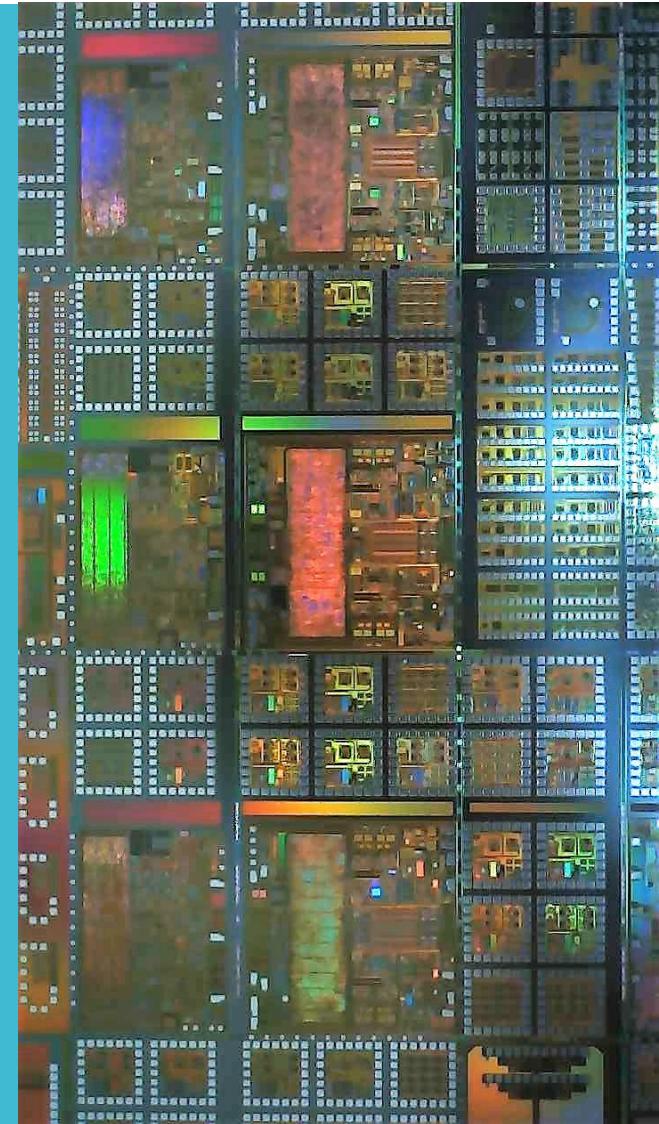


# Class 4: Quality Management

## Agenda:

- 3P's (policy, process and procedure)
- Why Quality is important?
- Quality definition
- Quality Management definition.
- Quality Management Framework
- Semiconductor Industry examples.



# Course Overview

(15 minutes)

Class 1

Introduction &  
Foundations

Class 2

Project Life cycle

Class 3

Risk Management

Class 4

Quality Management

Class 5

Scheduling Part I

Class 6

Scheduling Part II

Class 7

Special Assignment

Class 8

Open discussion  
with Industry expert

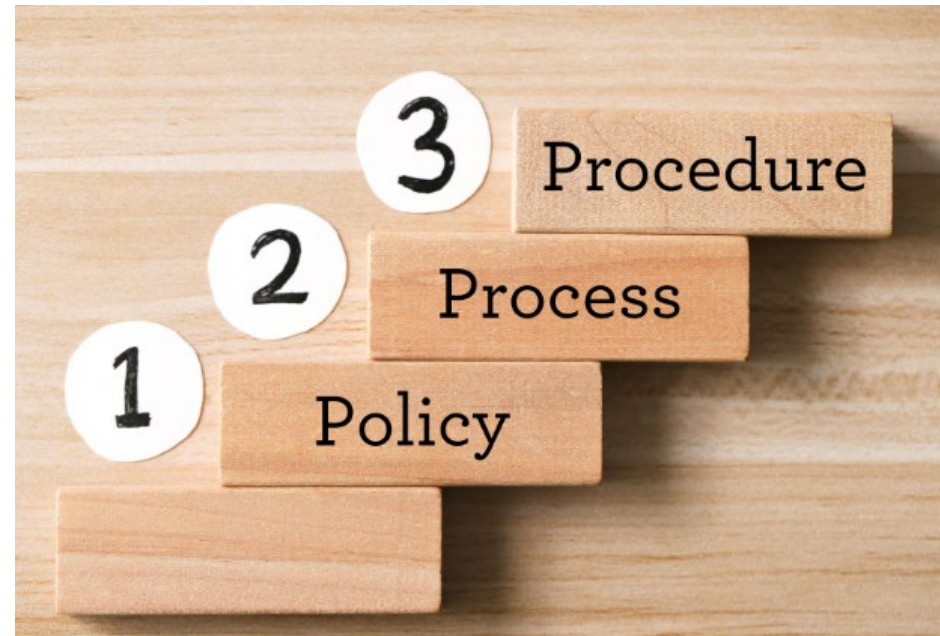
# Process Group and Knowledge Area Mapping

