Operational Excellence
for
Successful Software Quality Assurance

Duvan Luong, Ph.D.
Operational Excellence Networks

Introduction

The French Pot of Soup

Lessons Learned

Executives' Desires for Improvement

Company has Clear Improvement Objectives

People Knows What Need To Do

People Implements the Improvement Well

People Measures and Tracks Progress

Company Improving Continuously

How did Operational Excellence start?

The "operational excellence" idea was drawn upon

- The training and practicing, the experience and lessons learned from both successes and failures from the author life long career in "operational excellence" improvement.
- The leveraging of best practices from industry standard frameworks and methodologies such as ISO 9000, SEI/CMM-CMMI, Six Sigma, Malcolm Baldrige, Lean Manufacturing, etc.
- The learning, sharing, and implementation of best practices to ensure success by the members of the "operational excellence" community

What is Operational Excellence

"The state of achievement for the good work one does to fulfill the desired objectives in the delivery of products and services that satisfies customers, and the ability to continuously improve the work by making it faster, cheaper, better, and more productive"

Why Company Needs Operational Excellence?

- **Company Success depends on:**
  - Bigger market share,
  - More revenue,
  - Lower costs,
  - Better customer loyalty/satisfaction,
  - Higher level of competitiveness with improving company core competencies,
  - Higher product and service quality,
  - Higher employee morale/satisfaction, etc.
- **Operational excellence provides the necessary foundation for the achievement of those crucial company success factors.**

What are the Benefits for Operational Excellence?

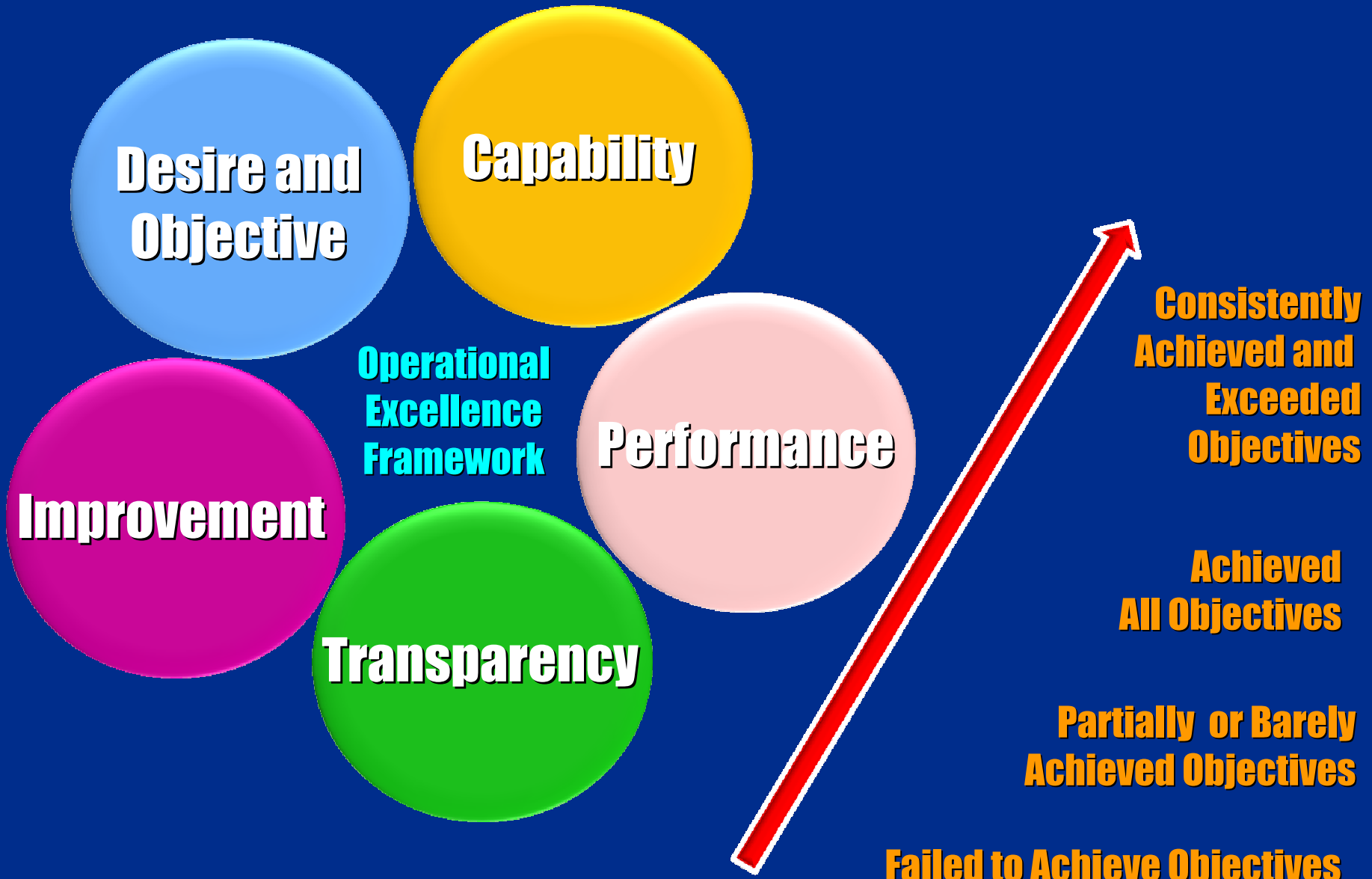
- ✓ **Business Fundamentals**
  - Produce high quality, functionally rich products – "GOOD"
  - Short cycle time – "QUICK"
  - Highly productive development capability – "CHEAP".
  - High customer satisfaction
  - High employee morale
- ✓ **Competitiveness**
  - The capitalization of the company core competencies, innovations, creativities, and continuously improving its business capabilities provides the competitive advantage that is very hard for competitors to match
- ✓ **Company Capabilities Management**
  - Making processes effective -- producing the desired results
  - Making processes efficient -- minimizing the resources used
  - Making processes adapt-able - being able to adapt to changing customer and business needs

How does Operational Excellence work?

The operational excellence framework and its associated methodology were developed to provide the necessary implementation guidelines and practices to enable the achievement of the desired objectives at work by ensuring that:

- Executives desire and support the company's operational excellence strategy
- The company has well defined and communicated objectives for success
- The company masters the capabilities to achieve the business objectives
- The company capitalizes the needed capabilities well
- The company has total visibility into its operations
- The company continuously improves its operational excellence capabilities

Operational Excellence Framework



What are the supports for Operational Excellence project?

Founded by Duvan Luong, Ph.D., after a life long career in "operational excellence" improvement.

