Operational Excellence for Successful Software Quality Assurance

Duvan Luong, Ph.D.
Operational Excellence Networks
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1 Software is a Big Business and Quality Assurance takes a Big Slice from the Profit Bottom Line

The Software Industry consists of the trading between software-producing companies and corporate and individual consumers. Traded software represents only a fraction of domestic software industry activities, in which the full financial data cannot be reliably estimated because much computer software activities take place within firms and their value cannot be captured by the industrial census or software industry analysts. According to market researcher “DataMonitor”, the size of the worldwide software industry in 2008 was US$ 303.8 billion, an increase of 6.5% compared to 2007, and American companies account for 42.6% of the global software market's value. “DataMonitor” forecasts that in 2013, the global software market will have a value of US$ 457 billion, an increase of 50.5% since 2008.

The company profit bottom line is the revenues minus costs. There are necessary costs for doing business such as costs for running the business operations, costs for marketing, sales and advertisement, costs for future product research and development, etc. There are also costs that un-necessarily cut into the profit bottom line such as cost for warranty, wastes, reworks, defect fixes, etc. If a company can eliminate those un-necessary costs, its profit bottom line surely will improve.

The CAST, Inc. (www.castsoftware.com) reported that the cost to fix a conservative number of latent problems in a software application once it is operational exceeds $1 million for the average business application. CAST developed the study by performing the automated code analysis to measure the structural quality of 288 IT applications from 75 companies that covered a variety of industries. The study comprised a total of 108 million lines of code. Using the data drawn from the automated analysis, CAST made a conservative estimate of which problems would be fixed and how much it would cost to fix them, revealing an average cost of nearly $2.82 per line of code. The average-sized application in the survey had 374,000 lines of code; this translated into a defects fixing cost of over $1,055,000 per application. The study also showed that software quality scores tended to be highest where there was a business mandate, such as higher security requirements for the core business applications that run financial services.

Furthermore; in another major research project conducted by the United States Department of Commerce, National Institute of Standards and Technology (NIST) showed that in a typical software development project, fully 80% of software development dollars are spent correcting software defects. The same NIST study estimated that software defects cost the U.S. economy, alone, $60 billion per year, with more than half of the cost borne by end users and the remainder by developers and vendors. Improvements in testing could reduce this cost by about a third, or $22.5 billion, but it won't eliminate all software errors, the study said. Of the total $60 billion cost, users incurred 64% of the cost and developers 36%.

Besides the costs for fixing defects as mentioned in the NIST report, company also incurs other costs in ensuring the delivery/production of quality products as they going through the development, manufacturing, delivery, maintenance, and service activities/operations, etc.
The costs to assure the quality of company products – quality assurance costs, are considered to include the “costs of conformance” and the “costs of non-conformance”.

“Costs of conformance” covers the costs for all the activities the company puts in place to ensure that the products are conformed to the quality requirements; they include the costs of prevention and the costs of appraisal.

“Costs of non-conformance” covers the costs for the activities that take place to ensure that the product non-conformances are fixed to satisfy the company quality requirements; and the negative impacts from these non-conformances are corrected, remedial, and prevented from happening again in the future. The non-conformance costs include costs of internal failure and costs of external failure.

Prevention costs are those associated with preventing defects before they happen. Prevention costs involve investments aimed at getting work done right the first time and preventing quality problems from happening. They include the following costs:

- Quality systems (consisting of quality policies, standards, guidelines, best practices, etc.) establishment and maintaining costs
- Measurement systems establishment and maintaining costs
- Quality related documentation and training costs
- Overhead costs for the appraisal of the conformance to the quality systems requirements (e.g. assessments, audits)
- Overhead costs for the preventive and continuous improvement efforts, etc.

Appraisal costs include costs incurred in the appraisal for the product conformance to company quality requirements. Appraisal techniques such as review, inspection, simulation, demonstration, software code analysis, de-bugging, testing, etc. are used for the verification and validation (appraisal) of product conformance.

Internal failure costs are associated with costs for failures that occur before the products are delivered to the customers. For software, these include the costs of rework in programming, re-inspection, re-testing, and in some cases, resolution for the side effects to the development system/environment (e.g. re-create the database, re-establish the code base, etc.), after the bugs are found and reported.

External failure costs are associated with product failures when used by customers. These include the costs of rework in programming, re-inspection, re-testing, resolution for the side effects to the customer business environments (e.g. re-create the database, re-establish the customer’s software applications, etc.), field service support and maintenance involvements, liability for customer damages, and litigation expenses, etc. External failure costs might also include the intangible costs such as lost of customer satisfaction, damage to the company’s image, lost of business, etc. These intangible costs can be serious business issues for the company’s future growth.
Software quality assurance costs can take a big slice out of the company’s profit bottom line, so the company wants to maximize quality assurance capability and coverage and at the same time optimize the costs for quality assurance, to take smaller slice out of the profit bottom slice.
2 Executives have Burning Desires for Successful Software Quality Assurance

For a company or business, the simple definition of success can be the achievement of the objectives for the following key business measurements:

- Increasing market shares,
- Improving revenues,
- Lower costs,
- Improving customer loyalty/satisfaction,
- Higher level of competitiveness with improving company core competencies,
- Higher product and service quality,
- Higher employee morale/satisfaction, etc.

Company must have a solid and balanced focus on these business measurements; and must execute its operations well in order to achieve the objectives set for them. While the balanced capabilities in all the business areas are important, some capability can be the enabler for the other areas achievement (hence, these capabilities deserved more focus/attention). These core capabilities provide the pivotal forces to drive decisions, resolve conflicts, and set priorities to ensure the company overall success.

Quality assurance includes all the activities to ensure the delivery of products and services that meets and exceeds customer requirements and expectations (including quality requirements and expectations). Quality assurance activities cover three focus areas:

- **Organization focus on quality and continuous improvement**: the primary tasks for this focus are the company quality systems establishment and maintaining, the oversight of the quality systems deployment, the measurement systems establishment and maintaining, the quality related documentation and training, the appraisal of the conformance to the quality systems requirements, the coordination for the building of needed capabilities to achieve company objectives, the coordination for the preventive and continuous improvement efforts, etc.

- **Process conformance**: includes the planning, executing and reporting of the validation of the company conformance to quality policies, standards and requirements. For example: process assessment, quality audits, etc.

- **Product quality conformance**: includes the activities for the review, inspection, simulation, demonstration, software code analysis, de-bugging, testing, etc. to validate/verify that products meet all the necessary quality requirements.
As quality assurance activities cover all aspects of the product generation, validation and delivery, they also impact other business areas as well: business planning, customer services and product supports, marketing, sales, etc. For this reason, quality assurance should be one of those company core capabilities. A solid foundation in “quality assurance” capability will ensure higher product and service quality and greatly enhance the achievement of the other business measurements. Once the company achieves the “excellent” for its quality assurance activities – the “quality assurance excellence”, it can be assured of the overall business success due to the following achievements:

- Higher quality – with quality designed into the products; better defects detection, resolution, and reduction; minimal latent defects in delivered products
- Lower costs – more effective, efficient and leaner product generation and quality assurance implementation, less wasted time and resources, less reworks
- Improving customer loyalty/satisfaction – less customer down time and business disruptions due to product failures, better software product usage experiences, better responses and services from the software product vendor
- Increasing market shares – due to the improvement in customer loyalty/satisfaction
- Improving revenues – due to increase in market shares
- Higher employee morale/satisfaction – employees spend more time in the generation of product and less time in rework/bug fix, sharing the company financial gain benefits
- Higher level of competitiveness with improving company core competencies – quality assurance becomes company core competitive competency; company gains more competitive advantages with the continuous improvement of existing core competencies.