| Knowledge Areas                                     | Project Management Process Groups © WWW.PM2.BIZ |   |  |   |                            |
|---|---|---|--|---|----------------------------|
|   | Initiating                                      | Planning  | Executing  | Monitoring and Controlling  | Closing                    |
| <b>4. Project Integration Management</b>            | 4.1 Develop Project Charter                     | 4.2 Develop Project Management Plan   | 4.3 Direct and Manage Project Work<br>4.4 Manage Project Knowledge | 4.5 Monitor and Control Project Work<br>4.6 Perform Integrated Change Control | 4.7 Close Project or Phase |
| <b>5. Project Scope Management</b>                  |   | 5.1 Plan Scope Management<br>5.2 Collect Requirements<br>5.3 Define Scope<br>5.4 Create WBS   |  | 5.5 Validate Scope<br>5.6 Control Scope                                       |                            |
| <b>6. Project Schedule Management</b>               |   | 6.1 Plan Schedule Management<br>6.2 Define Activities<br>6.3 Sequence Activities<br>6.4 Estimate Activity Durations<br>6.5 Develop Schedule                       |  | 6.6 Control Schedule  |                            |
| <b>7. Project Cost Management</b>                   |   | 7.1 Plan Cost Management<br>7.2 Estimate Costs<br>7.3 Determine Budget  |  | 7.4 Control Costs   |                            |
| <b>8. Project Quality Management</b>                |   | 8.1 Plan Quality Management   | 8.2 Manage Quality   | 8.3 Control Quality   |                            |
| <b>9. Project Resource Management</b>               |   | 9.1 Plan Resource Management<br>9.2 Estimate Activity Resources   | 9.3 Acquire Resources<br>9.4 Develop Team<br>9.5 Manage Team       | 9.6 Control Resources   |                            |
| <b>10. Project Communications Management</b>        |   | 10.1 Plan Communications Management   | 10.2 Manage Communications   | 10.3 Monitor Communications   |                            |
| <b>11. Project Risk Management</b><br>© WWW.PM2.BIZ |   | 11.1 Plan Risk Management<br>11.2 Identify Risks<br>11.3 Perform Qualitative Risk Analysis<br>11.4 Perform Quantitative Risk Analysis<br>11.5 Plan Risk Responses | 11.6 Implement Risk Responses                                      | 11.7 Monitor Risks  |                            |
| <b>12. Project Procurement Management</b>           |   | 12.1 Plan Procurement Management  | 12.2 Conduct Procurements  | 12.3 Control Procurements   |                            |
| <b>13. Project Stakeholder Management</b>           | 13.1 Identify Stakeholders                      | 13.2 Plan Stakeholder Engagement  | 13.3 Manage Stakeholder Engagement                                 | 13.4 Monitor Stakeholder Engagement   |                            |



## Assignment 1: Whiteboard Session

- 1 Define Policy
- 2 Define Process
- 3 Define Procedure





# The 3 P's

Policy

Rules & Standards

Process

What, Who & When

Procedure

How & Where

If you don't have clearly defined and documented Policies, Processes and Procedures, your business operations are likely to fall short on quality, accuracy and efficiency, and that's bad for any business.

