COMPUTER SCIENCE AND INFORMATION TECHNOLOGY
RMITUniversity

Intro to Computer Systems
Chapter 8: Lean Practices, Quality and Metrics

Course Materials

Online Course Material

Please select a subtopic to view its contents.

Lean Practices in Project Management

Quality and Metrics

Additional Materials

There are no additional materials available at this time.

Software Engineering Project Management

Chapter 8: Lean Practices in Project Management

What are we going to cover this week?

- Lean- another agile methodology - *What?*
- The motivation behind Lean - *Why?*
- Lean practices and artefacts - *How?*
- Quality and metrics in the world of Project Management - *a necessary component of Lean*

History

- Toyota, a small car manufacturing plant in Aichi Prefecture, Japan
- Low morale in the country
- Almost destroyed morale
- Continuous improvement and collective effort
- The harbinger of Showa era (1946-89)
- Led to the birth of "lean production"
- *The Japanese miracle!*

Understanding Lean

- *"Copying practices without understanding the underlying principles has a long history of mediocre results. But when the underlying principles are understood, it is useful to copy practices that work for similar organizations and modify them to fit your environment."*

  Mary and Tom Poppendieck, Lean Software Development

The Five Principles of Lean[1]

1. Understand *and* maximise value
   - Specify value as the customer sees it
2. Optimise the value stream
   - Eliminate waste
3. Pull production
   - Make value flow at the customer's pull
4. Single-piece flow
   - Involve and empower employees
5. Continuous improvement (Kaizen)
   - Keep changing

1) Understand and maximise value

- Clearly identify objectives and requirements
- Use them as acceptance criteria
- Doing the right projects right means
  - Satisfying the needs of all stakeholders.

  "Make things as simple as possible, but not simpler."- Albert Einstein

2) Optimise the value stream

- Identify value stream- all the actions required to create a product, the process
- Further identify
  - Redundant steps
  - Steps that burden resources

- Steps that impact risk, relationships and quality
- Fine-tune the process
- A popular tool to implement this step - Stream mapping[2]

3) Pull production

- Ensure that every project addresses a real meaningful need
- Planning and executing cycles must be reduced to the minimum possible
- Industry trends (here in Australia and USA) show- most software industries in the Agile or Lean startup frameworks
  - are moving to 2-week production cycles of plan, execute, release, and collect feedback.
- For the third principle to work, the fourth principle is needed!

Contemporary news

- IBM CIO Thinks Agile Development Might Save Company
- Blog published on April 27, 2015
- New workflow for struggling tech giant

4) Single piece flow

- What is meant by this term?
- The ability of a single order or piece of work to flow smoothly across the whole system without interruptions and at the maximum possible speed.
- In other words, the more things you think you are doing at the same time, the less productive you become.
  - Gerald Weinberg (his extensive research led to the creation of the book) Quality Software Management: Systems Thinking
- Avoid committing teams to unrealistic schedules and budgets

5) Kanban

- Keep the strategic goals in focus
- Avoid short sighted "efficiencies"
- Measure performance
- Analyze results
- Improve the process
- Involve all stakeholders

Kanban

- Lean skeptics will try to argue that "perfection is impossible" or even ask "Why do we want to be better? We are just fine now…"
- In a Lean environment, there is a perpetual state of discomfort with the current state.
  - Lean leaders will constantly push the organisation out of its zone of comfort in search of a new, higher level of quality, performance, and, overall, client satisfaction.
- Push, out of comfort zone? - arent these negative words? What do you think?

How does agile fit in?

- Moving quickly and lightly - Sleek, nimble, adaptive, responsive
- Iterate to deliver meaningful results
- Allow Requirements to evolve
- Communicate - real time, quick, informal (preferably face to face)
- Give project participants autonomy
- Cultivate open-mindedness
- Avoid "cure-all", "either-or" thinking

Lean + Agile =

- A methodology to deliver performance efficiency & effectiveness
    - Free flowing, meaningful communication
    - No excess and no insufficiency
    - Self-managed teams
    - Commitment to success
   - Managed change & continuous improvement

Lean mindset

Misconceptions	Lean Perspectives
We don't have enough people with the right skills	We have not made a strong effort to simplify, standardise and error-proof
Our customers don't understand	We aren't really solving customer problems
Employees are dedicated and valuable	Our processes help waste employee's time & cause stress
We pay for strong, reliable performance	Poor performance is often hidden by heroics
We listen to our employees (but really listen to others)	Employees have answers that need to be unleashed
We continually create value	We're all busy but only some of it really adds value
We know who the big problems are	Our systems are set up to give us exactly what we get