“First you fuel the desire, and then the desire will fuel you”
- Napoleon Hill

For business Executives, who have the pivotal role in ensuring company success; mastering and having the core quality assurance capability under control is very crucial for the company. Executives’ strong desire for the achievement of excellent for quality assurance capability will ensure the establishment of a foundation from which the company can relentlessly drive for the fulfillment of its business objectives, the fundamental factor for its success; Executives’ desires will also provide the necessary energy and supports for the implementation of the quality assurance excellence strategy by ensuring that:

- Necessary resources and time are allocated,
- Responsibilities are defined and assignments are made for the implementation tasks,
• Appropriate progress reviews are put in-place for tracking the achievement of the objectives (for both of the business and quality assurance excellence objectives),

• Results of the quality assurance excellence strategy implementation are recorded and published for all in the company to see,

• Improvement actions for failures are taken and rewards are given for individuals, teams, and organization that achieved the business and “operational excellence” objectives.
3  Company has clearly defined and well communicated Objectives for Quality Assurance Excellence

Executives’ energy must be channeled to the right direction that will eventually get the company to its final destination for success. The translation/generation of the Executives’ desires into achievable and actionable company objectives will create the necessary information for that important direction and final destination. Once the objectives for quality assurance excellence are set and communicated, the company can start its journey in the right direction to the final destination where the company quality assurance excellence will deliver its outstanding success.

Generally speaking, objective setting is the foundation for individuals, teams, and organization success. Compelling objectives create motivation and engagement. Objectives are the means by which one’s ultimate desires are met. An acceptable and realistic objective should compose of action words, key results, target dates, and achievement conditions. It should also be specific, measurable, achievable, relevant, and time bound.

Objectives for the achievement of the quality assurance excellence should provide the necessary “pulls” to draw people toward it (i.e. objective supports people desires). It should attract support and motivate/rally people in the company to move forward toward its final destination. In order to ensure the necessary executions/implementations to take place, the quality assurance excellence objectives must be aligned with the company short and long term business objectives and strategy.

The potential achievements for the quality assurance excellence effort are the positive results in higher product and service quality, lower costs, improving customer loyalty/satisfaction, increasing market shares, improving revenues, higher employee morale/satisfaction, higher level of competitiveness with improving company core competencies, etc. These achievements should be the convincing reasons for the people to buy-in and the company to support them.

As the pivotal player for the company’s success, Executives should be engaged throughout the company’s effort for quality assurance excellence. Executives should sponsor and engage in the translation of the quality assurance excellence desires into objectives. Once the objective definition is completed, Executives should enthusiastically involve themselves in the communication of those quality assurance excellence objectives to people in the company;
Executives must “walk the talk” to ensure the achievement of the objectives. With regard to the quality assurance excellence strategy/effort, Executives set the “walk the talk” example by making and keeping commitments, building a strong foundation of integrity and trust in all dealings, follow up during and after the course of action, take note and involve in the resolution on any roadblocks along the way. The Executives’ commitments and their “walking the talk” on quality assurance excellence will make the difference between getting things in the company done and getting things done well.

Some examples for quality assurance excellence objectives are:
- To reduce the amount of customer dissatisfaction as measured by the “annual customer satisfaction survey” by 50% for X year, 70% for X+2, by 80% for X+3, 90% for X+4 year. The reduction will be calculated from the X-1 year survey baseline.

- To reduce the amount of defects found by customers – The reduction of total customer found defects by 10% for X year, 20% for X+1, by 30% for X+2, 50% for X+4 year. The reduction will be calculated from the current year baseline (figure 1).

- The achievement of level 2 CMMI capability by X year, level 3 by X+2, level 4 by X+4 and level 5 by X+5 year.

- The next release X will be completed on time (Y date), within budget, and meet all the scope requirements (as defined in the release plan dated on MM/DD/YY).

- 50% of projects have trained review/inspection moderators and 30% of developers trained in review/inspection by X date. 100% of projects have trained moderators and 100% of developers trained by Y date.

Figure 1 - Example for the Customer Found Defects Reduction Objective

Quality assurance excellence objectives can be set for different organization levels in the company. Company level objectives can be breakdown to several lower level objectives for the appropriate areas or organizations. These lower level objectives, in turn, can be breakdown further into even lower level objectives; until the objectives are appropriate for the applicable implementing “parties”. The key points for objective are compelling, motivating, realistic, acceptable, and “SMART” (Specific, Measurable, Articulate-able, Realizable, and Time-bound).
“The reason most people never reach their goals (objectives) is that they don't define them, learn about them, or even seriously consider them as believable or achievable.”

- Denis Waitley

Quality assurance excellence objectives will provide the necessary information for the company to start and to make progress for its journey on the right direction to the final destination, where the company quality assurance excellence capabilities will deliver its outstanding success.
4 Company masters the Quality Assurance Excellence Capabilities to achieve the Objectives

In general, capability is the ability in doing things to get what one wants/needs. Capabilities for achieving the desired objectives are the unique combination of needed processes, tools, materials, resources, methods, information, experiences, skills and people, etc. that engaged and coordinated in fulfilling the objectives. There are three capability categories:

- **Process**: is the core element of the capability, it represents the ability to get the work done to deliver results to the satisfaction of stakeholders (e.g. process for product development, testing, delivery; financial planning, book keeping, etc.)

- **Process enabling**: is the ability to make available and ready the needed supports so the process can be properly executed to achieve its purposes (e.g. *physical facilities*: buildings, plant, equipment and other physical assets, *information technologies*: applications, databases, networks, and related infrastructure, *human resources*: skills, competencies, motivations and capacities of staffs, partners and contractors, etc.)

- **Process guidance**: is the ability to ensure that the process can be executed correctly (e.g. *information for the execution*: lessons learned from experience or stakeholder feedback, knowledge to manage, direct, control or influence company operations, techniques for process execution, etc. *reference documentation*: training materials, business rules, best practices, etc. *formalized constraints*: policies, standards, guidelines, algorithms to be applied to associated events and conditions of the data, and process workflows, etc.)

It is essential to complement “processes” with “process enabling” and “process guidance” to create the whole part of capability. All of these capabilities need to work together in concert, and also in alignment with business objectives and stakeholders’ needs in order to achieve the company’s success.

“If you know your capabilities and the objectives you want to achieve, you will likely successful in the efforts for achieving those objectives” – Operational Excellence Networks

Mastering the capabilities for the achievement of the desired objectives involves:

- The defining/understanding of the necessary/needed capabilities for achieving the objectives – know what need to do

- The identifying of current capabilities – know what you can do now

- The defining/understanding of company core competencies – know your special abilities that enable and ensure your competitive advantages
• The identifying of the necessary capability gaps – know the additional capabilities you need to have to achieve your objectives

• The availability of a plan and the execution of it to fill the capability gaps - the planning and execution of this capability gaps plan to get the additional needed capabilities

• The documentation and training for the necessary capabilities – ensure people have the skills and abilities to do their job

4.1 Capabilities Analysis

Capabilities analysis is the technique for the identifying and the defining of the necessary/needed capabilities, the current capabilities for achieving the objectives, and the identification of the associate gaps. The analysis focus on the finding of the answers for the following questions:

• What are the process, enabling and guidance capabilities that will be needed for the achievement of the objectives?