# Policy “why”

A **policy** is a rule or guideline that helps an organization govern a process to reach its **long-term goals**. Is designed to guide decisions, to explain the “**why**” of how actions are taken.

Policies are crucial for several reasons:

- **Direction:** policies help to define clear direction and purpose to the organization. Ensures that employees are align with corporate Mission, Vision and Values.
- **Compliance:** Policies ensure that organizations **comply with laws, regulations and industry standards**.

Some Examples:

- Employee Code of conduct Policy - outlines the ethical standards and behavior expected.
- Employee leave policy - governs the various types of leave available to employees, such as sick leave, vacation, maternity or paternity leave, medical leave, etc.
- Health and Safety Policy - focuses on creating a safe and healthy work environment.
- Information Security Policy - protect the organization’s sensitive information and data assets from unauthorized access.

# Process

## “what, who and when”

- The **Process** sits one level down from the Policy.
- It outlines how the rules and standards set by the Policy will be achieved by listing the tasks to be done, who does them, and when they do them.
- The Process is a list of tasks showing the **WHAT**, **WHO** and **WHEN**.

| WHAT   | WHO           | WHEN                    |
|--|---------------|-------------------------|
| Collect mail from post office and street letterbox | Receptionist  | after 8am business days |
| Record inward mail in the Correspondence Register  | EA to the CEO |                         |
| Deliver mail to addressee                          | EA to the CEO | by 11am business days   |

- **Broad Scope:** Processes encompass multiple tasks and functions, involving various stakeholders. They span across different departments or teams within an organization.
- **Emphasis on Flow:** Processes focus on the overall flow of work, highlighting the sequence of activities and the relationships between them.

# Procedure

## “How and Where”

- A **procedure** is a sequence of steps or work instructions to complete an activity within a process.
- The documented procedure should be detailed enough for an experienced employee or new starter to carry out the process activity without difficulty.

### **Good Procedures:**

- A good procedure must be simple.
- A good procedure document is focused on a specific task or activity, with detailed, step-by-step instructions and sequence of actions employees can easily follow.
- A good procedure is regularly and promptly reviewed and updated

### **Examples:**

- Employee Onboarding Procedure
- Quality Control Procedure



# 3 P's Summary

| Feature    | Policy  | Process  | Procedure   |
|------------|---|--|---|
| Definition | A high-level principle or rule that <b>guides decision-making</b> . | A series of steps taken to achieve a particular end. | A detailed set of instructions that outlines how to perform a specific task within a process. |
| Purpose    | Why.  | What, Who & When                                     | How & Where   |
|            | Sets the overall direction and establishes boundaries.              | Defines the workflow and how things get done.        | Provides clear, step-by-step guidance for consistent execution.                               |
| Scope      | Broadest<br>(organization-wide)                                     | Mid-level<br>(department, function)                  | Narrowest (specific task)   |



# Assignment 1: Whiteboard Session

(15 minutes)

1

Define Quality

2

Define Quality Management

3

Why we invest in Quality?



# Defining Quality

- **Quality** : the ability of a product (a good or a service) to consistently meet or exceed customer expectations.
  - **Consistently**: This means delivering quality every time, not just occasionally. It's about establishing reliable processes that minimize variations and defects.
  - **Meeting**: It's not enough to just come close; you must fully satisfy all applicable requirements.
  - **Requirements**: These are the specific needs and expectations that your product or service must fulfill to be considered "quality."





# Defining Quality Cont'

- Quality is simply “conformance to requirements/specifications.”
- Should not be confused with excellence, luxury, prestige, “gold-plating,”
- There can be waste involved in producing a product or service that exceeds requirements just as surely as in producing a product that falls short of requirements.

This definition of quality is the essential concept on which quality management operates.