The "Operational Excellence Networks" is a network/community of enthusiastic, experienced and passionate "operational excellence" professionals that are available and ready to assist people in the effort of fulfilling their work objectives through the achievement of operational excellence.

Operational Excellence for Successful Software Quality Assurance

Software Quality Assurance Excellence

What is Software Quality Assurance

Software Quality Assurance includes all the activities to ensure the delivery of software 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
- Process conformance
- Product quality conformance

What will it like when Quality Assurance Excellence is achieved

- Higher quality
- Lower costs
- Better customer loyalty/satisfaction
- More market shares
- More revenues
- Higher employee morale/satisfaction
- Higher level of competitiveness with improving company core competencies

Elements of Software Quality Assurance Excellence

Quality Assurance Excellence - Desires

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

- Executives
  - Have burning desires for Quality Assurance Excellence
  - Investments and Supports
  - Participation and monitoring the implementation progress

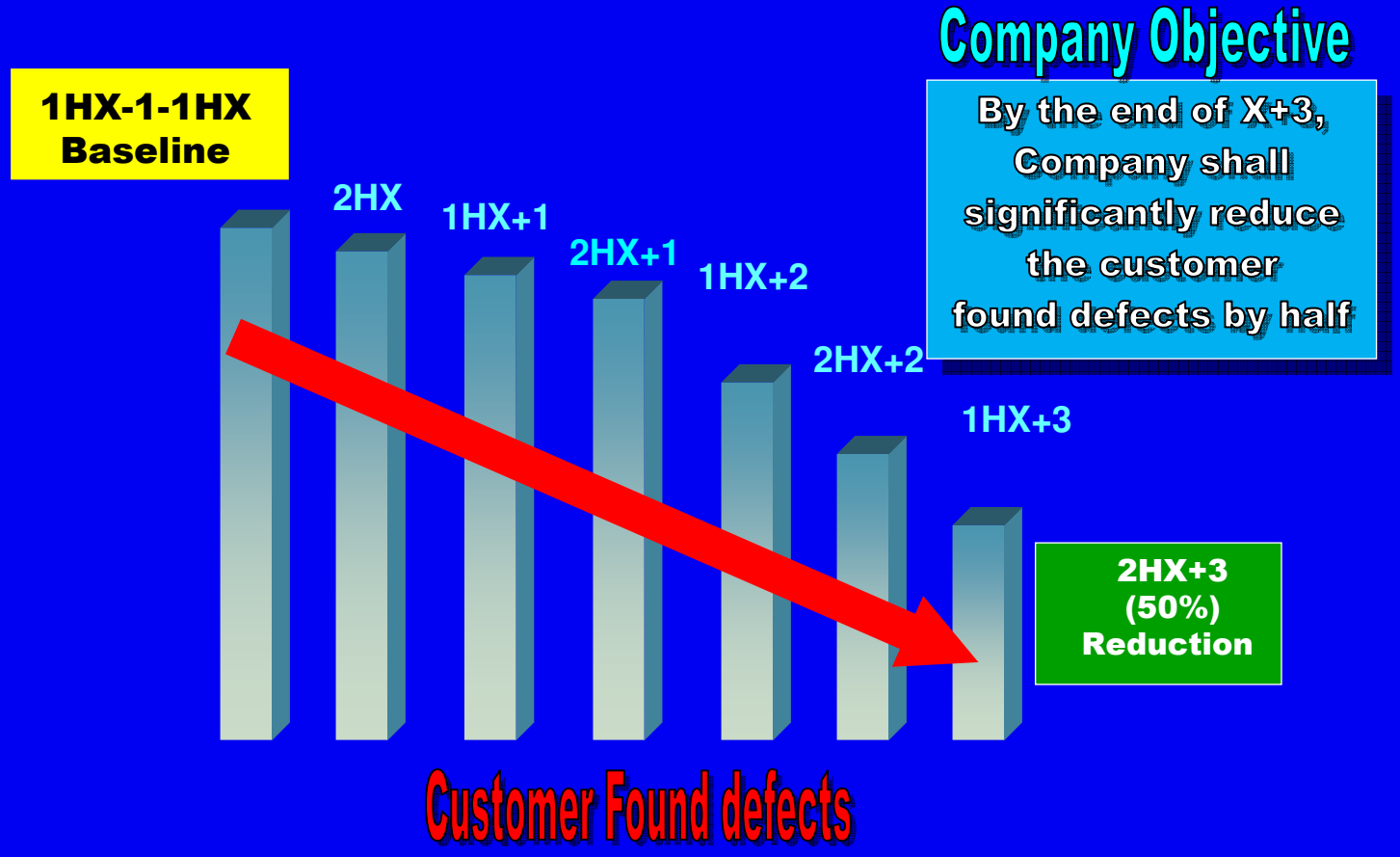
Quality Assurance Excellence - Objectives

"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

- Establishing and Implementing Quality Assurance Objectives
  - "SMART" Objectives
  - Alignment with short/long term business strategy
  - Support Executives' Desires
  - Communicate/share and get buy-in from people in the organization

Example for Software Quality Assurance Excellence Objectives

Customer Found Defects Reduction



What is Capability

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.

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**

- **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, information technologies, human resources)**

- **Process guidance: is the ability to ensure that the process can be executed correctly (e.g. information for the execution, reference documentation, formalized constraints)**

Quality Assurance Excellence - Capabilities

"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

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

Example for Software Quality Assurance Excellence Capabilities

Processes

Quality Product Development Process

- Planning
- Customer satisfaction
- Lifecycle product generation
- Purchasing
- Operation
- Testing, Inspection
- Product Quality planning
- Product Quality review

Measurement, Analysis and Improvement Process

- Establishment of measuring systems
- Progress status monitoring and measuring
- Control of non-compliances for products and services
- Analysis of quality information/data
- Continuous improvement
- Calibration

Enabling Capabilities

Support for Quality

- Quality Management
- Organization and Communication
- Infrastructure and support environment
- Training
- Tools/equipments

