected and tabulated and decisions are made, no study of the cost of poor quality should end without a continuing action plan to eliminate a major portion of the costs that have been identified. There is no need to use a complex accounting method for measuring costs because it would be expensive and waste valuable effort. Simple methods are sufficient.

The most important step in developing useful cost of poor quality data is simply to identify activities and other factors that affect costs. Any consistent and unbiased method for estimating costs will yield adequate information that will identify key targets for quality improvement. More refined estimates may be needed for specific projects when diagnosing the cause of a specific problem or identifying specific savings.

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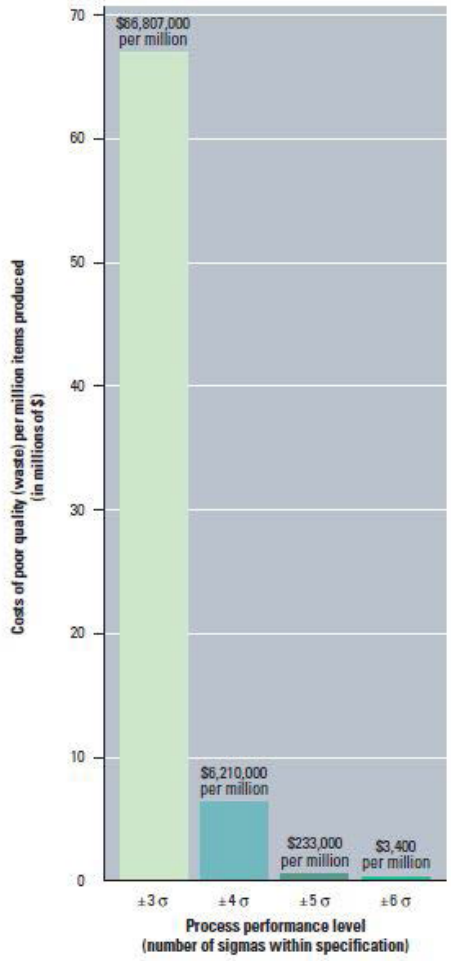
Figure 4

FIGURE 4 Cost of Poor Quality as a Function of Six Sigma Perormance Levels
(assuming 1 million items produced and a cost of $1,000 per defect)



CALCULATING

Data for calculating the total resourcesused in an expense category come from a variety of sources:

Accounting categories

Financial and cost accounting systems often contain specific categories that can be allocated partly or totally to costs of poor quality. Typical examples include scrap accounts, warranty costs, professional liability, discarded inventory and total department operating costs.

Time reporting

Many organizations routinely ask employees to report how much time they spend on specific activities. This makes it possible to assign some or all of the time in a category to a specific cost of poor quality.

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Other information systems

Other information systems include cost accounting, activity based cost accounting, materials management, sales or similar reports.

Resources Used

Data for calculating the percentage of resources used for cost of poor quality activities can be obtained through a variety of techniques, including: • Informed judgment. Supervisors and experienced employees can make adequate judgments about what proportion of a department's time is spent on an activity. This is especially true if the unit performs very few distinct functions or the effort consumes a very large or small portion of total time.

- Special time reporting. This method has been used to calculate costs for processing computer complaints. A special short-term collection of time distribution data may be appropriate if a department performs many different functions, activity is neither unusually small nor large, or there is uncertainty or significant disagreement among informed individuals as to the percentage of time or money allocated to a specific activity. A significant disagreement would typically be one of more than 10% of the total amount allocated.
- Special data collections. Besides collecting data on how much employee time is spent on an activity, an organization might also collect data on the amount of time a computer network is inoperative, the volume of items consumed or discarded, or the amount of time special equipment or other resources are not used.

In all these examples, the general calculation to determine costs of poor quality is:

Cost of poor quality = (cost of total resources in a category) X (percentage of resources in category used for activities related to poor quality)

Unit cost

An example of this strategy occurs when a project team calculates the annual cost of correcting erroneous shipments. To find the cost, the team should estimate the cost of correcting an average erroneous shipment, estimate how many such errors occurred in one year and then multiply the average cost by the annual number of errors.

Focusing on unit cost requires two pieces of data: the number of times a particular deficiency occurs and the average cost for correcting and recovering from that deficiency when it does occur.

This average cost, in turn, is computed from a list of resources used to make corrections, the amount used of each resource and the cost of each resource unit.

Unit cost is often the most appropriate strategy when deficiencies occur rarely and may be costly, when deficiencies are complex and require the participation of many departments to correct, or when deficiencies occur frequently and correcting them is so routine that those involved may not realize their pervasiveness.