# The Importance of Quality



- More than 90% of Dissatisfied Customers **NEVER** Again Do Business with the Offending Organization
- The Average Customer who has a Problem Tells **Nine Others**
- Attracting a New Customer Costs Five to **Six Times as Much** as Keeping the Current Customer

**QUALITY IS FREE BECAUSE IT PAYS FOR IT'S SELF.**

# What is Quality?

## Quality Dimensions

- **Performance:** the achievement of quality, which is the consistent delivery of results that meet a defined purpose.
- **Reliability:** The probability a product operates correctly for a given time frame under specified conditions.
- **Conformance:** the degree to which a product or service meets a set of standards or specifications.
- **Durability:** How long a product lasts before it needs to be replaced.
- **Serviceability:** The ease of getting a product serviced or repaired after is bought.
- **Aesthetics:** how well the products looks, feels and smells.
- **Safety:** assurance that the customer will not be injured when using the product.
- **Perceived quality:** Subjective assessment based on image, advertising, etc.



# Quality Management History

## Shifting from Inspection to Prevention

- **Traditional Approach (Inspection):** Find and fix problems after they occur (more costly, time-consuming, and potentially riskier).
- **Modern Approach (Prevention):** Prevent problems from occurring in the first place by focusing on process control, continuous improvement, and early detection. "Manage Quality" is about building quality into every stage of the project, not just checking for defects at the end.

- **Prevention** means keeping errors out of the process
- **Inspection** means keeping errors out of the customers' hands



# Quality Owner

**Ownership of Quality Responsibility** - The individual employee performing a given task has the ultimate responsibility for the conformance of results to the requirements/specifications.

When the individual is provided the essential tools, skills, knowledge and opportunities, he/she is encouraged to develop a sense of personal pride and commitment in the product's internal and external quality. This concept is called "**ownership.**"

**Self-Inspection** - The individual performing a given task also performs measurements to ensure that conformance is continually achieved.





# What is Quality Management

## ISO 9001 Definition

- "Coordinated activities to direct and control an organization with regard to quality"

## PMI Definition

- "The processes for incorporating the organization's quality policy regarding planning, managing, and controlling project and product quality requirements in order to meet stakeholders' objectives"

## Comparison

- **Similarities:** Both emphasize coordinated efforts and meeting objectives
- **Differences:** PMI's definition is more **project-centric**, while ISO 9001 is broader and applicable to entire organizations

# Quality Management Frameworks

## ISO 9001

- **Definition:** emphasizes the organizational aspect, covering all activities related to quality.
- **Framework:** Plan-Do-Check-Act (PDCA) cycle. Emphasizes continuous improvement, aligned with TQM (Total Quality Management) methodology. The process approach ensures that interrelated processes are managed as a system. Risk-based thinking helps prioritize actions.

## PMI's

- **Definition:** is more project-centric, focusing on how quality management integrates with project management processes.
- **Framework:**
  1. Planning Quality Management involves identifying requirements and standards.
  2. Managing Quality involves auditing requirements and results.
  3. Controlling Quality involves monitoring results and recommending changes.

# Quality Management Frameworks

- ISO 9001 is more comprehensive and applicable to entire organizations
- PMI's framework is tailored specifically for project management

| Aspect                 | ISO 9001 (Quality Management System)  | PMBOK (Project Management Framework)  |
|------------------------|---|---|
| Purpose                | Building a quality management system  | Guiding project management practices  |
| Scope                  | Organization-wide   | Project-specific  |
| Focus                  | Ongoing processes and customer satisfaction   | Delivering successful individual projects   |
| Scope of Quality       | Focuses on the quality of processes and their outputs to ensure they consistently meet requirements.  | Emphasizes the quality of the project management processes and the final deliverables to meet stakeholder requirements and project objectives.                                  |
| Quality Assurance      | Integrates quality assurance throughout the entire process lifecycle, from design and development to production and delivery.   | Includes quality planning, assurance, and control processes to ensure project deliverables meet quality standards.  |
| Continuous Improvement | A core principle, encouraging ongoing evaluation and improvement of the QMS and its processes.  | Emphasizes monitoring and controlling project work to identify and address deviations from the project management plan, which can contribute to quality improvement.            |
| People and Competence  | Highlights the importance of competent personnel performing tasks that affect quality. Requires establishing training and competence requirements for relevant roles. | Recognizes the importance of a skilled project team and includes processes for defining roles and responsibilities, managing the project team, and developing the project team. |