Guidance Capabilities

General Quality Information

- Vision, mission, goals, value proposition
- Definition and terminology

Focus on Quality

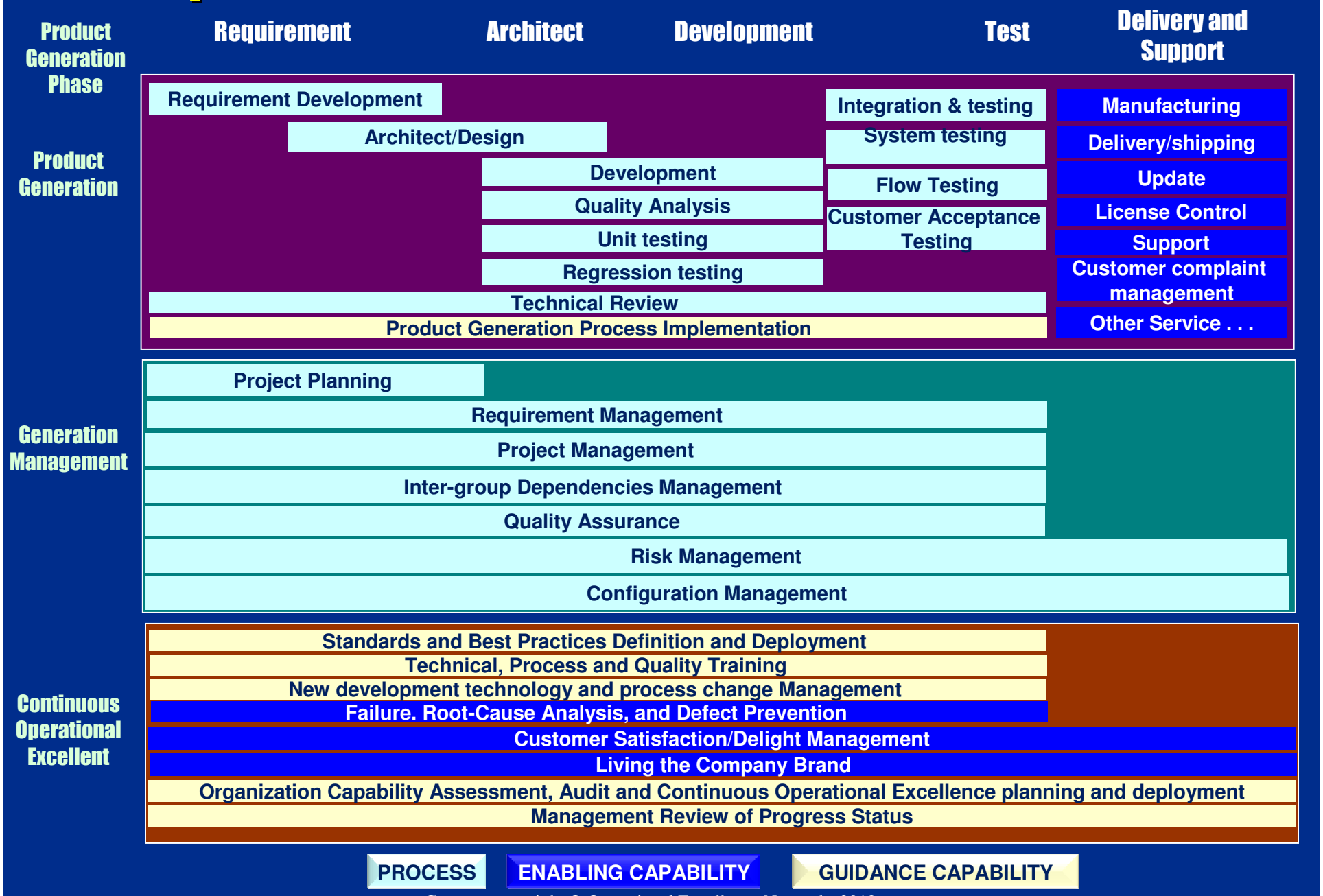
- Management responsibilities and focus
- Quality Policy, Standards and Guidelines

Organization Learning

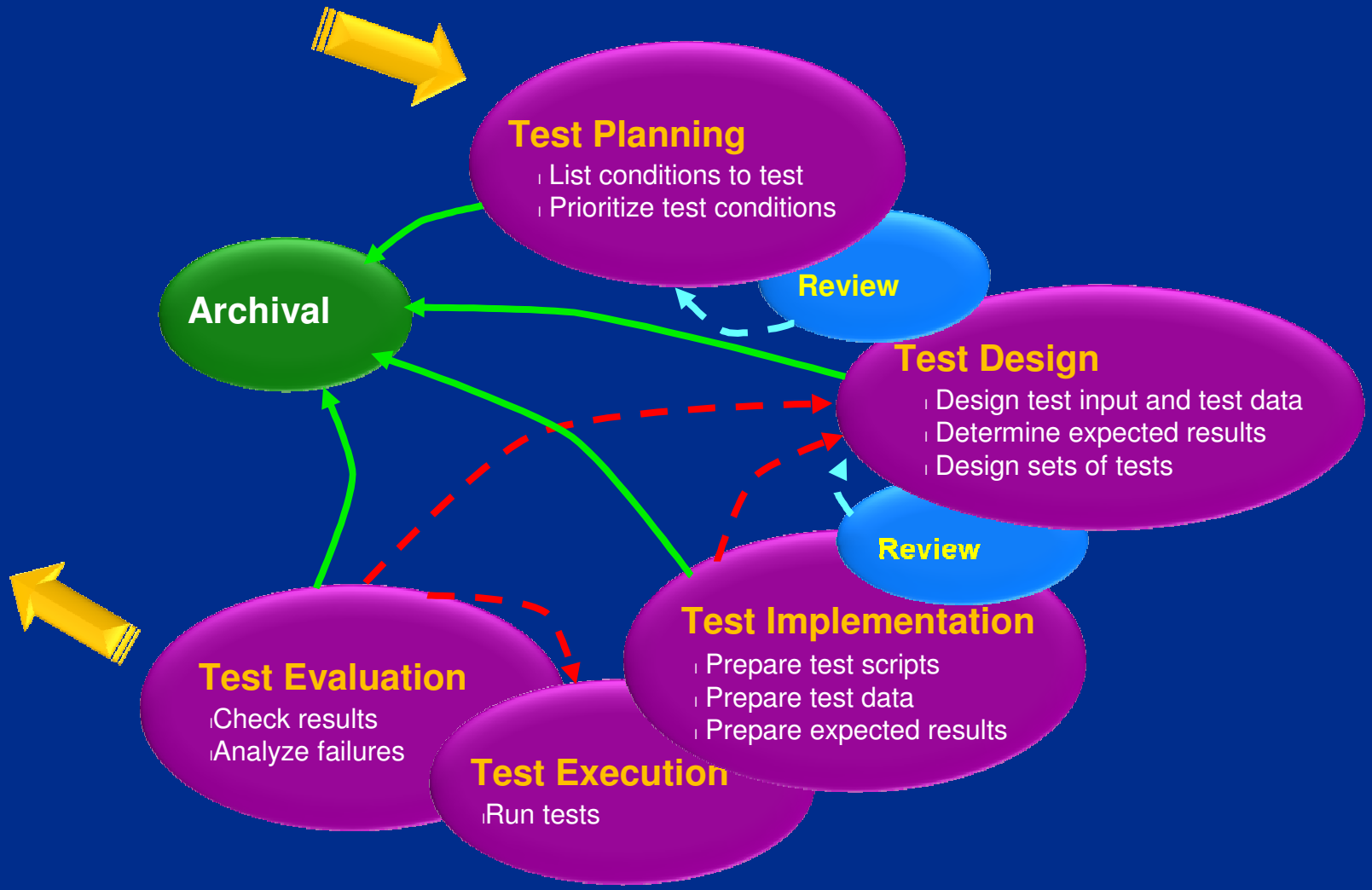
- Best practices
- Lessons learned, etc.