Kanban cards[1]
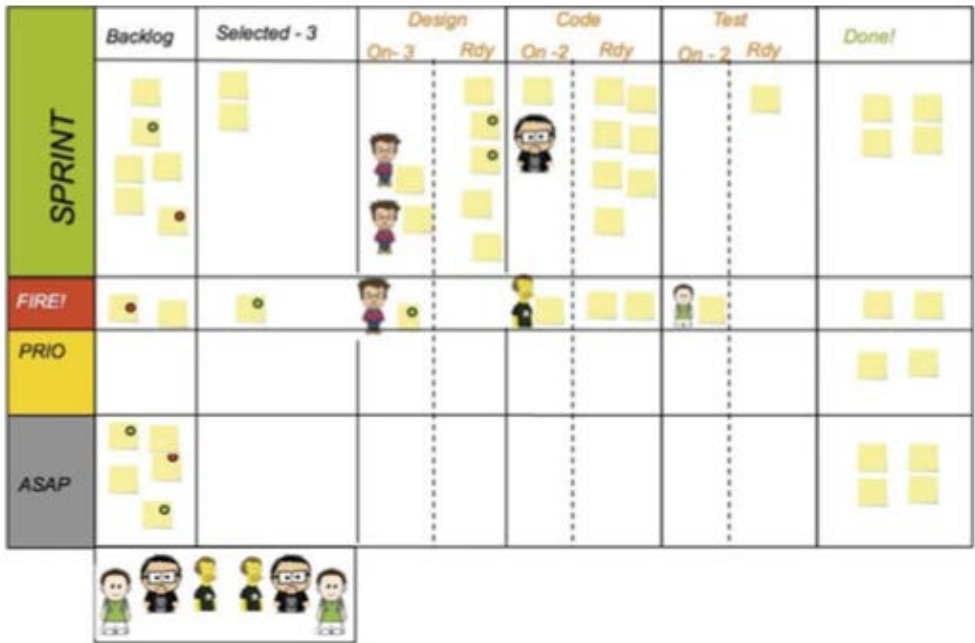
Lean software engineering project
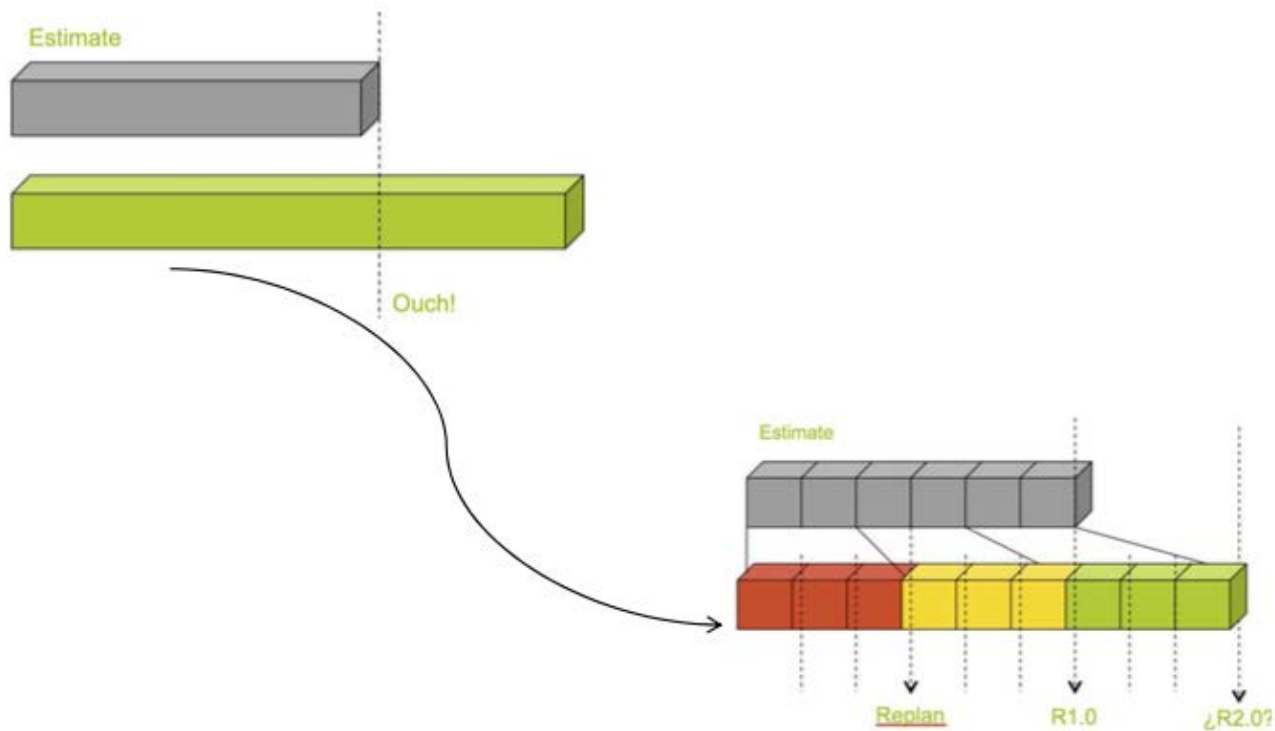
Implementation of Lean

- Project Planning phase
- Perform Visual workflow management
    - Sprint plans
    - Visual workflow boards
    - Stand up meetings
    - Risk mitigation
    - Quality control
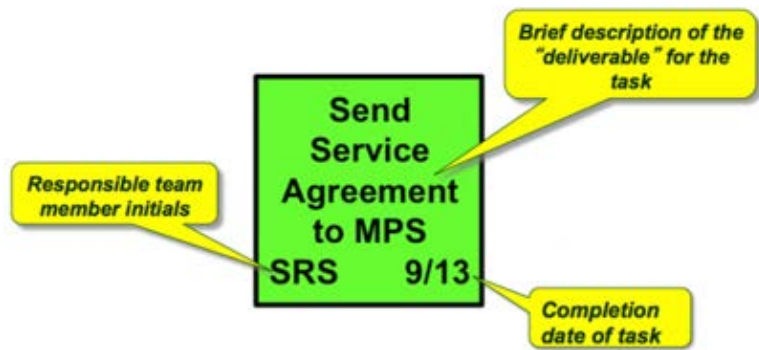- Project delivery

Task implementation[4]

Task impact to Schedule and Cost is low.

Task impact to Schedule and Cost is medium.