# Project Quality Management (PQM) Framework

According to the PMBOK, QM involves the processes of quality planning, quality assurance, and quality control

- 1 **Planning quality management:** Define quality requirements and how to achieve them
- 2 **Performing quality assurance:** Implement planned quality activities.
- 3 **Performing quality control:** Monitor and adjust processes to ensure quality standards are met.





# 1. Planning Quality

It is the process of identifying the quality standards relevant to the project and deciding how to meet them.

## Defining Quality Requirements

**Q:** What is Quality Planning?

**A:** Quality Planning is identifying **which quality standards are relevant** to the project and determining how to satisfy them.

**Translate Needs into Engineering Terms:** Engineers need to translate sometimes vague customer desires into concrete, measurable specifications.

## Tools & Techniques

The Planning process may include:

- Benefit/Cost tradeoffs
- Risk Analysis
  - Benchmarking
  - Cause/Effects analysis
  - Design for experiments

# 1. Planning Quality

## Example:

### Customer Need:

- The product must be low power.

### Requirement (what the product must do):

- When operating at 5 V, the product shall draw 10 mA or less.

### Specification (what the product does / measured result):

- When operating at 5 V, the product draws no more than 8 mA.

## Customer Needs or Customer Requirements.

- Sometimes they are too vague, impossible to implement, contradictory, etc. so they may not be adapted as actual requirements.
- Usually, the first pass of customer needs are not specific enough to be good requirements, so we need to have some back and forth to understand their actual needs.

## Requirements

Items that define what the product must be or what the product must do.

These are *inputs* to the project design for requirements driven design.

## Specifications

Items that define what the product is or what the product does. }

These are *outputs* of the project design for requirements driven design (measured performance).

The industry as a whole does a bad job of using "**spec**" to mean requirements or specifications.

## 2. Quality Assurance

# Quality Assurance (QA)

**Q:** What is Quality Assurance?

**A:** Quality Assurance is evaluating the overall project performance on a regular basis to **provide confidence that the project will satisfy the relevant quality standards.**

**Purpose:**

- QA is a proactive, preventive process that focuses on the overall project processes. It aims to ensure that the project will meet the required quality standards by reviewing and improving the processes.
- QA is about making sure you're "doing things right" throughout the project, while QC is about making sure "things turned out right" at the end.

**Output:**

From the quality assurance process there may be:

- Quality improvements actions
- Corrective actions

Which may require **Change Requests.**

## 3. Quality Control

# Quality Control

**Q:** What is Quality Control?

**A:** Quality Control is the monitoring of specific project results to determine if they comply with the relevant quality standards and identifying ways to eliminate causes of unsatisfactory performance.

**Purpose:**

- QC is a reactive, detective process that focuses on the project deliverables themselves. It involves inspecting and testing the outputs to verify if they meet the specified quality standards and requirements.
- While QA is typically an ongoing process throughout the project, QC is often performed at specific checkpoints or milestones when deliverables are completed.
- QA helps reduce the need for extensive QC by catching and addressing potential issues early in the process. However, both are necessary for comprehensive quality management.

Quality Control is often performed by a **Quality Control Department**.

### 3. Quality Control

## Quality Control Department (QC)

The QC department is often established as a separate entity within the organization for several key reasons:

1. **Independence:** To maintain objectivity in quality assessments and avoid conflicts of interest.
2. **Avoid Pressure:** To resist potential pressures from other departments (e.g., production, sales) that might prioritize speed or cost over quality.
3. **Specialized Focus:** To allow for a dedicated focus on quality without distractions from other operational concerns.
4. **Accountability:** To create clear lines of responsibility for quality-related issues and improvements.

These competencies enable the QC department to effectively monitor, maintain, and improve the quality of an organization's products or services, ultimately contributing to customer satisfaction and business success.