• What are the descriptions/definitions for those needed capabilities?

• What are the current capabilities?

• What are the gaps between the current and the needed capabilities?

Once the capabilities analysis is done, the availability of relevant information about the needed capabilities and the associate capability gaps; enables the filling of the gaps with the acquisition/building of the additional/new capabilities. It is necessary to close the gaps so that you can get all the needed capabilities.

4.2 Capability Planning

Capability Planning is the effort to ensure that the organization has the necessary capabilities to fulfill the desired objectives. Primarily, the effort focuses on getting the missing capabilities (the capability gaps) and the training of relevant employees for the necessary knowledge and skills for fulfilling the objectives.

Capability plans are a key component of successful capability building and deployment effort. The plans help to summarize what capabilities to build/develop/acquire, what actions to do to achieve those capabilities and by when. When planning for actions, aim to break down each of your capability building/developing/acquiring effort into detailed tasks. This has two purposes:

• It ensures that all areas of required action have been taken into account

• It breaks the effort down into manageable chunks
To ensure that all the needed capabilities ready for use on time, you will need to define all necessary actions and assign responsibility to individuals for delivering these actions within agreed timeframes.

**Figure 2 – Example for Software Quality Assurance Capabilities**

<table>
<thead>
<tr>
<th>Quality Assurance Capabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Processes</strong></td>
</tr>
<tr>
<td>Quality Product Development Process</td>
</tr>
<tr>
<td>- Planning</td>
</tr>
<tr>
<td>- Customer satisfaction</td>
</tr>
<tr>
<td>- Lifecycle product generation</td>
</tr>
<tr>
<td>- Purchasing</td>
</tr>
<tr>
<td>- Operation</td>
</tr>
<tr>
<td>- Testing, Inspection</td>
</tr>
<tr>
<td>- Quality planning</td>
</tr>
<tr>
<td>- Quality review</td>
</tr>
<tr>
<td>Measurement, Analysis and Improvement Process</td>
</tr>
<tr>
<td>- Establishment of measuring systems</td>
</tr>
<tr>
<td>- Progress status monitoring and measuring</td>
</tr>
<tr>
<td>- Control of non-compliances for products and services</td>
</tr>
<tr>
<td>- Analysis of quality information/data</td>
</tr>
<tr>
<td>- Continuous improvement</td>
</tr>
<tr>
<td><strong>Enabling Capabilities</strong></td>
</tr>
<tr>
<td>Support for Quality</td>
</tr>
<tr>
<td>- Organization and Communication</td>
</tr>
<tr>
<td>- Infrastructure and support environment</td>
</tr>
<tr>
<td>- Training</td>
</tr>
<tr>
<td>- Tools/equipments</td>
</tr>
<tr>
<td><strong>Guidance Capabilities</strong></td>
</tr>
<tr>
<td>General Quality Information</td>
</tr>
<tr>
<td>- Vision, mission, goals, value proposition</td>
</tr>
<tr>
<td>- Definition and terminology</td>
</tr>
<tr>
<td>- Focus on Quality</td>
</tr>
<tr>
<td>- Management responsibilities and focus</td>
</tr>
<tr>
<td>- Quality Policy, Standards and Guidelines</td>
</tr>
<tr>
<td>- Organization Learning</td>
</tr>
<tr>
<td>- Best practices</td>
</tr>
<tr>
<td>- Lessons learned, etc.</td>
</tr>
</tbody>
</table>

Typical software quality assurance excellence capabilities (as in figure 2) cover all the three areas of:

- **Organization focus on quality and continuous improvement** – primarily focus on defect prevention; aiming at getting the work done right the first time and preventing quality problems from happening.

- **Process conformance** – primarily focus on the planning, executing and reporting of the validation of the company processes/operations execution/implementation conformance to quality policies, standards and requirements.

- **Product quality conformance** – primarily focus on the validation/verification that products meet all the necessary quality requirements.

If the Executives’ desire is for the company to produce/generate quality products that meet and exceed customer requirements and expectations; the mastering of the capabilities for quality assurance excellence is a very important task. However, quality assurance capabilities alone will not ensure the delivery of quality products; quality assurance capabilities cannot do much to directly change the low-quality products into high quality products after they already were made. Therefore, it is necessary to ensure the quality of the capabilities used in the generation of quality software products; for this purpose, the company also needs to master the “product generation” capabilities as well. Achieving quality
assurance excellence will provide the necessary operational framework from which the company can capitalize its capabilities to generate quality product. Typical needed capabilities for the generation of high quality software products are listed in figure 3.

Figure 3 – Example for Product Generation Capabilities

4.3 Capability Definition

After the identification/selection of needed capabilities (the processes, enabling, and guidance capabilities) based on their contribution to the fulfillment of the desired objectives; the next step is the definition for these capabilities – the capability definition. Capability definition is the task of pulling together all the necessary information about the needed capabilities into the appropriate definitions/representations so people can understand and be able to use these capabilities in the fulfillment of the desired objectives. In general, the definitions/representations for the needed capabilities are consisting of the capabilities architecture and the process definition.

4.3.1 Capabilities Architecture

Capabilities architecture is the organized collection of inter-related capability elements for solving the fulfillment of the desired objectives; it identifies the capability elements of process, process enabling, and process guidance. The capabilities architecture defines the fundamental framework in which the capability elements integrated together; how the processes are related and how they interact with each other; how the enabling and guidance capabilities related to the processes; what are the constraints on these capability elements; what is the configuration for them, what are the rationale; and how all of these capabilities...
elements work together as a “cohesive integrated unit” to fulfill the desired business objectives.

Figure 4 – Example for Software Quality Assurance Capabilities Architecture

Figure 5 – Example for Software Product Generation Capabilities Architecture.
Capabilities architecture provides the overall big picture of the entire solution for the objectives. It is the primary communication of the solutions for the objectives to the various, often disparate groups that are involved in the implementation of the solutions or some piece of them. Foremost amongst all things is the capabilities architecture flexibility; the capabilities architecture must be adaptable to changes in requirements or implementation impediments and for that reason it must be a living document. Figure 4 is the architecture for needed capabilities to achieve the “software quality assurance excellence” objectives. Figure 5 is the architecture for needed capabilities for the generation of high quality software products.

Capabilities architecture provides the answers to the following questions:

- What are the key decisions that make it possible for the solution to meet the business objectives?
- What are the key decisions that make it possible to overcome the current constraints imposed on the solution?
- How does the solution take into account the known/planned future objectives?
- How does the solution take into account the unknown future objectives?
- What are the constraints imposed by the solution on business?

### 4.3.2 Process Definition

Once the generation for the capabilities architecture is done, the emphasis for the next step is on the definition for the processes in the capability. As the core element of the capability, processes deserved more attention to details that the other two capability categories of enabling and guidance. Definition for the process capability should include the following information:

- What are the needed/involved processes?
- How are they related to each other?
- How are they interacting to each other?
- For each process:
  - Process purposes
  - Tasks and task descriptions
  - Verification requirements
  - Inputs
• Outputs
• Start/stop, entry/exit criteria
• Involved Stakeholders
• Internal/External retained Data/database
• Limitations/constraints, etc

**Figure 6 – Example for Software Development Process Map**

The process description consists of process map(s) and process description(s) to provide the necessary information coverage for the answers to the above questions; in both visual and text forms; process map(s) provides the visual form for the high level process relationship and the flow information; process description provides the text form for the low level process detailed information. Figure 6 is the process map for the Software Development Process. Figure 7 is the process map for the Software Testing Process. Figure 8 is the process map for the Software Test Plan Generation Process.