Task likely on the critical path. Impact to Schedule and Cost is HIGH

Out - Not available. Indicates if off site, tied up with other project, etc.

Sticky Notes[4]

Three weeks look ahead[4]

Stand up meetings

Stand-up Meeting

Virtual/Visual Planning Project Board

Stand up meeting - how to?

- Should be held either at starting time, or just before lunch hour.
- Should last for no more than 1 - 1 1/2 minutes times the number of attendees (15 minutes MAXIMUM duration at first; the team can always agree to a longer duration later).
- Team members with active tasks should attend off - site people can "virtual" process overseas people can be connected through designated "liaison".

Stand up meeting - how to?

- The meeting leader (anyone) should ask three simple questions:
    - What progress have you made since the last meeting?
    - How will you work toward your next key milestone?
    - What do you need from others to meet this goal?

To summarise

- Please note that Lean is a mindset and not a framework
- Quality control is a bog part of it - as such we will discuss quality control during the second half of the lecture
- Widely implemented and documented by many popular organisations
    - Microsoft's take on Lean

To summarise

- "It is important to note that mere application of is generally not, in itself, sufficient to ensure a successful process improvement project. Achieving better efficiency and process flow also requires a receptive organizational climate, active management support and engagement, sufficient financial and other resources, and clear communications channels within the organization about the process change."[5]

    (Schweikhart, Dembe 2009)

Lean Enterprise Australia

- Lean Enterprise Australia

- Lean Training programs

References

1. Lean and Agile in Nutshell, Angel Medinilla Appress Inc.
2. VSM: What is Value Stream Mapping?
3. Intro to Kanban in Under 5 Minutes (What is Kanban, Learn Kanban)
4. Agile and Lean Project Management: A Zen-like Approach to Find Just the Right Degree of Formality for Your Project- a session by George Pitagorsky, PMP for PMI.org
5. Schweikhart, S, Dembe, A. 2009, The Applicability of Lean and Six Sigma Techniques to Clinical and Translational Research - http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2835466
6. http://www.solutionsiq.com

Software Engineering Project Management

Chapter 8: Quality and Metrics

## Quality and Metrics

CMMI

- Capability Maturity Model Integration (CMMI) is a set of rules and recommendations which should lead to improvements within an organisation.
- It puts best practices used in software development and service management.
- It has been developed in Carnegie-Mellon University by the Software Engineering Institute (SEI).
- CMMI may also be understood as a framework to recognize and improve processes within organization. Because of its abstraction it can be used for all kinds of manufacture. CMMI levels is a set of steps which each organization can obtain in order to increase its value on a market. It requires a lot of involvement and effort to get to level 5.

  http://www.tutorialspoint.com/images/

CMMI

- A maturity level is a well-defined evolutionary plateau toward achieving a mature software process. Each maturity level provides a layer in the foundation for continuous process improvement.
- In CMMI models with a staged representation, there are five maturity levels designated by the numbers 1 through 5
    - Initial
    - Managed
    - Defined
    - Quantitatively Managed
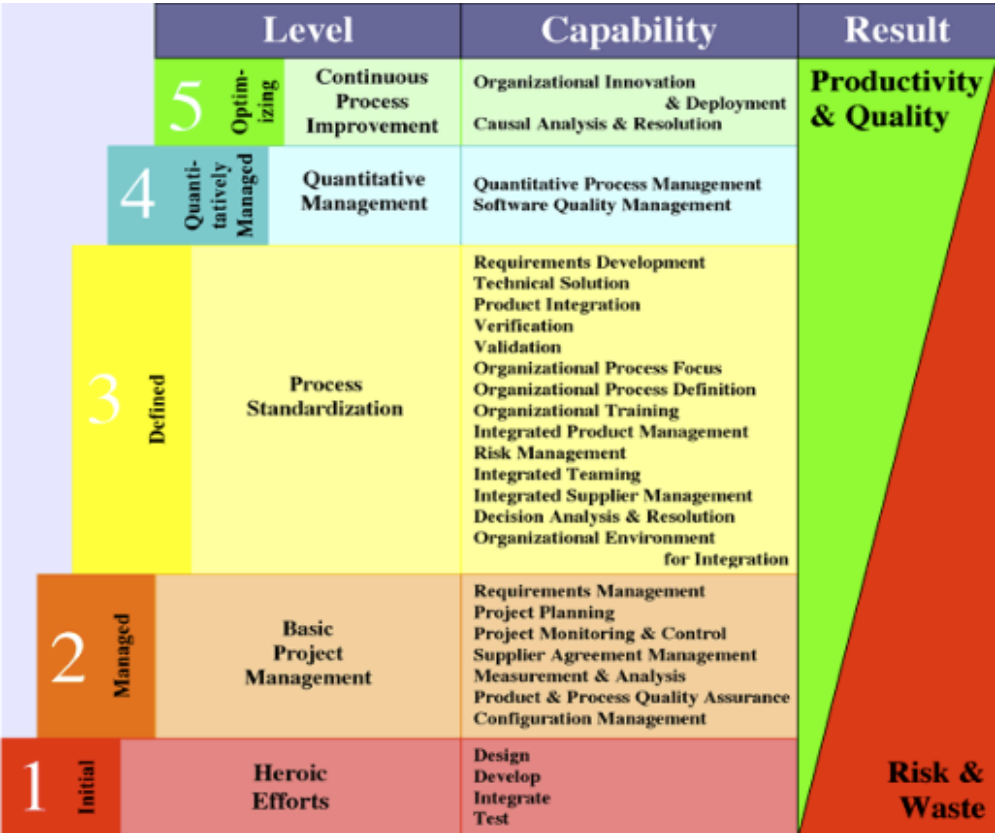   - Optimizing