# Quality Assurance VS Quality Control

| Aspect             | 2 - Quality Assurance (QA)                                | 3 - Quality Control (QC)                            |
|--------------------|---|---|
| Definition         | Process-oriented approach to prevent defects              | Product-oriented approach to identify defects       |
| Focus              | Processes used to create deliverables                     | The deliverables themselves                         |
| Timing             | Ongoing throughout the project lifecycle                  | Typically performed after deliverables are produced |
| Nature             | Proactive and preventive                                  | Reactive and detective                              |
| Goal               | Ensure quality standards will be met                      | Verify if quality standards have been met           |
| Key Question       | Are we doing the right things in the right way?           | Are the results of what we did correct/as planned?  |
| Activities         | Process analysis, quality audits, process improvements    | Inspections, testing, measurements                  |
| Responsibility     | Typically performed by a separate QA team                 | Often performed by Quality Control Department.      |
| Outcome            | Improved processes, reduced need for QC                   | Accepted deliverables, rework, or rejection         |
| Tools & Techniques | Quality management plan, process analysis, quality audits | Control charts, inspections, testing                |



# Quality vs Qualification

## Quality & Qualification

### 1. Definition of **Quality**

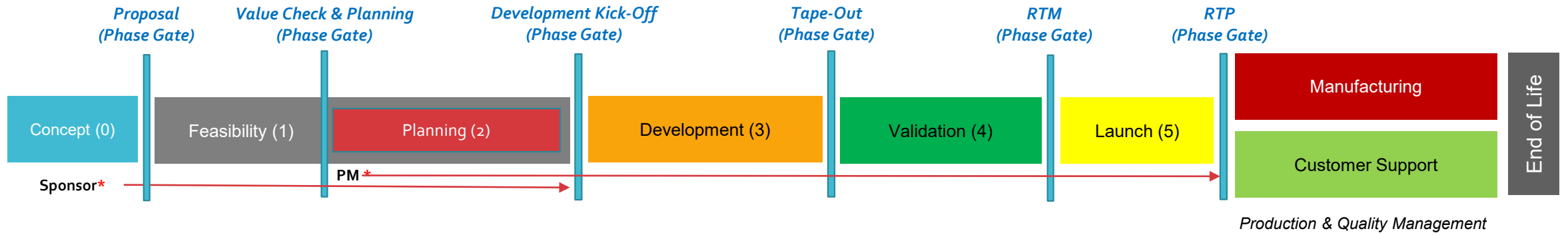
- Focuses on consistently meeting or exceeding requirements and expectations.
- Is an ongoing concern throughout the project and product lifecycle

### 2. Definition of **Qualification**

- The process of verifying that a product, service, or system meets specified requirements consistently.
- Is typically a point-in-time activity to verify that requirements are met.

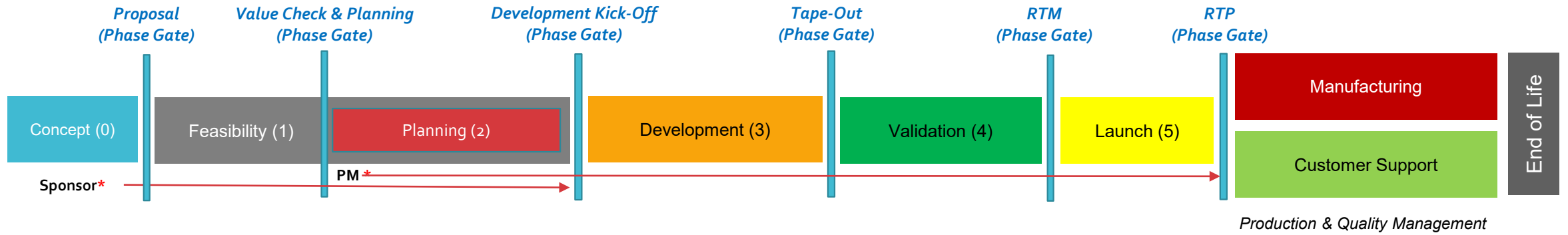
### 3. Relationship

- Qualification can be seen as a tool to achieve and demonstrate quality.