### 4.4 Gaps Analysis

Gap analysis provides the necessary information to determine whether the company is on the right path to accomplish its set objectives. A company will list the capabilities that are required to reach the target state ("to be" state); from the list, it identifies the capabilities that are currently used/existed ("as is" state); and then determine how to fill the "gaps" between the two states.
The identification/definition for the “to be” state can potentially be a very time consuming task when you are dealing with a complex set of capabilities with a large number of processes. There is no hard and fast rule about how much detail you should go into this task. This depends very much on the nature of the capabilities and the degree of control you have over them. However, the hard work on the definition for the capabilities architecture, the associated process maps, and the process descriptions, will have a big pay-off for this analysis task. The information from these capability definitions provides a good understanding foundation for the needed or “to be” capabilities.

Figure 7 – Example for Software Testing Process Map

The next task is to identify the capabilities in its current state. This is sometimes known as ‘as is’ analysis. To do the “as is” analysis, you need to go through each of the element of the “to be” capability definitions and ask: Are we currently performing this? Mark the appropriate “yes” areas. The aggregate of all the marked areas constitutes the “as is" capabilities" or "where are you?" part of the gap analysis.

Now, look at the aggregate of all the un-marked areas, these constitute the list of the capability gaps. Where are your biggest gaps? How can you fill these gaps? What steps need to be taken? Look at each capability in the gap and carefully analyze what needs to be done in order to ensure that capability gap is filled. Sometimes, this will require multiple steps. Keep track of each step involved.

Once you have performed a capability gap analysis, you should have a good idea of where the company stands, where it wants to be, and what needs to be done in order to get there. The next step, after performing a capability gap analysis will be to create a project plan for how those gaps will be filled. Once your plan is ready to go, you just need to execute it. Performing a capability gap analysis is a great way to make strides forward when you're not certain of what direction your company should take to achieve the desired objectives.
In most of the software companies, the product generation and the quality assurance capabilities already exist; in general, the needed capabilities for software industry quality assurance excellence are not that much different from the capabilities of other industries. There are some differences in the needed capabilities for the generation of quality products between the software vs. the other industries, due to the nature of the software products. However, these differences in product generation capabilities will not impact the achievement of the quality assurance excellence for software products. What have the most impact are the rationales about software quality and the approaches used by the company/developers in the generation of quality products. A capability analysis for quality assurance excellence will result in the typical observations and recommendations:

**Table 1 - Quality Assurance Excellence Analysis Observations and Recommendations**

<table>
<thead>
<tr>
<th>Area of observation</th>
<th>Current rationale/ approach</th>
<th>Recommendation for quality assurance excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality definition</td>
<td>Quality is product defects</td>
<td>Quality includes all product characteristics that are important for customers: Functionality, Usability, Reliability, Performance, and more. Quality also means customer satisfaction.</td>
</tr>
<tr>
<td>Quality approach</td>
<td>Use testing to find and fix all defects in product</td>
<td>Defects prevention: Set quality requirements from customer perspectives, build quality into product, find defects early close to their originations, continuously improving the defect prevention and detection capabilities.</td>
</tr>
</tbody>
</table>
Responsibility for quality assurance

Developers focus on the generation of product to deliver more functionality sooner. Test team is responsible for finding all the defects.

All appropriate teams that involved in the generation and the assurance of the products quality are responsible to carry-out the needed tasks to ensure the building of quality into the products that meet all customer requirements/expectations. Dedicate independent quality assurance team to ensure defect prevention and early detection implementations.

Capitalize quality assurance excellence enabling and guidance capabilities such as company quality systems, supporting environment and tools, best practices, and Management review of progress status for quality related efforts, etc.

Little capitalization of needed quality assurance excellence capabilities

Fully capitalize on the needed capabilities for quality assurance excellence. Use and conform to the guidance as stated in the quality system, establish and implement “execution transparency”, effective product generation management, continuously improving the needed capabilities, Management “walk their talk” on quality assurance excellence strategy.

<table>
<thead>
<tr>
<th>Capability Area</th>
<th>Current rationale/approach</th>
<th>Recommendation for quality assurance excellence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Defect Prevention</td>
<td>Little focus on defect prevention</td>
<td>Integrate customer quality requirements into product requirements; build schedule and resources needed for quality activities into product development plan; management review of customer and quality requirements status.</td>
</tr>
<tr>
<td>Early Defect Detection</td>
<td>Quality focus starts with the testing process</td>
<td>Implement reviews and inspections on appropriate product deliverables: requirements, design, code test cases, etc. Measure, track and take actions for defect escape rate. Use code analysis tools to ensure code quality.</td>
</tr>
<tr>
<td>Operational Transparency</td>
<td>Some implementation of measurement system, feedback system</td>
<td>Full establishment and use of measurement systems, feedback systems, data driven management review of progress.</td>
</tr>
<tr>
<td>Continuous improvement</td>
<td>Some implementation</td>
<td>Implement Failure and Root Cause Analysis. Establish and allocate resources for continuous improvement efforts</td>
</tr>
</tbody>
</table>

Example for the integration of customer satisfaction (values) into the software product generation life cycle is shown in Figure 9, defect prevention activities in figure 10, and early defect detection in figure 11.
4.5 Capability Gaps Planning and Deployment

Once you have identified the capability gaps, it is necessary to brainstorm for ways to close the gaps so that you can get the needed capabilities. Capability planning is the effort to ensure that the organization has the necessary capabilities to fulfill the desired objectives. Primarily, the effort focuses on getting the missing capabilities (the capability gaps) and the training of relevant employees for the necessary knowledge and skills for fulfilling the objectives.

Figure 9 - Example for the Integration of Customer Satisfaction/Value into the Product Generation Life Cycle

Capability gap plans are a key component of successful capability building and deployment project. The plans help to summarize what capabilities to build/develop/acquire, what actions to do to achieve those capabilities and by when. When planning for actions, aim to break down each of your capability building/developing/acquiring effort into detailed tasks. This has two purposes:

- It ensures that all areas of required actions have been taken into account
- It breaks the effort down into manageable chunks

Figure 10 – Example for Software Quality Engineering Activities for Defect Prevention
To have the needed capabilities on time, you will need to define all necessary actions and assign responsibility to individuals for delivering these actions within agreed timeframes.

Steps to produce an action plan to achieve the needed capabilities:
• Define your objectives by asking ‘what capabilities do we want to build/develop/acquire?’

• Next, establish the steps to achieve each identified capability by asking ‘What do we need to do to get the capability’?

• Finally, decide who is required to achieve the action? What is the target date?

Once you have produced the action plan for building/developing/acquiring the missing capabilities, you need to review it regularly to ensure that actions are being completed. You could aid this by making the action plan visible so that the whole team can continually view what actions are outstanding.

As the needed capabilities are established, management support and the establishment of a team to oversee the deployment are essential for the fulfillment of the desired business objectives.