CMMI
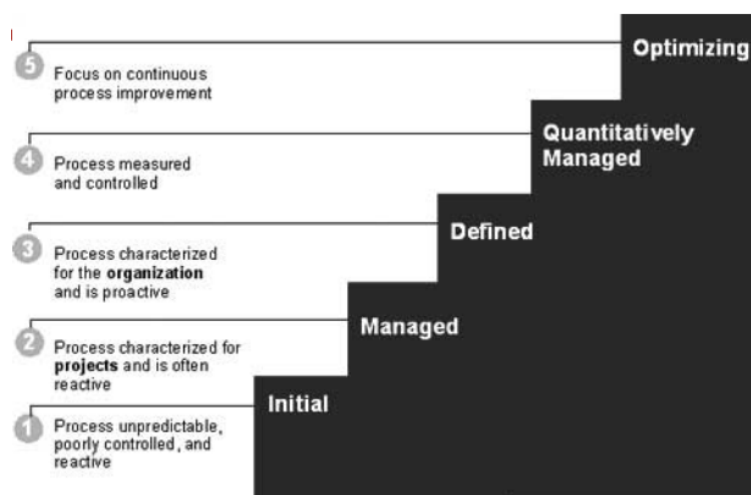
5 Maturity Levels

Maturity Level Details:

- Maturity levels consist of a predefined set of process areas. The maturity levels are measured by the achievement of the specific and generic goals that apply to each predefined set of process areas. The following sections describe the characteristics of each maturity level in detail.

CMMI

Level		Capability	Result
5 Optimizing	Continuous Process Improvement	Organizational Innovation & Deployment Causal Analysis & Resolution	**Productivity & Quality**
4 Quanti-tatively Managed	Quantitative Management	Quantitative Process Management Software Quality Management	
3 Defined	Process Standardization	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition Organizational Training Integrated Product Management Risk Management Integrated Teaming Integrated Supplier Management Decision Analysis & Resolution Organizational Environment for Integration	
2 Managed	Basic Project Management	Requirements Management Project Planning Project Monitoring & Control Supplier Agreement Management Measurement & Analysis Product & Process Quality Assurance Configuration Management	
1 Initial	Heroic Efforts	Design Develop Integrate Test	**Risk & Waste**

Quality Assurance

- What is Quality?
  - Superior or Non-Inferior (Relative term)
  - Of high standard
- Why is Quality a cause for concern?
  - Quality supports Dependability
  - Dependability supports Speed
  - Speed supports Flexibility
  - Flexibility supports Cost

Quality Movement

- First Established in Japan in 1946 by W. Edwards Deming.
- Quality Control (QC) and Quality Assurance (QA) branched out of this Quality Movement.
  - Quality Control: Testing & Inspection
  - Quality Assurance: Process Compliance
- QC & QA often mixed in software development

Standards and Procedures

- The Consortium for IT Software Quality (CISQ) is an IT industry leadership group comprising IT executives from the Global 2000, system integrators, outsourced service providers, and software technology vendors committed to making dramatic improvements in the quality of IT application software.
- Jointly organized by the Software Engineering Institute (SEI) at Carnegie Mellon University and the Object Management Group (OMG), CISQ is designed to be a neutral forum in which customers and suppliers of IT application software can develop an industry- wide agenda of actions for defining, measuring, and improving IT software quality.

Software Quality Assurance

- Software Quality Assurance (SQA) is the function of software quality that assures that the:
  - Standards
  - Procedures
  - Processes

  are appropriate for the project & have been correctly implemented.

Standards and Procedures

- Why are they important?
  - Provide framework from which software evolves.
  - Establish the prescribed methods for developing software.
  - SQA activities of Process Monitoring, Product Evaluation & Auditing rely upon proper documentation/definitions of Standards & Procedures.
- How do they come about?
  - Driven by the needs and problems of the technical & managerial staff.
- General categories:
  - Industry standards & procedures
  - Company specific standards & procedures

Standards and Procedures

- Standards:
  - What are standards?
    - Established criteria for Product
    - Specify details for:
      - Documentation
      - Design
      - Coding
  - Types (Industry Standards):
    - International Organisation for Standardisation (ISO)
    - Institute of Electrical and Electronics Engineers (IEEE)
    - US Department of Defence (DoD)

Standards

- Standards
  - Compliance certifications
  - Example:
    - ISO:9000 - Quality Systems. It is a model for Quality Assurance in:
      - Design
      - Development
      - Production
      - Installation & Servicing

Procedures

- Procedures
  - What are procedures?
    - Established criteria for Development & Control process.
    - Explicit steps to be followed in carrying out a process.
    - All processes have well documented procedures.