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Data on the frequency of a deficiency may come from any of the following:

- Quality assurance.
- Warranty data.
- Customer surveys.
- Field service reports.
- Customer complaints.
- Management engineering studies.
- Internal audit reports.
- Operational logs.
- Special surveys.

Estimating the cost of a single occurrence usually requires some analysis. A flowchart showing various rework loops associated with a deficiency can often help identify all important resources used.

When searching for resources, consider hours worked by occupation and level, contracted services, materials and supplies, capital equipment and facilities, and cost of money for borrowed or uncollected funds.

To find out how much of each resource is used, check the following sources:

- Time reporting systems.
- Cost accounting systems.
- Various administrative logs.
- Management engineering studies.
- Informed judgment.
- Special data collections.

When a team has identified the amount of each resource used, it is ready to calculate the cost for each and add up costs for all resources. Thefinance or engineering functions typically will have standard methods for calculating the unit costs a team might require.

Here are hints to remember when calculating unit costs:

- Include benefits as well as wages and salaries.
- Include allocated capital costs for major equipment and facilities.

While this is a minor consideration for many activities that can be safely ignored, it is vital for some activities.

Do not be misled by the argument that capital costs are fixed and would exist even if deficiencies did not occur. This is a typical example of the cost of poor quality's being hidden by standard practices. If computers were used more efficiently, it would be possible to process more jobs without buying additional equipment. Idle capital or

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misused capital resources are a cost of poor quality just as surely as discarded paper from a faulty computer run.

Be sure to include penalties or misused discounts for late payments and premium prices paid for rush orders or shipments.

Other methods

Still other methods can be developed for special projects. For example, in lost supplies the organization should calculate the cost that would have been consumed if there had been no defects and the cost of supplies actually consumed. The difference between the two is the cost of poor quality. This type of approach might also be applied in comparing actual outcomes with the best others have achieved. Special circumstances may lead a team to develop still other approaches that are appropriate to the specific problem.

About The Author

Joseph A. DeFeo is Chairman and CEO with Juran. He is recognized worldwide for his training and consulting expertise which enables organizations to achieve superior results. For additional information, visit www.juran.com.

Financial Impact

Current State: 16.1 days to install

Future State: 11.1 days to install

- Placements per Day: 100 machines installed at new customers
- Sales per Machine per Day: $10.00 based on the last 12 months of OCS sales
- Operating Days per Year: 250 days

Reducing the time to install by 5 days would capture an additional $1.25MM in Revenue

- 100 placements per day = 25,000 placements per year
- 25,000 placements per year = $250,000
  Installing 5 days sooner = $1.25MM

The Finance Department is Needed to Validate COPQ

The finance department:

- Calculates a projects financial impact and benefits.
- Provides timely, accurate, and relevant reporting of project results.
- Ensures the credibility of the “numbers.”

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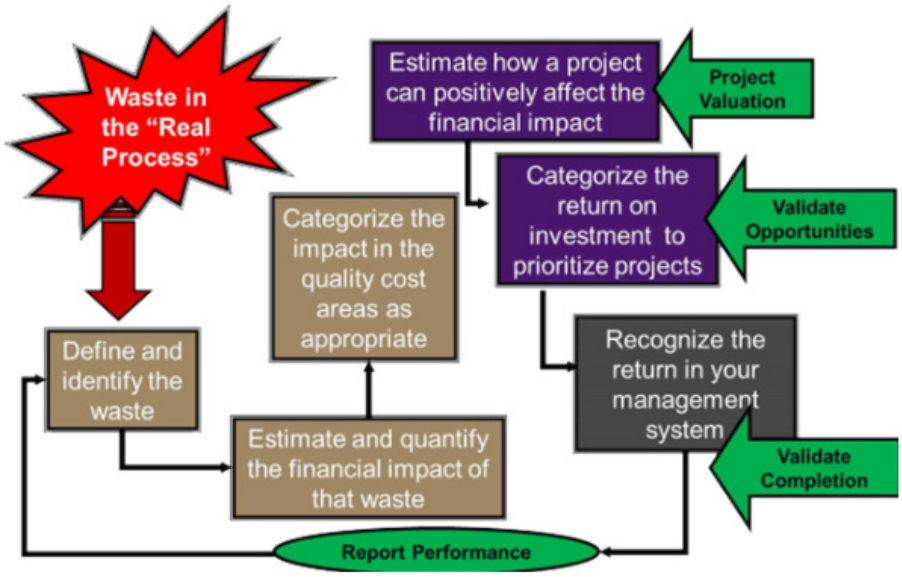
The Financial Reporting Cycle



Project Valuation

- Define "hard" savings
- Create a savings template for projects
- Determine the time period to track returns
- List any allocation/rate assumptions

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