4.6 Management Support

Support from the top leaders is essential in implementing a company-wide deployment of the needed capabilities. This requires a major emphasis and in some cases change in the way business is done in the minds of most employees. The importance of deploying the needed capabilities is an idea that must be accepted by, and trickle down from, the top. Messages about the needed capabilities must be communicated. Relevant policies, standards and practices must be established. Management review of requirements and schedules for the deployment of needed capabilities should be created, made visible, and implemented.

Executives will need to manage the capability building/acquiring and deploying as part of the business objectives by assigning the ownership of the task; allocating appropriate time, resources; sponsor the effort to define and implement the processes for capture, document, store and access for the “newly added capabilities”; and review the progress status for the “operational excellence” effort (which includes the needed capabilities building activities) on a regular timeline basis or as needed.

4.7 Establish the Oversee Team

The deployment of the needed capabilities; starts with the establishment of a team, for the coordination and oversee of the deployment. A formal document should be created and communicated to the people in the company about the team’s authority and what are expected as the results of the deployment of the needed capabilities. This team will work with relevant employees to ensure the proper deployment, and the continuous improvement of the capabilities.

4.8 Capability Documentation

Capability documentation is one crucial part of your business – Capability documentation explains what and how to fulfill the desired objectives. If the needed capabilities are well
documented, everyone will still be able to work toward the fulfillment of the desired objectives even if the key employee capability owner leaves. Each documented business capability is one more piece of knowledge that doesn't need to be reinvented whenever turnover occurs in your organization.

The act of capturing and documenting business capability helps company to identify inefficiencies in its operations. If you checked every major operation in your business and formalized those operations into capability, you would come across a number of inefficiencies. Correcting those inefficiencies can obviously help to improve the level of output and quality of those procedures, with little additional cost.

4.9 Capability Training

Training employees on the needed capabilities for the fulfillment of the desired objectives is an essential operational requirement for all organizations. Training provides employees with the key knowledge and skills that they need to perform their job, also the behaviors, roles, and responsibilities expected of them. Training on the needed capabilities also bringing-in the following benefits:

- It will keep your employees motivated. New skills and knowledge can help to demonstrate to the employee that they are valuable enough for the company to invest in them and their career development.

- It can be used to create positive attitudes through clarifying the roles, responsibilities, behaviors and attitudes that are expected from the employee.

- It can be cost effective, as it is cheaper to train existing employees compared to recruiting new employee with the skills you need.

- It can save the organization money if the training helps the employee to become more effective and efficient – deliver the expected results with no wasted effort.
5 Company capitalizes the Needed Capabilities well to achieve the Objectives

“There are no secrets to success. It is the result of preparation, hard work, learning from failure” - Colin Powell

A strong desire for the achievement of your objectives is at the heart of reaching your dreams. While desire can provide the energy, it will take much focus and effort to reach your objectives:

- Communicate to the world about your objectives to hold you accountable and gain the necessary advocates
- Develop a strong understanding on what need to do, what capabilities you need to have
- Carefully prepare, plan and deploy the necessary capabilities.

While each of these above effort and focus is wonderful and admirable, the thing that pulled it all together is the excellent capitalization of your capabilities (the execution of the needed activities/tasks) to fulfill the objectives. You need to take steps, take actions every day; and you have to do these steps/actions well to achieve your objectives. Without action/execution, you could have the greatest idea, the greatest capabilities and the greatest plan in the world and you would still fail – not achieve your objectives.

We often hear that "capability is power." But, capability is really a power when it is capitalized to drive the achievement of the objectives. It remains useless if it's not tapped into by applying action. Capability that is not put to action remains just knowledge in your head and provides no benefit. It's completely wasted.

To be successful, we must achieve the expected results. To accomplish results, we must couple our capability with the necessary actions. The guideline for achieving results is: “Capabilities couple with Effective and Efficient Actions will ensure the attainment of Results”.

We all want success – to achieve the desired objectives/results, but success does not just happen; efforts and actions must be put-in to achieve success. However, taking action is necessary but is not sufficient to ensure success, we must take the right actions, and we must do the actions effectively and efficiently – We must achieve the greatness for the actions we take.

To ensure the greatness (outstanding performance) for the actions we take to achieve the desired objectives, we must address the followings:

- The thorough understanding of the situation and the set objectives.
- The availability of a realizable, actionable plan to achieve the objectives
- The use of the defined capabilities
• The effective and efficient management of the capabilities capitalization
• The leanness of the capabilities capitalization
• The use/leverage of best practices for optimal results
• Being innovative and creativity at work
• The leveraging of core competencies for competitive advantage
• The achievement of the desired objectives
• The customer satisfaction achievement
• The capturing, retaining of the implementation knowledge

5.1 The thorough Understanding of the Situation and the Set Objectives

The works on the desires determination, the translation of the desires into objectives, and the mastering of needed capabilities for the achievement of the set objectives; provide all the necessary information for a thorough understanding of the situation and the set objectives, that is necessary for the work on the planning and the generation of the associate action plan.

5.2 The Availability of a Realizable, Actionable Plan to achieve the Objectives

“Failing to plan is planning to fail” - Proverb

Planning is an important management technique in ensuring a smooth capitalization of needed capabilities. Planning is preparing a sequence of action steps to achieve some specific objective. If you do it effectively, you can reduce much the necessary time and effort of achieving the objectives.

The associate actions plan provides a vehicle to facilitate Executive, customer and stakeholder reviews. It should make major assumptions explicit and provide a forum for communicating the planned approach and for obtaining appropriate agreements and approvals. If the implementation team includes diverse organizations or ambiguous lines of authority and communication, it may be useful to include in the actions plan the description for the roles and responsibilities of the various organizational entities; it can also be used to communicate management systems and procedures to be used throughout the organization.

The actions plan should address implementation, training, and supports, as well as planning for future growth and expandability. The actions plan should demonstrate that all aspects of the implementation have received careful thought and that clearly defined actions plan for the execution and control have been formulated. The availability of the actions plan at the
beginning of the capabilities capitalization can be useful if they are concise and are used to set policy and procedures for the conduct of different aspects of the implementation. An actions plan is like a map. When following an actions plan, you can always see how much you have progressed towards your objective and how far you are away from it. Knowing where you are is essential for making good decisions on where to go or what to do next.

A realizable, actionable plan should include the elements:

1. Purposes and Objectives of implementation project
2. Deliverables
3. Quality criteria
4. Resources
5. Roles and Responsibilities
6. Milestones
7. Limits and Constraints
8. Dependencies
9. Risks
10. Schedule

For any implementation project, it is absolutely vital to have a project plan and although it will take time to create, a good project plan will enable the smooth and effective implementation/execution. Ultimately it will, save you a good deal of time and money, as well as the achievement of the objectives.

5.3 The Capitalization (Implementation/Use) of the Defined Capabilities

In the previous preparation step of “mastering the needed capabilities”, the needed processes/procedures and their associate enabler and guidance capabilities should have been defined, documented and training provided for the appropriate implementers. These defined capabilities supposedly provide an effective mechanism for the achievement of the desired objectives. In order to be effective, the capabilities must provide a way to achieve the expected results and meet the needs and expectations of the users/implementers. The capitalization (implementation/use) of these defined capabilities will ensure the achievement of the objectives.

Using the defined capabilities is a qualifying condition for the achievement of quality assurance excellence. The using of defined capabilities will dramatically improve the performance of the implementation team and assure the achievement of the desired objectives.
5.4 The Effective and Efficient Management of the Capabilities Capitalization

At the end of the capabilities capitalization, the desired objectives should be fulfilled, on time, and within the allocated/planned budgets. To achieve these expectations, the right actions/processes/procedures must be used to get the results, the execution must be smooth with no wasted time and resources, the needed capability enablers and guidance must also be available for use to support the needed capabilities capitalization.

