

Team vs Individual

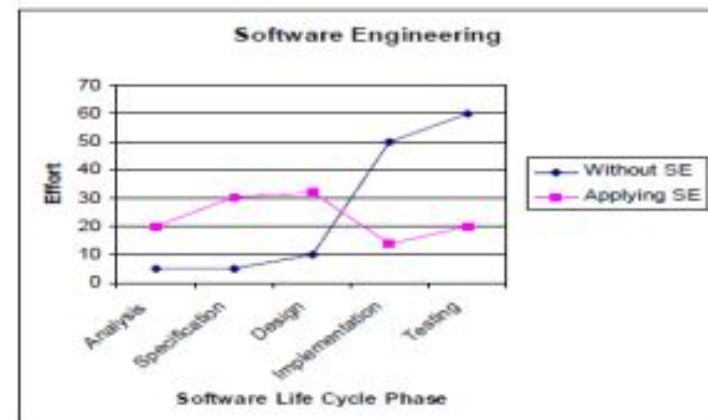
Processes

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Historical Perspective

- ❖ The apparent purpose of early software life cycle models was to *provide a conceptual scheme for rationally managing the development of software* systems.
- ❖ Such that it provides basis for:
 - ❖ Planning,
 - ❖ Organizing,
 - ❖ Staffing,
 - ❖ Coordinating,
 - ❖ Budgeting,
 - ❖ Directing software development activities.



What is a Software Process?

- ❖ A structured set of activities required to develop a software system.
- ❖ Many different software processes but all involve:
 - ❖ *Specification* – defining what the system should do;
 - ❖ *Design and implementation* – defining the organization of the system and implementing the system;
 - ❖ *Validation* – checking that it does what the customer wants;
 - ❖ *Evolution* – changing the system in response to changing customer needs.
- ❖ A software process model is an abstract representation of a process.
 - ❖ It presents a description of a process from some particular perspective.

Software process descriptions

- ❖ When we describe and discuss processes, we usually talk about the activities in these processes such as **specifying a data model**, **designing a user interface**, etc. and the **ordering of these activities**.
- ❖ Process descriptions may also include:
 - ❖ **Products**, which are the outcomes of a process activity;
 - ❖ **Roles**, which reflect the responsibilities of the people involved in the process;
 - ❖ **Pre- and post-conditions**, which are statements that are true before and after a process activity has been enacted or a product produced.

Individual Models

- Waterfall Model
- Incremental Model
- Iterative Model
- Spiral Model
- Agile Model
 - Extreme Programming
 - Scrum

Team Models

- Six Sigma
- CMMI
- ISO

Development of Six Sigma

- Motorola launched the Six Sigma program in the 1980s
- General Electric initiated the implementation of Six Sigma in the mid-1990s
- Organizations in all industries have applied Six Sigma in recent years
- Six Sigma has replaced TQM as the key strategy for quality improvement

Definitions

- σ – Standard Deviation, a measure of variability
- Six Sigma – A quality improvement philosophy that focuses on eliminating defects through reduction of variation in a process
- Defect – A measurable outcome that is not within acceptable (specification) limits

TQM Versus Six Sigma

TQM	Six Sigma
A management philosophy of quality improvement	A philosophy that focuses on defect reduction and cost reduction
Encourages involvement of all employees	Relies on a selected group of highly-trained employees
Senior management provides direct support	Senior management is held accountable for results

Key Success Factors for Six Sigma

- Committed leadership from top management
- Integration with existing initiatives, business strategy, and performance measurement
- Process thinking
- Disciplined customer and market intelligence gathering
- A bottom-line orientation and continuous reinforcement and rewards
- Training

GE's Six-Sigma Problem Solving Approach

1. Define
2. Measure
3. Analyze
4. Improve
5. Control

The logo for the DMAIC process, consisting of the letters D, M, A, I, and C in a bold, sans-serif font. The letters are filled with a vertical gradient that transitions from a bright yellow at the top to a deep orange at the bottom.

DMAIC - Define

- Identify customers and their priorities
- Identify business objectives
- Select a six sigma project team
- Define the Critical-to-Quality (CTQ's)
characteristics that the customers consider to
have the most impact on quality

DMAIC - Measure

- Determine how to measure the processes
 - Identify key internal processes that influence CTQ's
 - Measure the defect rates currently generated relative to those processes

DMAIC - Analyze

- Determine the most likely causes of defects.
 - Identify key factors that are most likely to create process variation.

DMAIC - Improve

- Identify means to remove causes of the defects.
 - Confirm the key variables and quantify the effects on CTQ's
 - Identify maximum acceptable ranges for the key variables and a system to measure deviations of the variable
 - Modify the process to stay within the acceptable ranges

DMAIC - Control

- Determine how to maintain the improvement
 - Put tools in place to ensure that the key variables remain within the maximum acceptable ranges under the modified process

DMADV

(Define—Measure—Analyze—Design
—Verify)

- **DMADV** is focused on the process of designing a new product, service or process, incorporating the following phases:

Phase	Description
Define	Define the process and design goals.
Measure	Measure and identify critical-to-quality characteristics of the product, service or process. This includes risk and production capabilities.
Analyze	Analyze the data to find the best design.
Design	Design and test the product, service or process.
Verify	Ensure that the design output meets the design input requirements (verification) and that the designed product performs satisfactorily under real or simulated conditions of intended use (validation).