Example for Software Quality Management Architecture

Example for Software Product Generation Architecture



Example for Software Testing Process



Example for Test Selection by Risk Assessment Guidelines

- Code volatility
- New vs. reused vs. leveraged code
- Defect history information
- Complexity and other software measurements
- Schedule constraints vs. risk level
- Test coverage (use of coverage tools)
- In-house vs. third party
- Critical capabilities vs. non-critical capabilities

Risk Management

- Communicate risks to team
- Identify areas untested
- Identify specialized environments
- Identify areas partially tested

Example for Software Quality Assurance Gaps

Capability Area	Current rationale/ approach	Recommendation for quality assurance excellence
Defect Prevention	Little focus on defect prevention	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.
Early Defect Detection	Quality focus starts with the testing process	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.
Operational Transparency	Some implementation of measurement system, feedback system	Full establishment and use of measurement systems, feedback systems, data driven management review of progress
Continuous improvement	Some implementation	Implement Failure and Root Cause Analysis. Establish and allocate resources for continuous improvement efforts

Quality Assurance Excellence - Execution

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

- 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

Execution – The Leanness of the Capabilities Capitalization

- Lean Capabilities Capitalization focuses on three system inhibitors: 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. The existence of inflexibility or proliferation impedes a company's ability to deliver an improved return on invested resources and efforts.
- Maintaining leanness for the capabilities capitalization will improve both operations and customer experiences with the following benefits:
  - Spending less on the implementation.
  - Optimizing the capabilities to increase efficiency of the implementers;
  - Reducing the number of people and resources needed to accomplish a task
  - Improving customer service
  - Satisfying/wining customers by having cheaper prices and faster services

Execution – use/leverage of best practices for optimal results

- Best practices are the collection of knowledge on processes, procedures, guidelines and things people have successfully done to get desired results. Best practices are based on an extensive amount of work, education, research and industry experiences.
- If you follow the proven best practices, you can perform at the same level as an expert who has got many years of experience plus a relevant education background.
- The use/leverage of best practices helps to establish boundaries, sets expectations, and generally puts everyone on the same page.

Execution – Being Innovative and Creativity at Work

"If at first an idea is not absurd then there is no hope for it." – Albert Einstein

- 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 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.

Execution – Example of Innovation at Work

Code Modification Quality Risk Profile

Risk Category	No Risk or N/A	Low Risk	Medium Risk	High Risk
Size of the modification		☐ 10< lines modified	☐ 10<= lines modified<100	☐ >= 100 lines modified
Number of files modified		☐ 1 file modified		☐ >= 2 files modified
Number of interfaces modified	☐ No interface modified	☐ 1 interface modified		☐ >= 2 interfaces modified
Number of shared objects modified	☐ No shared object modified	☐ 1 shared object modified		☐ >= 2 shared objects modified
Developer experience	☐ Lead engineer involved or > 5 year experience	☐ 3 or 4 year of experience	☐ 1 or 2 year of experience	☐ < 1 year of experience
Modification complexity	☐ Typos	☐ Data handling	☐ Memory usage	☐ Timing, locking
Ability to problem	☐ Reproducible by modifier	☐ Reproducible by other engineers	☐ Reproducible by support Org	☐ Cannot be reproducible
Schedule pressure	☐ Adequate resources and schedule planned	☐ Pressured by support organization	☐ Modification has been escalated	☐ Delay will hold-up the release
Performance impact	☐ No impact	☐ Modification resulted in long code path	☐ Modification impacts the use of computer resource	☐ Related to timing or throughput
Customer usage impact	☐ No modification in current way customer use product	☐ Some minor modifications in current way of usage	☐ Many modifications to the basic way customer use the product	☐ Require total new way of using the product
Level of defect prevention	☐ Technical review is properly planned and implemented	☐ Review with technical lead	☐ Review with peer engineer	☐ No review at all
Ability to be tested	☐ Can be automated and will be added to regression suite	☐ Automated but will not be added to regression suite	☐ Only manually test	☐ No test/ test case is not possible