The following tips will ensure the effective and efficient management of the capabilities capitalization:

- **Business case**: Ensure there is a strong business case for the needed capabilities capitalization.

- **Critical Success Factors**: The critical success factors should be clearly identified, defined, included in the implementation plan, and communicated to all involved people at the beginning of the implementation. These success factors should be used at the end of the implementation to measure the overall achievements.

- **Planning**: Use the actions plan that was created in the previous planning step. Ensure that appropriate updates and changes made during the implementation. It is necessary to communicate the changes to all related stakeholders.

- **Team motivation**: Keep the team involved throughout the implementation by having sufficient milestones to help them feel and aware of the progress.

- **Stick to the planned objectives**: By saying “no” to the items that not contribute to the achievement of the objectives, or anything that you can’t deliver or non value-added to the end customers. Make sure you are firm and prepared to justify the reasons for you “no” decision.

- **Avoiding Scope Creep**: Make sure that the scope for the implementation is correctly set at the beginning and maintain throughout the implementation as close to its original as possible.

- **Risk Management**: When dealing with risks, produce a risk log with a resolution plan with action for minimizing each risk. Communicate and publish this log to all involved stakeholders.

- **Implementation closure**: Ensure that the objectives are met by have the agreement with stakeholders about the achievement of all the success factors.

- **Conduct regular and milestone driven status review**: There should be regular and milestone driven reviews as part of the implementation plan.

Use of these simple tips will enhance the effectiveness and efficiency of the needed capabilities capitalization and avoid many of the common mistakes. The key to solid
capabilities capitalization management is the progress status checking and the communication with stakeholders.

5.5 The Leanness of the Capabilities Capitalization

The leanness of the capabilities capitalization refers to the elimination of wastes from all aspects of the organization's operations – lean operations, where wastes are viewed as any use or loss of resources that does not lead directly to the achievement of the desired objectives (that is to create the product or service that customer wants when they want it). Typically, in many industrial operations, such non-value added activities could comprise more than 90 percent of a company’s total effort (http://www.tmssonline.com/Lean_Manufacturing.html).

The execution of organization operations and activities must be lean to be effective. The purpose for lean operations is to get the right things to the right place, at the right time, in the right quantities, while minimizing waste. This leads to the lean actions/operations that are faster, more responsive and more productive and the extra value added goes straight on the bottom line. It doesn’t matter whether the operations are: product generations, sales, marketing, etc - lean operations always generate extra business value.

Lean operation focuses on three system inhibitors, namely: waste, variability and inflexibility.

- Waste – Use of resources beyond what is needed to meet customer requirements – Any non-value adding activities
- Variability – Input variability, Process variability, Demand variability
- Inflexibility – The inability to react fast enough to change. Inflexibility existence or proliferation impedes any company’s ability to deliver an improving return on invested resources and efforts.

To ensure the achievement of leanness in the capitalization of the company capabilities, the following guidelines can be used

- Identify activities that create value. Specify value from the standpoint of the end customer
- Identify all the steps in the operation stream that deliver the value. Determine the major steps to deliver that value. Eliminating whenever possible those steps that do not create value.
- Make the value-creating steps occur in tight sequence so the operation will flow smoothly toward the implementation completion.
- As operation flow is introduced, make sure that customers drive/pull value from the next upstream activity.
- As capabilities (processes, enablers and guidance) specific to an objective are specified, operation streams are identified, wasted steps are removed, and flows and
pulls are introduced, begin the process again and continue it until a state of perfection is reached in which value is created with no waste.

- Ensure that products are available when consumers want them.
- Continuously improve the capabilities.

### 5.6 The Use/Leverage of Best Practices for Optimal Results

People in general will always perform to their level of standards, using their most comfortable skill-sets, to produce end results that fall into their perceived acceptable parameters. In other words, they'll do what's easiest and most familiar. For this normal effort, it is likely that normal results will be achieved. To reach the high “excellent” level, one needs to be creativity/innovative at work and use/leverage the available best practices to generate great results - the greatness in execution.

Best practices are the collection of knowledge about processes, procedures, guidelines and things people successfully done to get the expected results. Best practices are based on extensive amount of work, education, research and industry experiences. Individual implementer who leverage best practices will benefit hugely from the intellectual guidance as they can completely leverage the experience one would need to go through to master the practices, and can perform at best practice levels with a fraction of the time and effort required to develop them.

Use/leverage of best practices helps to establish boundaries, sets expectations, and generally put everyone on the same page; it's like having built-in knowledge sharing across the entire team of even the most advanced concepts. If every team members use/leverage best practices, you can be assured that they all play by the same rules, and deliver great end results falling into the same expected parameters with the same levels of great quality.

### 5.7 Being Innovative and Creativity at Work

Creativity is the ability to come up with new ideas and different ways to solve problems that provide opportunities.

Innovative is being or producing something like nothing done or experienced or created before.

Creativity/innovative stimulates the mind and energy of employees. Creativity/innovative can have profound impacts on the bottom line of a company. Creativity/innovative thinking will turn untapped sectors of the market into loyal customers. Success heavily favors companies that based on creativity/innovation that can come up with the best solution to a problem. Apple is the best example for creative/innovative products; its creativity/innovative product lines of “iPod”, “iPhone”, and “iPad” helped to propel the company to the top of the market just in a short period of time.

Creativity/innovative at work is the prerequisite for breakthroughs in today complex and highly competitive business and working environment. To be successful, a company needs to be
creativity/innovative. With serious attention and a strong desire for being creativity/innovation at work, the company can be on the path to achieving it.

The use/leverage of best practices combines with the ability for being creative and innovative at work will greatly enhance the company’s ability to achieve quality assurance excellence for the fulfillment of the desired objectives.

5.8 The Leveraging of Core Competencies for Competitive Advantage

Core competencies are the source of competitive advantage that enables the company to develop and deliver an array of new products and services that lead to business success. The needs for the use of company core competencies is similar to the use of best practices with one very important different - core competencies are uniquely associate with the company, they provide all the benefits of best practices and also the competitive advantages that nobody else can copy.

One of the requirements for the achievement of “operational excellence” is the need to sustain the company success. By the use/leverage of company core competencies, the company can be sure about its ability to maintain the competitive advantages over its competitors, which helps to sustain the company success.

5.9 The Achievement of the Desired Quality Objectives

The achievement of the desired quality objectives is the main purpose for the quality assurance excellence effort. Through this achievement, products and services will be delivered that would satisfy customer requirements and expectations; this is a necessary condition for qualifying quality assurance excellence status. When necessary, quality objectives will need to be broken down to small manageable sub-objectives and appropriate goals/targets. These will be tracked and monitors during the capitalization of the needed capabilities; indicators and trends will be established to determine the achievement of the quality objectives alongside with the project implementation flows. At the end of the implementation project, the indicators and trends will be used for the final validation that the overall desired quality objectives have been achieved.

5.10 The Achievement of the Customer Satisfaction

Customer satisfaction is a measurement of customer attitudes about products, services and brands. Positive/good customer satisfaction will add to the company financial bottom line. Available statistics suggest that the cost of keeping a customer is only one tenth of winning a new one. Therefore, when we win a new or already have an old customer, we should hang on to them by making them happy and satisfied with our products and services.