SQA Activities

- Product Evaluation
 - Assuring Standards are being followed

Process Monitoring
- Ensure appropriate steps are being followed to carry out a process
- Auditing
  - Looks at both, Processes & Products in depth

Quality Audits - Accreditation

- Why Audit?
- Terms
  - Auditor
  - Auditee
  - Client/Customer

Audit Types

- By who conduct the audit
  - Internal/First-Party Audits
  - External Second-Party Audits
  - External Third-Party Audits
- By what is being audited
  - System Audit
  - Process Audit
  - Product Audit
  - Project Audit
  - Follow-up Audit
  - Document Audit
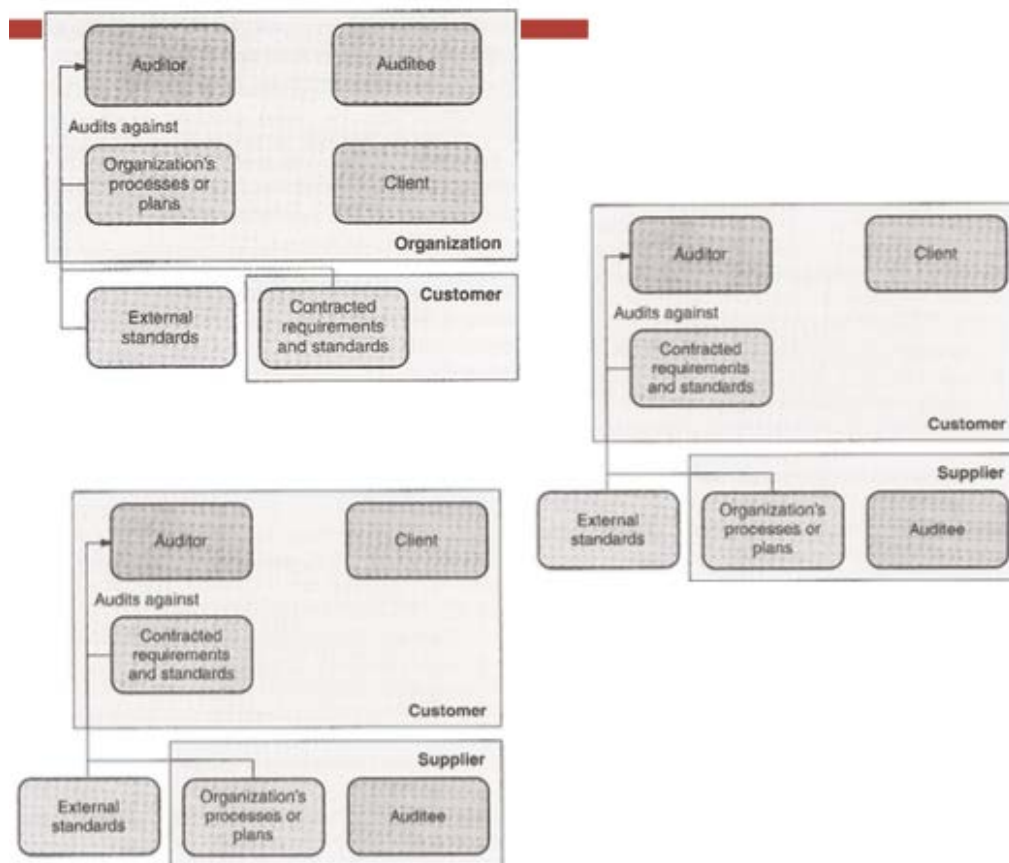
Source: L. Westfall, The Certified Software Quality Engineer Handbook. Wisconsin: Quality Press, 2009., pp.110-111

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Audit Process

- Initiation
- Planning
- Preparation
- Execution
- Reporting
- Correcting action and follow-up

Software Metrics

- What is Software Metrics?
- Software Metrics must be:
    - Measurable
    - Independent
    - Accountable
    - Precise
- Software Metrics for SQA
    - Product Evaluation Metrics
    - Product Quality Metrics
    - Process Audit Metrics

Examples

Indicator Category	Indicators
Progress	Actual vs. planned task completions Actual vs. planned durations
Effort	Actual vs. planned staffing profiles
Cost	Actual vs. planned costs Cost and schedule variances
Review Results	Status of action items
Trouble Reports	Status of trouble reports Number of trouble reports opened, closed, etc. during reporting period
Requirements Stability	Number of requirements changes/clarifications Distribution of requirements over releases
Size Stability	Size growth Distribution of size over releases
Computer Resource Utilization	Actual vs. planned profiles of computer resource utilization
Training	Actual vs. planned number of personnel attending classes