# Concept Phase:

1. Understand what the project needs to be successful.
2. Is all about creating requirements.
3. Are we picking the right project? Is this the right thing at the right moment for the company?
  - i. Cost assessment & margins,
  - ii. Market feasibility.
  - iii. Do we have the resources?



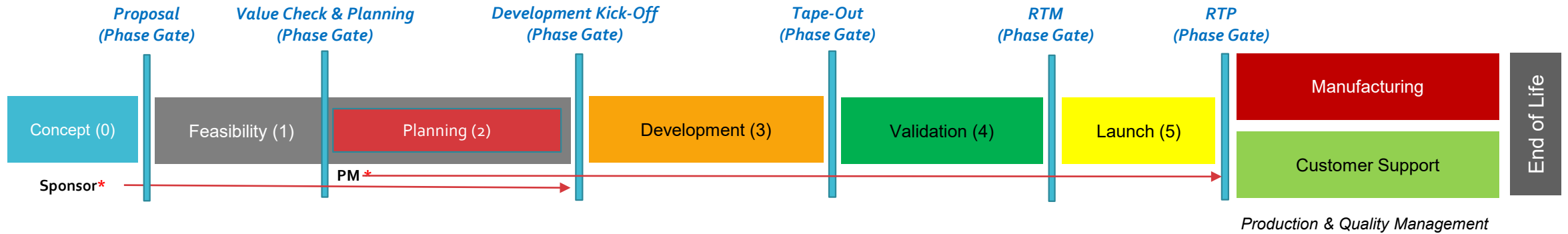
# Feasibility Phase:

1. Can I meet the requirements?

- You can proceed as far as you can do it.

## Deliverables:

- Feasibility Plan
- Out of Bounds Criteria
- Package Request form
- Business Case.

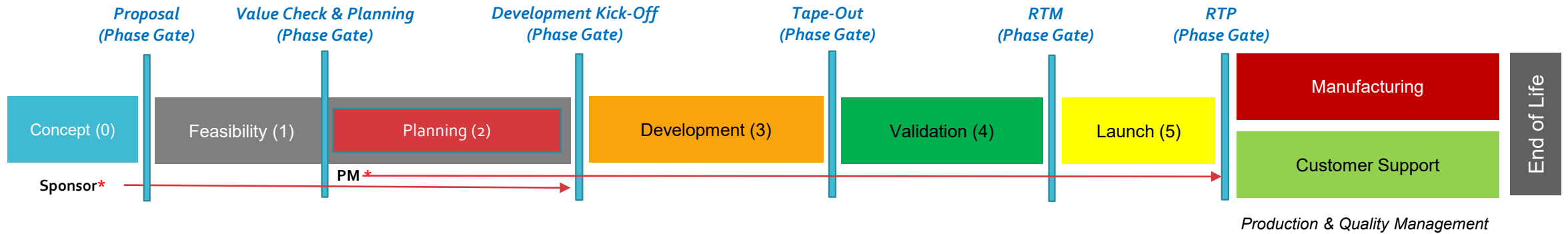


# Planning Phase:

1. Putting detail to the feasibility on how to meet the requirements.
2. Planning on what we are going to do on development and validation
3. Quality Planning to ensure team resources to do proper Quality Assurance and Control.
4. Ensure you will be compliant with necessary standards, and necessary activities to accomplish that.