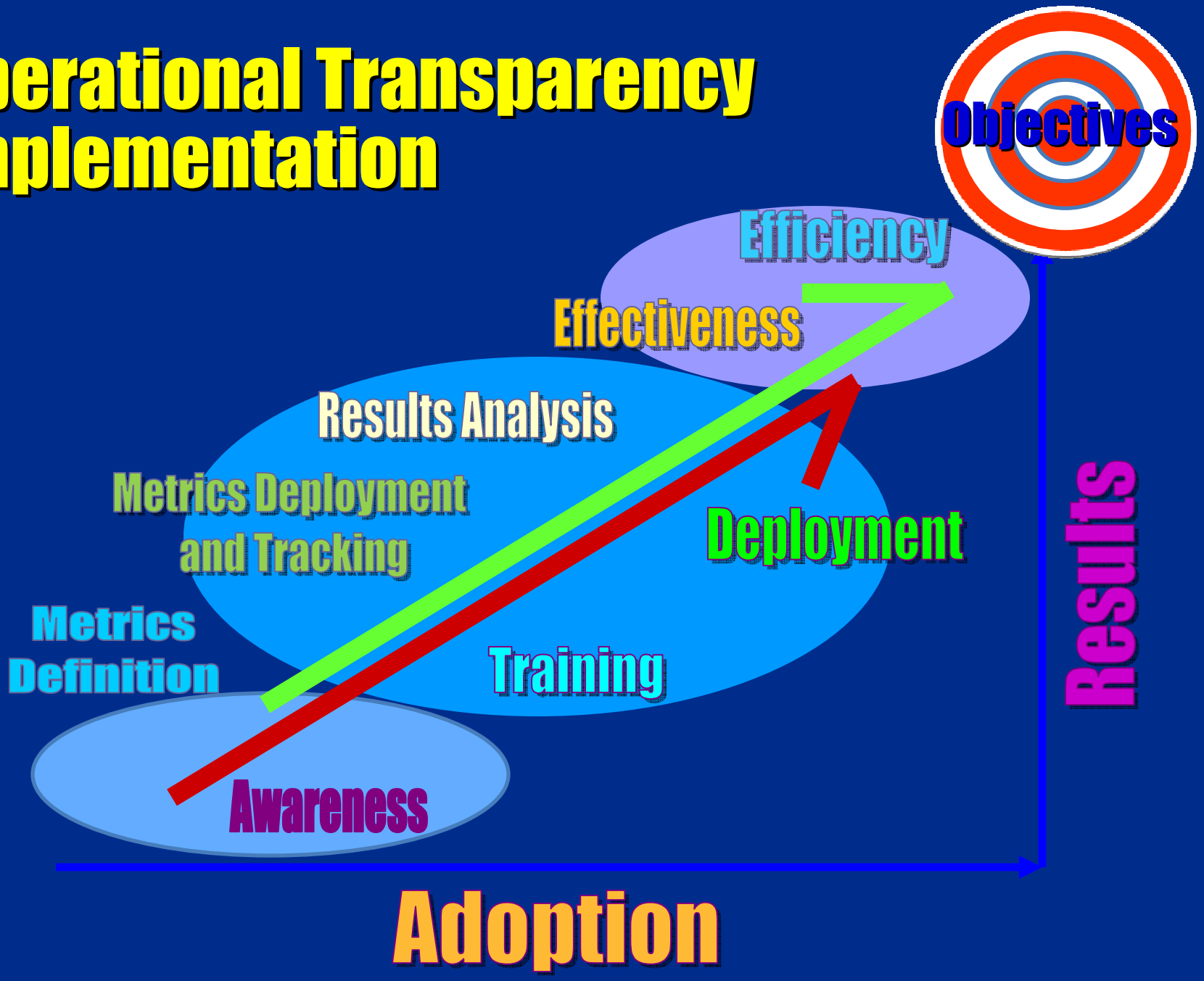
Execution – Leveraging of Core Competencies for Competitive Advantage

- Core Competencies are uniquely associated with a company. They provide all the benefits of best practices and also the competitive advantages that nobody else can copy
- Core competencies are the source of competitive advantage that enables a company to develop and deliver an array of new products and services that lead to business success
- By using/leveraging a company's 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.

Quality Assurance Excellence - Transparency

- Operational transparency is the state where key information about the executions and associated results is readily available for use to ensure the progress toward the desired objectives. Transparency is achieved when all relevant execution information is fully and freely available to all who need to know
- Operational transparency is the cornerstone of operational excellence. The effective establishment and use of the measurements system is the key factor for the achievement of operational transparency.
- Operational transparency status is achieved when the company fulfills the following requirements:
  - The establishment and use of a measurement system
  - The selection of the “right” metrics
  - The availability and the use of the feedback systems based on the defined metrics
  - The Executives and Management Staffs reviews for the results and progress status of the implementation of company business and operational excellence strategies.

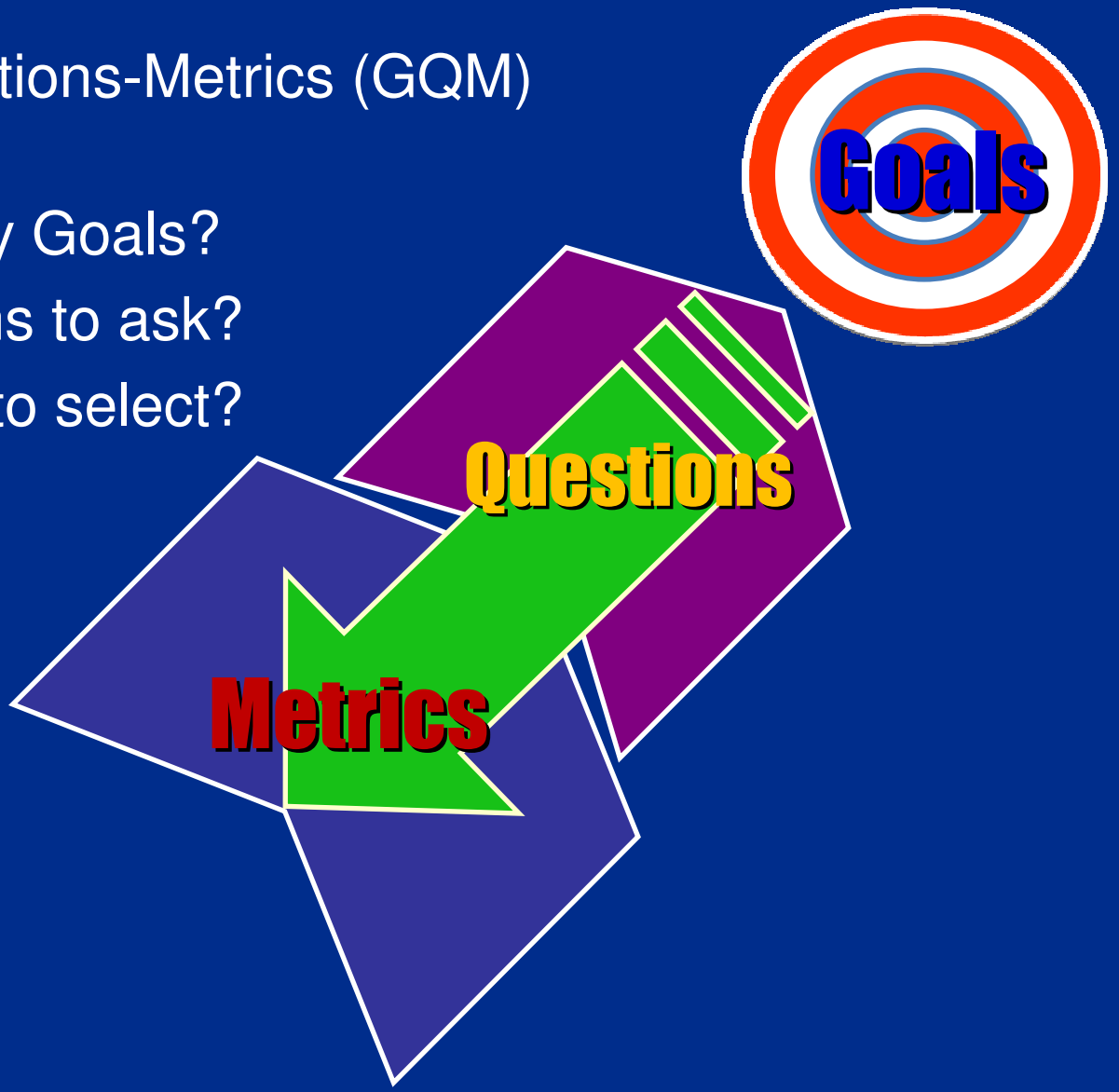
Operational Transparency Implementation



How to Define/Select Metrics?