Source: http://sunset.usc.edu/classes/cs577b_2001/metricsguide/metrics.html

Software Metrics

Effort

Progress


Cost

Trouble Reports
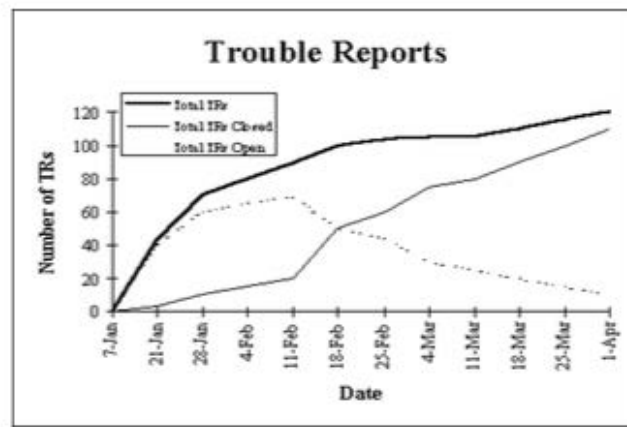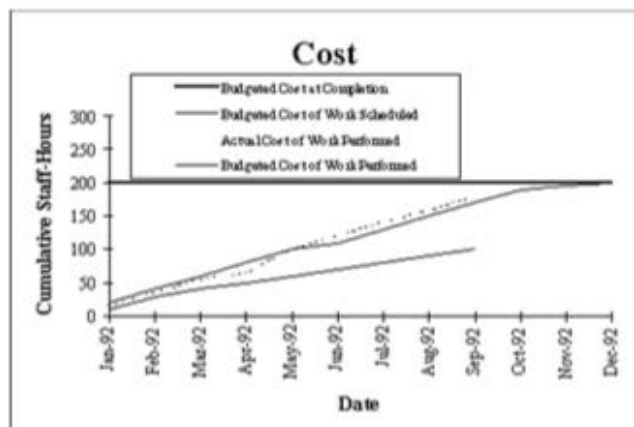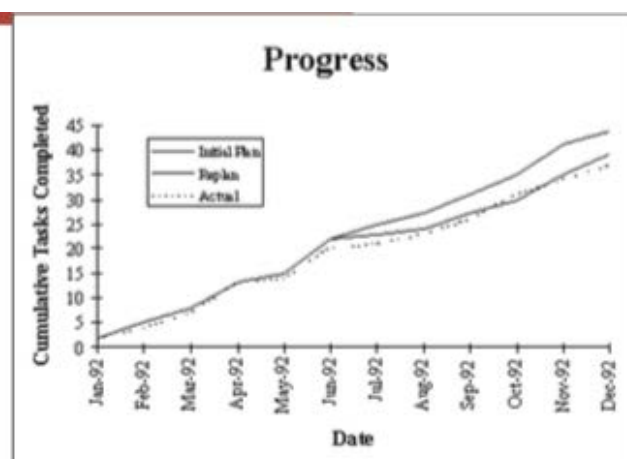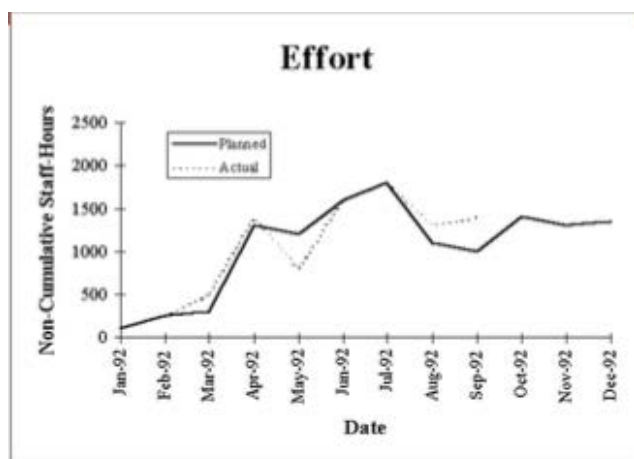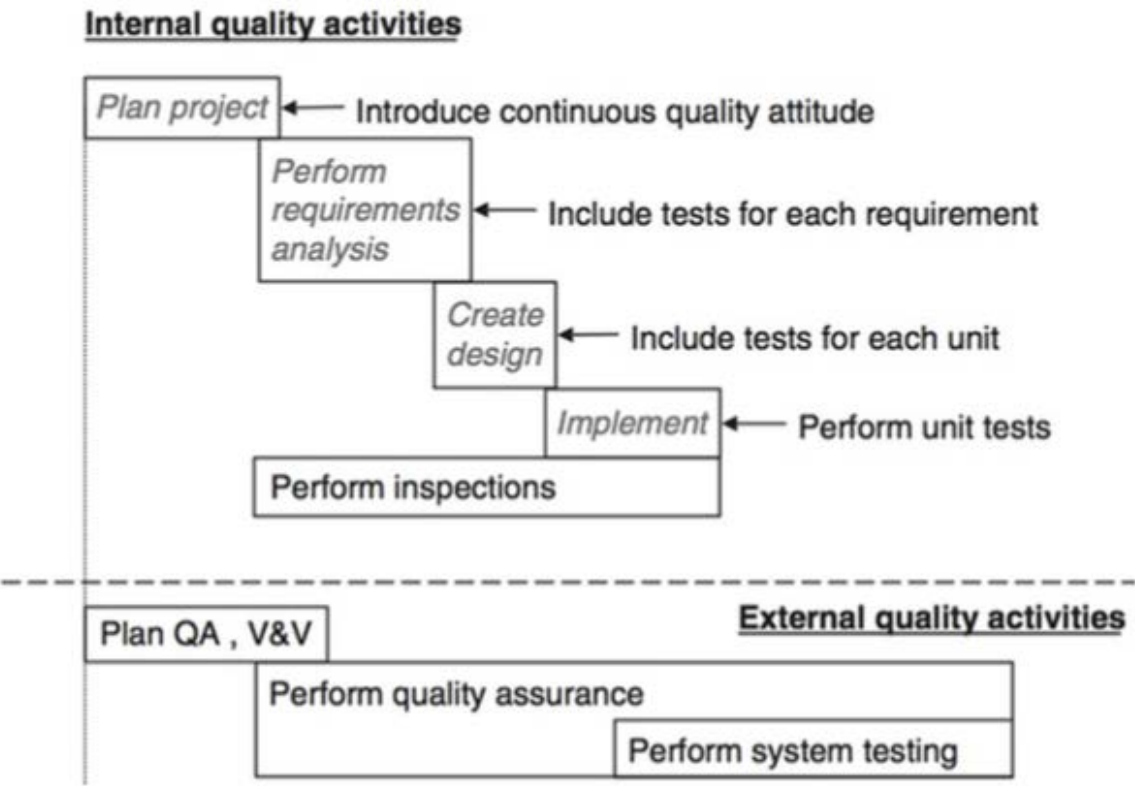

Quality Assurance Plan Template

- 1.0 **GENERAL INFORMATION**
- 1.1 Purpose
- 1.2 Scope
- 1.3 System Overview
- 1.4 Project References
- 1.5 Acronyms and Abbreviations
- 1.6 Points of Contact
- 1.6.1 Information
- 1.6.2 Coordination