Customer satisfaction can also help in the achievement of a sustainable competitive advantage. It’s about the understanding the way a customer feels after purchasing a product or service and, in particular, whether or not that product or service met the customer’s expectations.
For these important reasons about the needs for customer satisfaction, in order to achieve the quality assurance excellence status, ones need to make sure that the end results of the company works will provide the value-add and the satisfaction for customer expectations of them.

**Figure 12 - Example for the Results of the Implementation for the Technical Review Process**

![Graph showing technical review savings for a 160 persons SW organization.](image)

5.11 The Capturing, Retaining of the Implementation Knowledge

Implementation experiences including lessons learned from failures are an important source of knowledge for company best practices/core competencies development/management effort. This knowledge will contribute to the company quality assurance excellence knowledge foundation. Capturing and retaining “implementation knowledge” is a requirement for the achievement of quality assurance excellence.

Capturing “implementation knowledge” is of vital importance. Unfortunately, it is often not done due to lack of priority or just simply ignored. To ensure the fulfillment of this “quality assurance excellence” requirement, we need to make it into an implementation requirement by getting the necessary management support; assigning the ownership of the task; allocating appropriate time, resources; and defining and implementing the process for capture, document, store and access of the “implementation knowledge”.

Once the knowledge is captured - make sure it is easily referenced by other implementer teams. Keep them in a location where they can be easily found and searched. Start every implementation project by accessing past project lessons learned. Track improved effectiveness and efficiencies on projects based on applying the lessons learned from past
projects. In this way, the lessons learned from past projects help to increase the success of future projects.
6 Company makes all of its Operations Visible ("Transparency")

Do you measure things in your company? What exactly do you measure and why do you measure it? What is your rationale for measuring the things you measured? Is it because measuring is just the right thing to do? Or is it to manage and improve your capabilities capitalization?

To properly manage the operations/activities in the capitalization of the needed capabilities, company needs to have the up-to-date implementation progress/status information to monitor against the planned targets/goals, and to make corrections or change directions if necessary. Company needs to establish and use a system of measurements/metrics to help it to focus on the critical issues. This system must provide up-to-date information for all the appropriate levels of the company so the collected measurements can be put into use effectively. Complete visibility into operations with fact-based information is fundamental to managing operational performance and ensuring continuous improvement.

Complete visibility or "operational transparency", in this context, refers to the setup where the key information about the executions and associated results is readily available for use to ensure the progress toward the desired objectives. Transparency is the state in which all relevant execution information is fully and freely available to all who need to know. "Operational transparency" context includes the visibility of the operations performance and the analysis capabilities for the implementation status/progress. Transparency is also a trust building mechanism generally used to "open up" the books or practices of a company to stakeholders with a "right to know".

Figure 13 - Example for the Operational Transparency Implementation
One important aspect of “operational transparency” is the availability of feedback information relative to set targets and objectives. The feedback information allows the making of the right decision or the taking of appropriate corrective actions if necessary - feedback measurement gains true value when used as the basis for timely decisions. The other emphasis of the operational transparency is not just to know how the implementation is performing, but also to enable it to perform better. The ultimate aim of the “operational transparency” is to ensure the achievement the expected results and to improve the implementation performance of the company. If you can get the implementation performance measurement right, the data you generated increases the chances of achieving the implementation efficiently and effectively.

6.1 The Establishment and Use of a Measurement System

The foundation for an effective “operational transparency” setup is the establishment of the measurement systems for use by all stakeholders. It is essential to define the objectives for the measurement systems; this will enable the smooth establishment of the measurement program. As in any effective program, the measurement program will require a strategy and a plan. The strategy addresses the implementation critical success factors, and the plan, which should be flexible and evolutionary in addressing the step-by-step implementation of the measurement program.

6.2 The Selection of the Meaningful Measurements/Metrics

Is a very crucial step in the establishment of a measurement program. GQM (Goals Questions Metrics) can be used for the selection of the meaningful measurements/metrics for the company.

Figure 14 - Example for the GQM methodology
GQM (Goals Questions Metrics) is a well-known, industry standard goal-driven method for developing and maintaining a meaningful set of measurements/metrics that are tied to business objectives. GQM approach emphasizes the alignment with organization business and technical goals as the driven factors for the selection of meaningful measurements/metrics. The GQM process starts with organizational objectives and goals, from these objectives and goals, additional information for measurement goals will be defined, then questions related to these measurement goals are identified and discussed by the team to ensure clarity and alignment for all on the business objectives. Collected information related to business objectives then drives the definition/selection of metrics that provide answers to the questions.

When GQM is implemented to support an organization-wide improvement process, the experiences and lessons learned from each implementation are packaged in the form of policies, procedures and best practices, to support future projects and improvement initiatives and to help the organization achieve greater leverage from its measurement program.

6.3 The Availability and the Use of the Feedback System based on the Defined Measurement/Metrics

At the heart of the measurement system is the feedback system based on the defined measurements/metrics. The main purpose of the feedback system is to communicate to management and staff the information about the implementation measurements/metrics. This implementation metrics information will be used to drive the business operations management, including the decisions for course/direction corrections when necessary and the improvement actions when the opportunities arise. Acting on feedback received it critical to the achievement of operational excellence.

It is necessary to provide the measurements/metrics information to the people who provided or related to it. By publishing the measurements/metrics, the company lets people know that the measurements/metrics information is at least being paid attention to and also being valued by the management. More important is actually publishing management-level decisions based on the measurements/metrics - If people see that the information is being used to make important decisions, they not only have an incentive to keep providing the data, they also have an incentive to provide the right data.

Feedbacks are necessary to drive changes - organizational and cultural change that produces growth and profit, driving superior business performance, the more feedbacks available the better possibility to evolve/improve the process. Feedback is vital for “operational transparency”, and in turn the quality assurance excellence. It is the visible status/progress update to all stakeholders on how well the implementation is doing. To be effective, feedback needs to be accurate and prompt. It has to tell stakeholders where they are and what changes are needed to stay on track. It is much like a compass and map to the navigator of a boat. It shows you the relationship of where you are to where you want to go. It would be difficult to navigate without a map and compass.
7 Company Continuously improves its Capabilities

To sustain its operational performance and business success through the delivery of products and services that satisfied customer, the company must ensure its continuous focus on its capability improvement opportunities through the implementation of techniques and practices such as post mortem, failure and root cause analysis, staff improvement meetings/reviews, introduce and use new processes, best practices and tools, and conduct the management reviews for the progress of the organization quality assurance excellence building effort.

7.1 Continuous Capabilities Improvement

Continuous capabilities improvement is a systematic approach to achieving ongoing improvements for the company capabilities to deliver products and services. In implementing continuous improvement, “Implementers” define the problem/issue areas, map the capabilities, identify improvement opportunities, take actions to achieve the improvements and continuously monitor the results for further improvement opportunities. Essential success factors for continuous improvement are:

- Total commitment from senior management
- Opportunities for all employees to contribute to the continuous improvement process
- Ensuring employees know their role in achieving the business strategy through continuous improvement
- Equitably reward employees for their performance and contribution to continuous improvement
- Good communication throughout the organization
- Development and training of continuous improvement to staff and linking training activities to operations and business strategy
- Ensure the company wide recognition/adoptions of quality management systems and standards
- Measure and evaluate progress against key performance indicators and benchmarks

Continuous improvement in management perspective means a never-ending effort to expose and eliminate root causes of problems; it is a philosophy, which seeks to improve all factors related to the transformation process (converting inputs into outputs) on an ongoing basis. It involves everyone, management and staff, in finding and eliminating waste in machinery, labor, materials, operations, and production methods.