The Goals-Questions-Metrics (GQM) methodology

- How to identify Goals?
- What questions to ask?
- What metrics to select?
- Examples

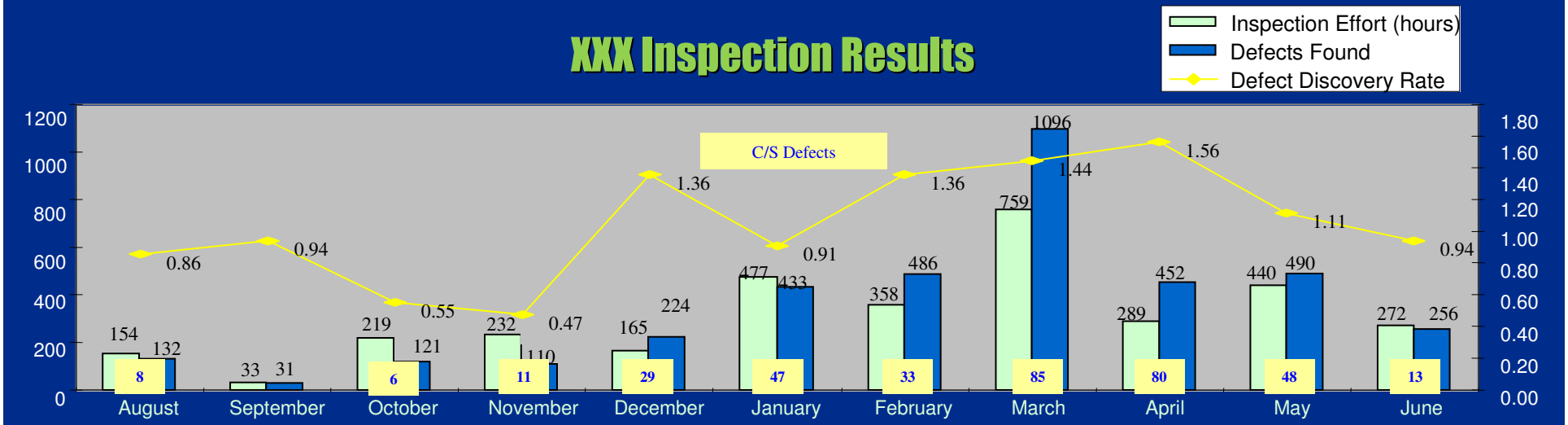


Example: 3 Years Metrics for Inspection Implementation

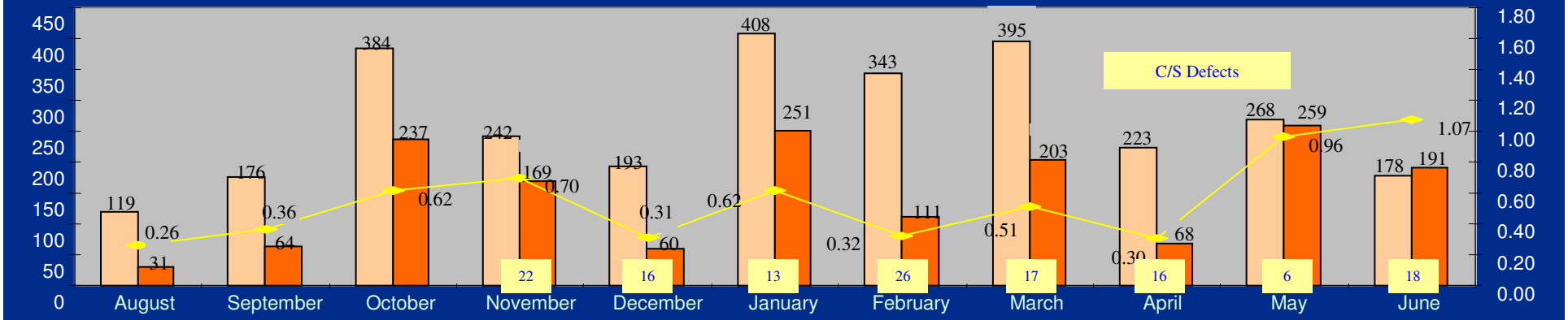
Metrics	First Measurement	Second Measurement	Third Measurement
1. Number of engineers involved with TRP training	30	90	150
2. Percentage of trained versus total engineers who are involved in TRP activities	20%	60%	100%
3. Number of moderators for the organization	2	9	30
4. Percentage trained versus total moderators	100%	100%	100%
5. Ratio of moderator versus engineers involved in TRP activities	1/15	1/10	1/5
6. Number of products with a list of key deliverables that need TRP	N/A	8	15
7. Percentage of products with a list of key deliverables that need TRP versus total products in the organization	N/A	80%	100%
8. Time spent in TRP activities	N/A	474 hrs	450 hrs
9. Amount of code (in KLOC) or documentation (pages) that get TRP during last month	N/A	N/A	10 KLOC (1hr – 23 LOC)
10. Number of TRP sessions done during last month	2	15	17
11Percentage of actual TRP sessions versus planned sessions	100%	100%	100%
12. Problems found by TRP activities (breakdown to total versus major, inspection versus walkthrough	N/A	Ins: 110 – 11 Walk:169 – 22	Ins: 272 – 13 Walk: 191 – 18
13. Number of major TRP problems closed	N/A	26	31
14. Percentage of major TRP problems closed versus total major problems found	N/A	80%	100%
15. Number of major TRP problem not closed	N/A	7	0

Example –Metrics for Inspection Implementation
(after 3 years)

XXX Inspection Results

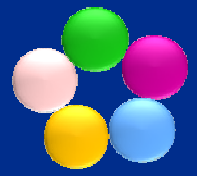


XXX Walk-through Results



Quality Assurance Excellence – Continuous Improvement

- 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
- Communicate improvement results throughout the organization
- Development and training of continuous improvement to staff and linking training activities to operations and business strategy
- Continuously measure and evaluate progress against key performance indicators and benchmarks