- 2.0 **SCHEDULE OF TASKS AND RESPONSIBILITIES**
- 3.0 SYSTEM DOCUMENTATION
- 3.1 Documents by Phase
- 3.1.1 Initiate Phase
- 3.1.2 Define Phase
- 3.1.3 Design Phase
- 3.1.4 Build Phase
- 3.1.5 Evaluate Phase
- 3.1.6 Operate Phase
- 3.2 Discipline for Documentation Standard Practices

- 4.0 **REVIEWS AND AUDITS**
- 4.1 Review Process
- 4.2 Formal Reviews and Audits
- 4.2.1 Lifecycle Reviews
- 4.2.2 Audits
- 4.3 Informal Reviews

Standards Quagmire

Courtesy Sarah Sheard, SPC
quag14t: 5 June 1998
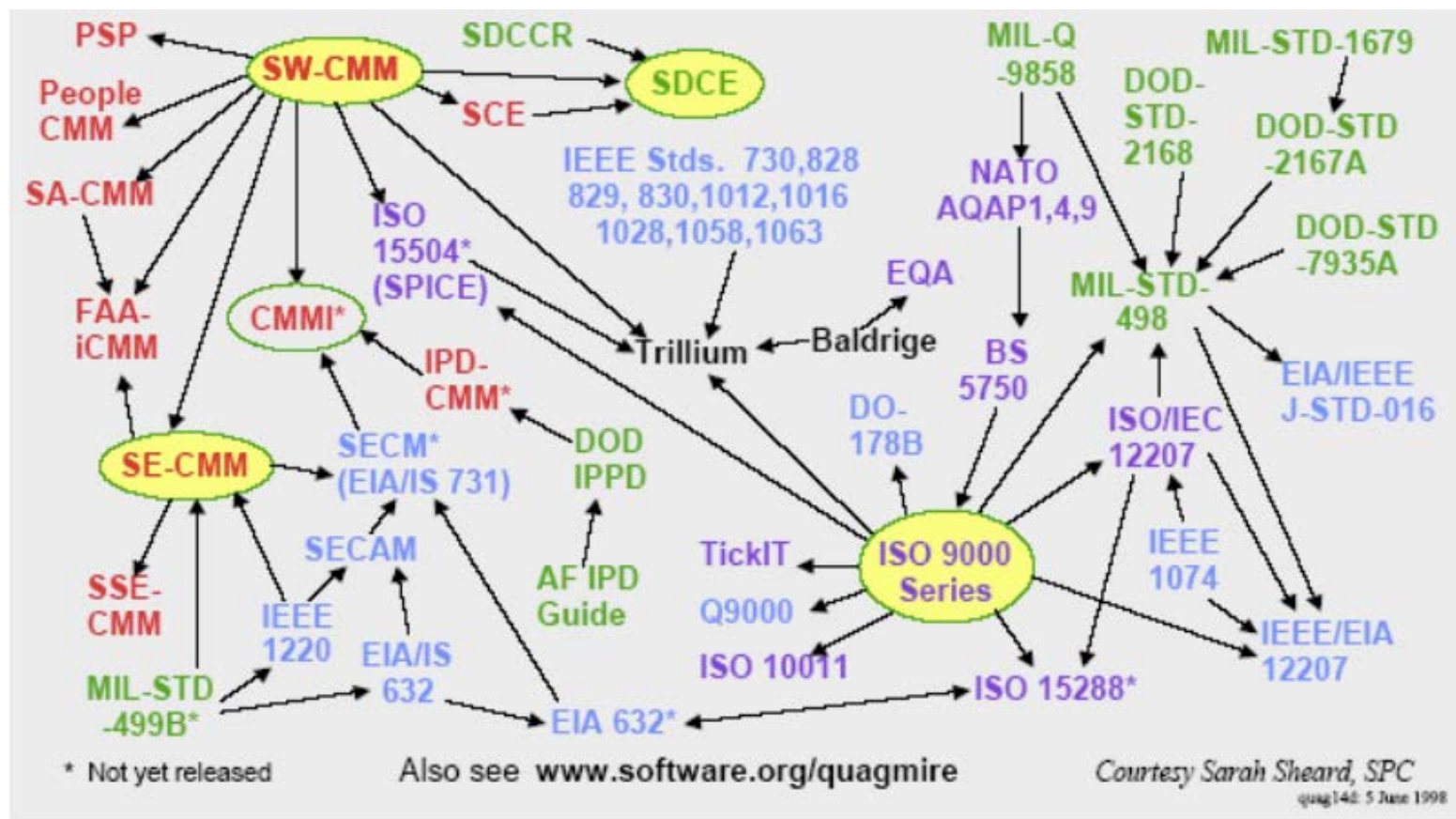
Internal and External control

Internal quality activities

External quality activities

Project Metrics documentation chart

Name	Primary Responsibility	Backup Responsibility
Alice Jarman	Team leader	Configuration management
Bruce Stern	Configuration management	Security
Bob Crowder	Internal quality	Team leader
Sarah Fournier	Security	Internal quality
Hans Lightman	Requirements	Release
Vladimir Norsk	Design	Requirements
John Green	Implementation	Design
Susan Klein	Release	Implementation

Example of defect tracking during metrics[4]

Week of	Build	Plan			Actual		
		Submitted	Resolved	Open	Submitted	Resolved	Open
2/17 - 2/23	44			66			66
2/24 - 3/02	45	40	40	66	52	42	76
3/03 - 3/09	46	40	40	66	48	42	82
3/10 - 3/16	47	40	40	66	56	35	103
3/17 - 3/23	48	40	40	66			
3/24 - 3/30	49	30	54	42			
3/31 - 4/07	50	20	44	18			
4/08 - 4/14	51	10	28	0			
4/15 - 4/21	52	10	10	0			
4/22 - 4/28	53	5	5	0			
4/29 - 5/05	54	3	3	0			
5/06 - 5/12	55	3	3	0			

TROUBLE!