The achievement of continuous improvement requires a long-term view and the support of top management; it is also important that all levels of management actively support and become involved in the process. Proper support structures of training, management, resource
allocation, measurement, reward and incentive systems must be in place for successful continuous improvement adoption.

Through continuous improvement, firms are able to produce more and better quality products and services at lower costs, hence, better financial returns; the improvement also providing greater customer satisfaction. In the long term, with continuous improvement, the company products and service will be more reliable, of better quality, more advanced, cheaper and more attractive to customers.

Figure 15 - Example for the Implementation of Continuous Customer Satisfaction Improvement

7.2 Post Mortem Process Implementation

What you do after a major work/project is complete will have the heavy influent to the success of similar future works/projects. Post-mortems are an important link in this chain of positive improvement and also an important aspect of organization quality assurance excellence. The purpose of post mortem is to learn, correct, and improve, it is to learn the things that done well for potential leverage them as best practices for use by others in the company; in the case the goals weren't met, post mortem help to discover what went wrong so failures can be documented for prevention in future works/projects, throughout the organization.

The post-mortem is an end-to-end review of the project from its conception to its delivery. A thorough post-mortem will require the involvement of appropriate stakeholders beside the implementers who work on the project.
The post mortem event should take place soon after the completion of the project, before the members of the project are going to move on to other projects; when the experience and knowledge/memory of working on the project still be fresh in everyone's mind.

To get the most out of your post mortem implementation, make sure the post mortem is carefully preparing in advance, analyzing the project systematically, producing actionable findings, and actively sharing the results.

7.3 Failure Analysis/Root Cause Analysis Implementation

Companies are always facing many challenges in improving their processes to ensure high product and service quality, better productivity, etc. These challenges include non-sustaining improvements caused by ineffective fixes. This is due in part to a lack of failures analysis (FA) and root cause analysis (RCA) implementation. By implementing the industry standard improvement best practices of failure analysis and root cause analysis (FA/RCA), companies can significantly reduce incoming defects, improve the defect detection efficiency, and shorten the customer problem resolution cycle time.

In failure analysis (FA), large amount of failures is analyzed for the identification of common patterns for the process or product weaknesses. Information about the common weakness areas will help the development for their resolutions and improvements. In root-cause analysis (RCA), staff/engineer-based group reasoning is applied to failure information to determine organizational understanding of the causes of a particular class of failures so an effective solution can be put in place to eliminate and prevent the occurrence of the same failure. To effectively solve and prevent the occurrence of failures, both types of analysis should be implemented together.

There are two complementary techniques for FA/RCA analysis: the full and mini FA/RCA analysis. The two techniques should be implemented to provide the necessary information for the needed company continuous improvement opportunities.

For the purpose of process and product quality improvement, full-FA/RCA analysis should be conducted at the end of a major process cycle (for example a product release cycle). For the purpose of effective problem resolution, mini-RCA analysis should be used when a critical problem is discovered.

One typical outcome of the FA/RCA analysis is the identification of a list of processes and products that have significantly more critical failures than others. These processes and products composed of about 20% of all the processes and products, and yet they accounted for 80% of all the critical failures. A full-RCA conducted on the top two or three of those, followed by the implementation of recommendations, complemented by the implementation of the mini-RCA for each occurrence of critical failure, will give the companies a good chance to meet their process and product quality improvement objectives.

7.4 Managing the Introduction of New Processes, Best Practices and Tools
In order to make the company capabilities better, faster, and cheaper, it may be necessary for the company to bring-in new processes, best practices, and tools, for use by its employees. The introduction process for these new improvement items will include the checking/validating of new approaches, exploring new methods and testing new ideas for improving the various processes, etc. Once the validations of potential improvement items are completed, the company must prepare and implement a solid deployment plan to place these newly adopted improvement items to the regular uses.

Figure 16 – Example for Software Failure/Root Cause Analysis Process.

7.5 Management review of Continuous Improvement and Quality Assurance Excellence Progress

The success for the strategy of quality assurance excellence ultimately depends on the company ability to sustain a high level of focus and engagement throughout its business operations, especially when the company objectives require employees to change - how they do their jobs, deal with customers, relate to colleagues - or call for them to boost their performance or productivity. Executive leadership will need to provide the necessary focus and engagement for the successful execution of the quality assurance excellence strategy.

Executives lead the company in the drive for quality assurance excellence strategy; by manage three emphasis areas:

- Communicate the ‘quality assurance excellence’ messages to the company,
• Develop tracking systems that facilitate decision making and problem solving,

• Set up formal reviews for the progress of the company quality assurance excellence effort.

Executives conduct reviews on quality assurance excellence progress to ensure that the company as a whole is following the strategy and meeting the stated objectives. Failures in meeting these set objectives are the opportunities for the company to revisit current capabilities so to improve and adjust them. Achievement of the objectives provides the opportunities for recognition and reward of the job well done by individuals, teams, and organization.

Executive reviews also provide the necessary visibility into company commitment and support to the quality assurance excellence strategy. The reviews are also the opportunities for the dialog between company management and staffs; questions or concerns about the quality assurance excellence benefits, costs, efforts, etc. can be openly discussed and clarified, this create a solid foundation for buy-in and alignment on the strategy and execution of the company quality assurance excellence effort.

Figure 17 - Example for Management Reviews of the Release Quality Assurance Excellence status

As a part of the overall continuous improvement strategy; executive reviews will make their contribution to the achievements by building trust in the company with incremental improvements. As the strategy rolls out changes incrementally, it won’t take much effort to implement each change, but will give tangible results. Resistance to small changes will be lower, and positive results will encourage people to accept, and perhaps even welcome further changes. Because the pace of change is slower, it will be easier to absorb without disrupting work in progress.
8 Summary

Quality assurance activities cover all aspects of company operations that related to the delivery of products and services that satisfied customers. Necessary and un-necessary quality assurance costs take a big slice out of the company profit bottom line. Achieving “excellent” for company quality assurance operations/activities will ensure the effectiveness and efficiency for their execution/implementation, the optimization of the necessary costs, and the drastically reduction of the un-necessary costs.

When the company is achieving quality assurance excellence, people in the company, starting with the Executives, rally around the common and compelling desire for doing better in the delivery of high quality products and services. These desires are transformed into the realizable and actionable objectives, which serve as the direction and the final destination for the company to drive toward the achievement of the desires for high quality products and services – the desires for quality assurance excellence. To ensure the smooth drive toward the objectives, the company needs to: totally master the needed capabilities for the achievement of the desired objectives; capitalize on those needed capabilities to get the expected results; make all of its activities totally “visible” to the people who have the need to know – the “operational transparency”; and establish and implement the continuous improvement strategy and programs to ensure the sustaining achievement of its quality assurance excellence and the associate company success.

Quality assurance excellence is a specific case of “operational excellence” which emphasizes the specific quality assurance objectives and activities. The defined “operational excellence” methodology and the associate framework provide the necessary guidelines and practices for the implementation effort to achieve “excellent” for quality assurance operations. A group of experienced and passionate professionals – the “Operational Excellence Networks” is available to assist you in the effort of fulfilling your work objectives through the achievement of operational excellence.