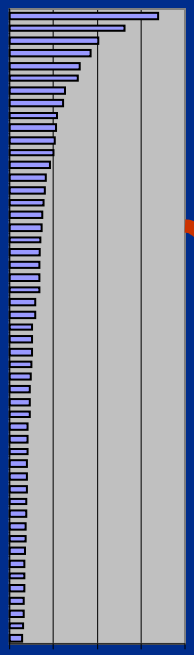


Continuous Improvement – Key Practices

- Post Mortem
- Failure Analysis/ Root Cause Analysis
- Introducing New Process, Practices, Technologies
- Executive/Management Review of Improvement Progress

Continuous Improvement – Failure/Root Cause Analysis

Defects by Product



1 Pin point most error-prone areas in large products portfolio

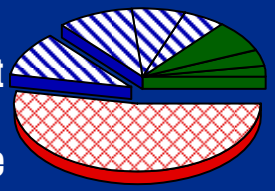
List of PCRs Records

PCRID	PRODUCT	PRODLEVEL2	MANAGER	TITLE
593693	ABSTRACT	ABSTRACT	kenny	picasso got Evaluation stack during abstract step
608864	ABSTRACT	ABSTRACT	kenny	verify in Picasso fail by Internal error
651238	ABSTRACT	ABSTRACT	kenny	Segmentation Fault occurrs with Abstract Step
661226	ABSTRACT	ABSTRACT	kenny	Abstract generator from dfII crashes on HP
680585	ABSTRACT	ABSTRACT	kenny	Abstract step hangs and Extract gives a warnign ABS-616
711650	ABSTRACT	ABSTRACT	kenny	Abstract step core dumps when abstracing IO Pad
650505	ABSTRACT	ABSTRACT	pawanf	Abstract should not transparently propagate pins
650615	ABSTRACT	ABSTRACT	pawanf	blockage spacing not consistant
720160	ABSTRACT	ABSTRACT	pawanf	Abstract does not create CLASS CORE for multiple ports
665338	ABSTRACT	EXTRACT	kenny	Abstract Crash during Extraction of Ram
597983	ABSTRACT	IMPORT	pawanf	Abstract fails to read a good GDSII file
608240	ABSTRACT	IMPORT	pawanf	gds2hld translator scales the x coordinate
707911	ABSTRACT	LEFDEF	kenny	Abstract Generator not extracting 45 degree pin shapes
605481	ABSTRACT	PINS	crc_pcr	Abstract doe not honor fat wire rules wrt blockage
684340	ABSTRACT	PINS	pawanf	cannot extract pin though overlapping geometry exist
711648	ABSTRACT	PINS	pawanf	pin and extract steps not seeing all pins
687553	ABSTRACT	UI	kenny	Turning off all layers causes design area into while colo
649165	CT_GEN	OTHER	psethia	pbobvo reports duplicate nets
641239	CT_GEN	VERILOG	psethia	Abnormal termination for phodiff
604498	FIRST_ENCOUNTER	APP	fang	VPP power estimation error
651378	FIRST_ENCOUNTER	APP	fang	Calculate does not work well in synthesize VPP
708978	FIRST_ENCOUNTER	APP	fang	4.1 APP SEGV in sun4v64 / hp64
692651	FIRST_ENCOUNTER	BBOX_WHATIF	psethia	saveBlackBoxTimingAssertions writes wrong lib name

2 Statistically reducing huge amount of complex defect data to meaningful information sample subset

3 Identification of key common defect types

Defect Type Profile



Root-Causes for the Common Defect Types

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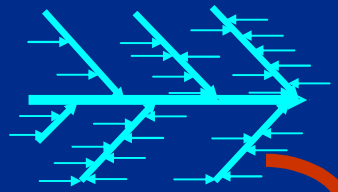
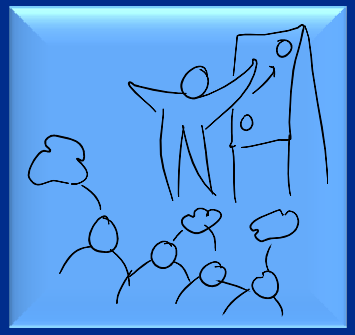


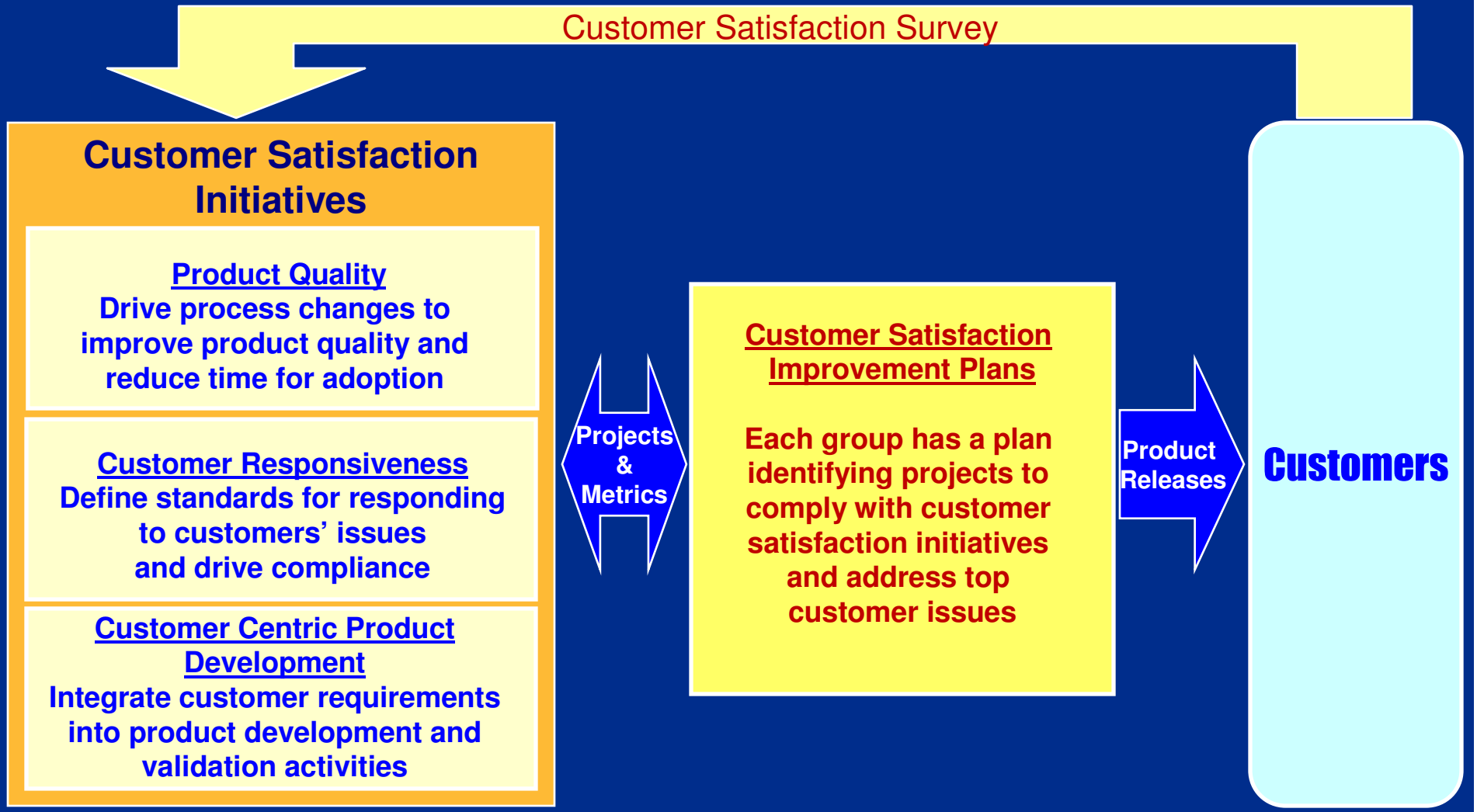
Accurate and useful root-causes identification