Differences of DMAIC and DMADV

- DMAIC addresses the current process; DMADV addresses the design process.
- DMAIC reduces/eliminates defects (reactive); DMADV prevents defects (proactive).
- DMAIC includes specific solutions; DMADV is part of the solution design process.
- DMAIC includes controls to sustain the gains; DMADV includes verification and validation of the finished design.

Tools for Six-Sigma and Quality Improvement

- Elementary and advanced statistics
- Product design and reliability analysis
- Measurement
- Process control & Process improvement
- Implementation and teamwork
- Customer survey and feedback
- Lean thinking

Organization for Six Sigma

- **Project Champions** – project selection and management, knowledge sharing
- **Master Black Belts** – instructors, coaches, technical leaders
- **Black Belts** – project team leaders and team members
- **Green Belts** – project team members, temporary team members

CMMI

- The Capability Maturity Model Integration (CMMI) is a process and behavioral model that helps organizations streamline process improvement and encourage productive, efficient behaviors that decrease risks in software, product, and service development.

CMMI Maturity Levels

- The CMMI model breaks down organizational maturity into five levels.
- For businesses that embrace CMMI, the goal is to raise the organization up to Level 5, the “optimizing” maturity level.
- Once businesses reach this level, they aren’t done with the CMMI. Instead, they focus on maintenance and regular improvements.

CMMI Maturity Levels

- **Maturity Level 0 – Incomplete:** At this stage work “may or may not get completed.” Goals have not been established at this point and processes are only partly formed or do not meet the organizational needs.
- **Maturity Level 1 – Initial:** Processes are viewed as unpredictable and reactive. At this stage, “work gets completed but it’s often delayed and over budget.” This is the worst stage a business can find itself in — an unpredictable environment that increases risk and inefficiency.
- **Maturity Level 2 – Managed:** There’s a level of project management achieved. Projects are “planned, performed, measured and controlled” at this level, but there are still a lot of issues to address.

CMMI Maturity Levels

- **Maturity Level 3 – Defined:** At this stage, organizations are more proactive than reactive. There's a set of "organization-wide standards" to "provide guidance across projects, programs and portfolios." Businesses understand their shortcomings, how to address them and what the goal is for improvement.
- **Maturity Level 4 – Quantitatively managed:** This stage is more measured and controlled. The organization is working off quantitative data to determine predictable processes that align with stakeholder needs. The business is ahead of risks, with more data-driven insight into process deficiencies.
- **Maturity Level 5 – Optimizing:** Here, an organization's processes are stable and flexible. At this final stage, an organization will be in constant state of improving and responding to changes or other opportunities. The organization is stable, which allows for more "agility and innovation," in a predictable environment.

What happens after Level 5?

- Once organizations hit Levels 4 and 5, they are considered high maturity, where they are “continuously evolving, adapting and growing to meet the needs of stakeholders and customers.” That is the goal of the CMMI: To create reliable environments, where products, services and departments are proactive, efficient and productive.

CMMI Capability Levels

- The CMMI also has capability levels that are used to appraise an organization's performance and process improvement as it applies to an individual practice area outlined in the CMMI model. It can help bring structure to process and performance improvement and each level builds on the last, similar to the maturity levels for appraising an organization.

CMMI Capability Levels

- **Capability Level 0 – Incomplete:** Inconsistent performance and an “incomplete approach to meeting the intent of the practice area.”
- **Capability Level 1 – Initial:** The phase where organizations start to address performance issues in a specific practice area, but there is not a complete set of practices in place.

CMMI Capability Levels

- **Capability Level 2 – Managed:** Progress is starting to show and there is a full set of practices in place that specifically address improvement in the practice area.
- **Capability Level 3 – Defined:** There's a focus on achieving project and organizational performance objectives and there are clear organizational standards in place for addressing projects in that practice area.

CMMI v2.0

- The latest version of the CMMI, Version 2.0, focuses more heavily on performance and how performance impacts business and how to understand an organization's performance needs. There's information on how to establish performance goals and then track those goals to make sure they're achieved at all levels of business maturity.

ISO 9000

- ISO 9000 is a family of *quality management* standards defined by the International Standards Organization. It is based on core principles:
 - ▷ Organizations must focus on their customers by understanding current and future customer needs.
 - ▷ Leaders within the organization must create and maintain an environment in which people can become involved and fulfill the organization's objectives.
 - ▷ People at all levels are important to the organization.
 - ▷ Activities and resources are best managed as a process.
 - ▷ Organizations have many interrelated processes, which must be understood and managed as a system.
 - ▷ The organization should continually improve its performance.
 - ▷ Decisions should be well informed and based on real data and information.
 - ▷ An organization and its suppliers are in a mutually beneficial relationship.