Project management dashboard[4]
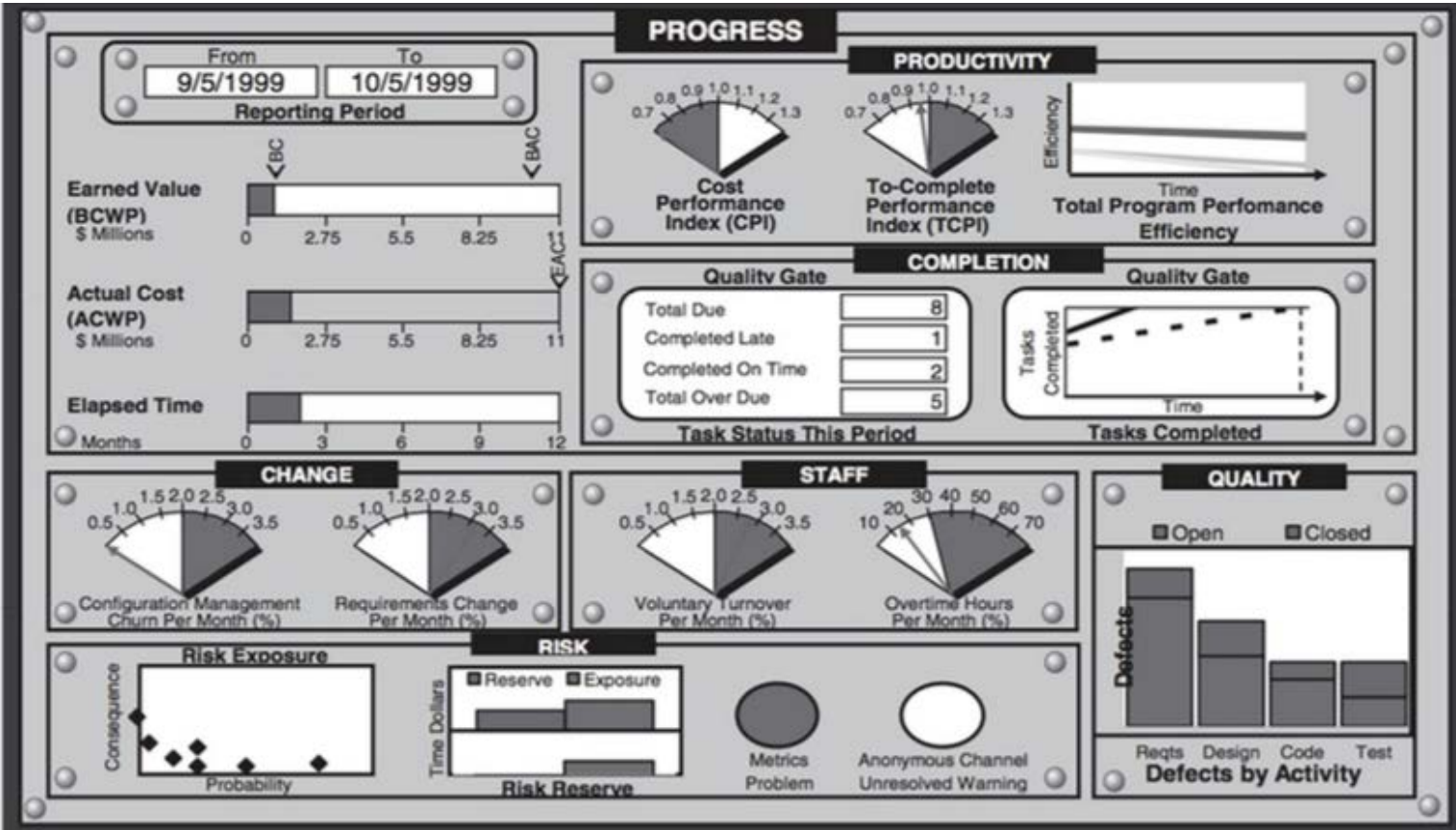
History[1]

- The NUMMI experiment
- NUMMI manufacturing plant in Fremont, California
- General Motors ended up closing the plant in 1982
- Toyota and GM opened the plant in 1984 - with 85% of the original workforce.
- Lean was implemented
- The whole workforce was hired from the former NUMMI workers, but virtually no former top manager was rehired.

- Complete turnaround

Lesson Number 8

- Lean is a mindset

  Acknowledgement: Youtube videos copyright is held by the Youtube website and the owner, it has been cited for educational-purposes.

References

1. Lean and Agile in Nutshell, Angel Medinilla Appress Inc.
2. VSM: What is Value Stream Mapping?
3. Intro to Kanban in Under 5 Minutes (What is Kanban, Learn Kanban)
4. Agile and Lean Project Management: A Zen-like Approach to Find Just the Right Degree of Formality for Your Project- a session by George Pitagorsky, PMP for PMI.org
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6. http://www.solutionsiq.com

Suggested Reading

- None in the prescribed textbook, but reading this lecture and going through associated video resources should suffice.