5 Practical and high value common solutions/preventions development

Engineers suggested common solutions/preventions

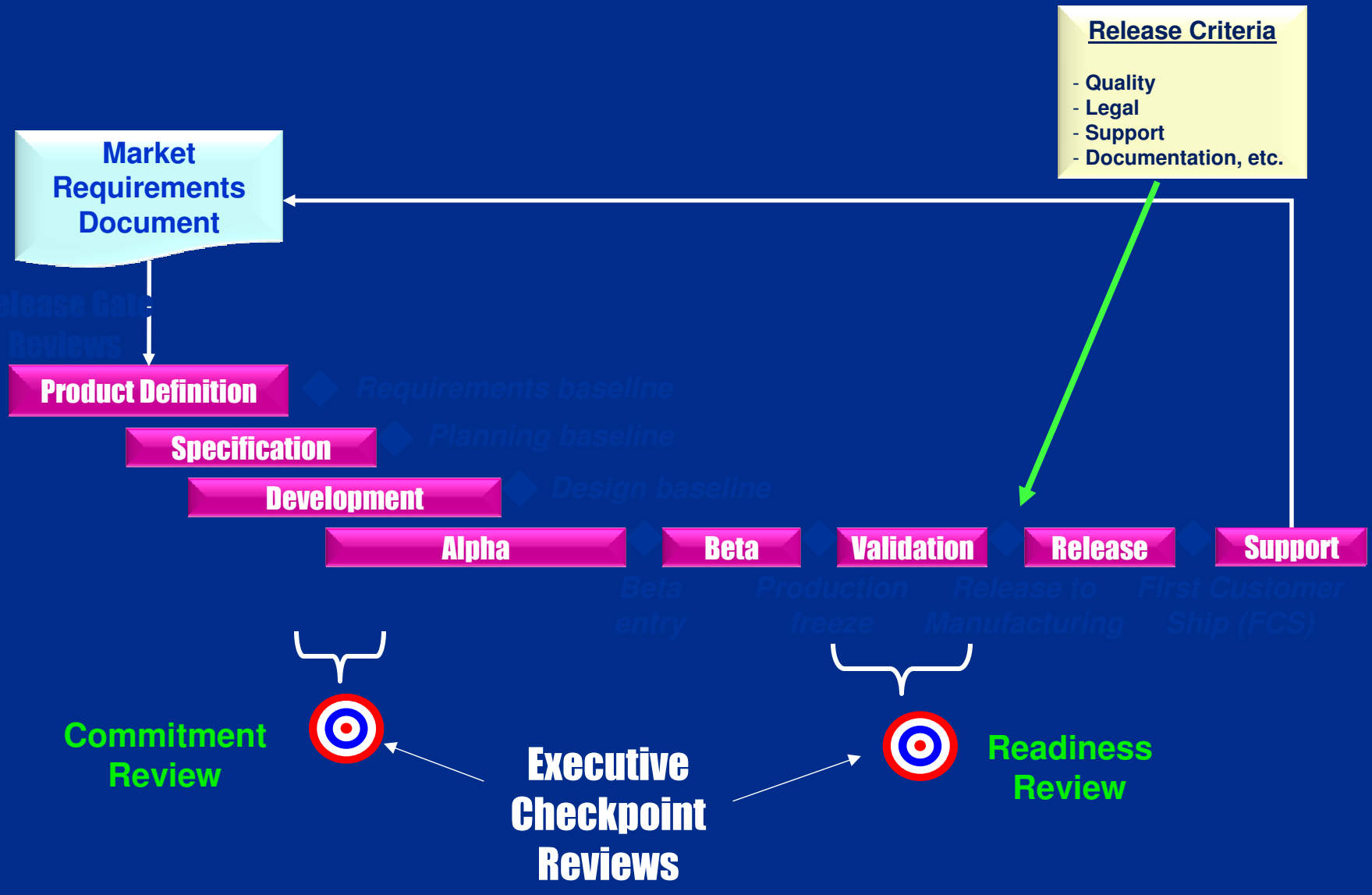
Continuous Improvement – Customer Satisfaction



Continuous Improvement – New Process/Technology Introduction Guidelines

- Proof of concept phase
- Preparing for the improvement items introduction
- Deployment
  - Initial deployment
  - Full deployment
- Continuous Improvement

Continuous Improvement – Executive/Management Review



Summary – Operational Excellence

- Operational excellence means “the good work one does to fulfill the desired objectives”
- It is the “success assurance” and the foundation from which the company can capitalize for the achievement of business objectives
- The operational excellence framework and methodology were developed to provide the necessary implementation guidelines and practices to enable the achievement of the desired objectives at work.
- 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.

Summary – Quality Assurance Excellence

- **Quality assurance activities cover all aspects of company operations that related to the delivery of products and services that satisfied customers.**
- **Quality assurance excellence is a specific case of "operational excellence" which emphasizes the specific quality assurance objectives and capabilities**
- **The Achievement of quality assurance excellence will ensure:**
  - Higher quality
  - Lower costs
  - Better customer loyalty/satisfaction
  - More market shares
  - More revenues
  - Higher employee morale/satisfaction
  - Higher level of competitiveness with improving company core competencies

Contact Information

- Duvan Luong at drduvanluong@gmail.com
- Operational Excellence Networks website: http://www.operationalexcellencenetworks.com

Thank You