## Deliverables:

- Risk Register
- Feasibility Summary
- Design Intent Spec
- Concept Datasheet
- Qual Planning
- Preliminary DFMEA
- Safety Deliverables
- Safe Launch Form
- Package Feasibility

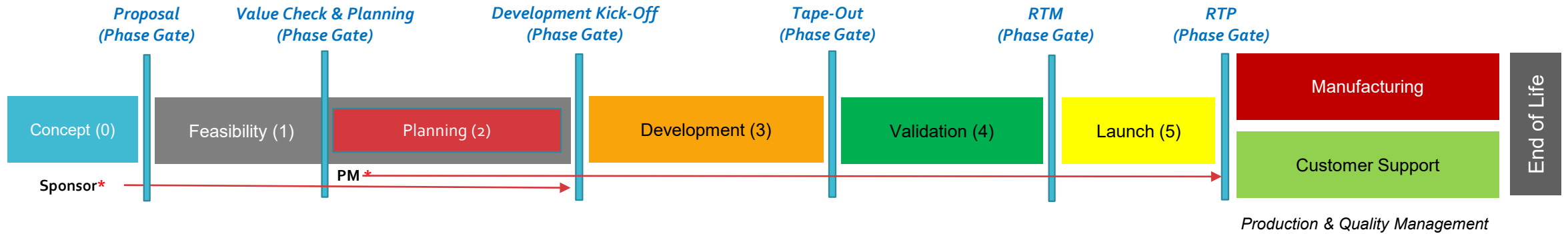


# Development Phase:

1. Its all about executing the plan.
2. Most of **Quality Assurance** is done on this phase:
  - i. Circuit simulations models, tools and rules
  - ii. Simulations / Verifications
  - iii. Etc.

## Deliverables:

- Risk Register
- **Design DFMEA**
- **Design Review**
- Silicon Validation Plan
- Safety Deliverable
- Qual Requirements Signoff
- Qualification Plan
- Master Design Check
- Packaging DFMEA
- Tape Out Approval



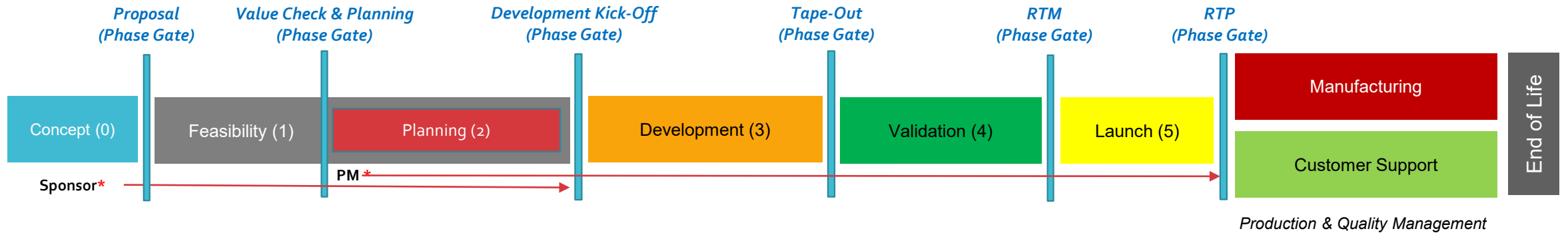
# Validation Phase:

1. Physical instantiation .
2. Does it conform to requirements?
  1. Probe Test
  2. Final Test
  3. QUAL (statistics testing)
3. Production Test Capability (PTC)
  1. Probe PTC
  2. Final Test PTC

## Deliverables:

- Risk Register
- Final Datasheet
- Design Evaluation Report
- Bench Correlation Results
- Systems Evaluation Report
- ESD Characterization
- **Silicon Review**
- **PTC Probe Approval Package**
- **PTC FT Approval Package**
- **Qual Results Summary**
- Yield and Test Time Summary Form
- Test Coverage Summary Form
- Safety Deliverable





# Launch Phase:

1. Prepare for mass production.
2. Safe Launch

## Deliverables:

- ASIL Certificate
- Release To Production (RTP)

**DFMEA** : design failure mode and effect analysis

Address systematic errors that can happen during development phase.

Its Qualitative analysis

**FMEDA** : Failure mode effects and diagnostic analysis.

Is used to analyze the Random Hardware failures in the field.

Safety mechanisms (SM) shall be put in place to detect/mitigate failure effects and move the device to a pre-defined safe state.

Is Quantitative analysis.

there must be consistency between both.



# Q&A and Discussion

This section is dedicated to addressing your questions, sharing real-world examples, and discussing case studies related to risk management in project environments.