University of Tripoli – Faculty of Information Technology

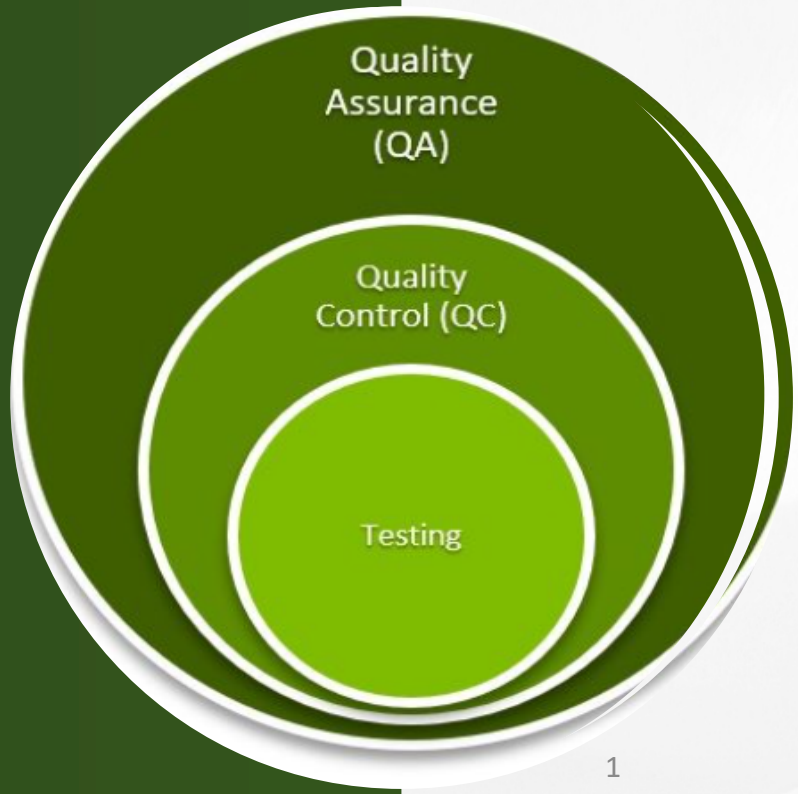
Software Engineering Department

Software Quality Assurance

ITSE421

Spring 2024

By Marwa Solla



Software Quality Assurance and Testing

Lecture 3 : SQA System Overview

Marwa Solla
m.solla@uot.edu.ly
Tripoli University - Faculty of Information Technology

Spring 2024

What We Learn In This Lecture

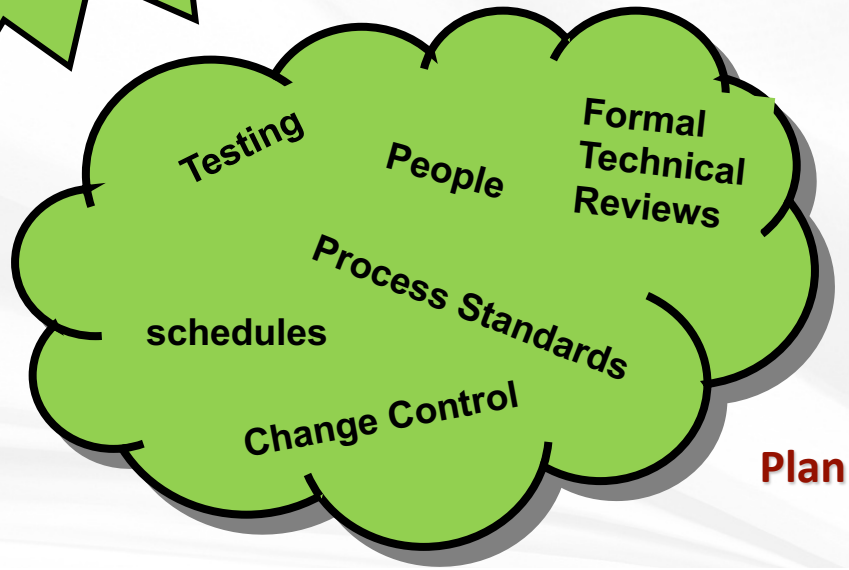
SQA Components

Where we have been so far,
Where we are going

Basic Concepts

SQA Plan

step one: contract review
step two: schedule FTRs
step …



Plan Components

Reality Check…

- **Is an SQA plan just busy-work, or does it really pay off?**
- Hughes Aircraft
  - moved from level 2 in 1987 to level 3 in 1990
  - cost = $500K
  - benefit = $2M annually
- Raytheon
  - moved from level 1 in 1988 to level 3 in 1993
  - productivity doubled
  - ROI = $7.70 per $1 invested

SQA Components

1. Pre–Project Components
2. Development and Maintenance Activities
3. Error Reduction Infrastructure
4. SQ Management Components
5. SQA System Assessment
6. Human Components

1. Pre-Project Components

- The SQA components belonging here are meant to improve the preparatory steps taken prior to initiating work on the project itself:
- To assure that:
  1) The project commitments have been adequately defined considering the resources required, the schedule and budget.
  2) The development and quality plans have been correctly determined.

1. Pre-Project Components

- **Contract Review**
- **Development and Quality Plans**
  - Development Plans
    - schedules
    - manpower requirements
    - tools
  - Quality Plans
    - measurable quality goals
    - success criteria for each project phase
    - scheduled V&V activities

Contract Review

Contract review activities must include a detailed examination of:

(a) the project proposal draft.

(b) the contract drafts. Specifically, contract review activities include:

- Clarification of the customer's requirements
- Review of the project's schedule and resource requirement estimates
- Evaluation of the professional staff's capacity to carry out the proposed project
- Evaluation of the customer's capacity to fulfill his obligations
- Evaluation of development risks.

Development and Quality Plans

The main issues treated in the project *development plan* are:

- Schedules
- Required manpower and hardware resources
- Risk evaluations
- Organizational issues: team members
- Software reuse plans.

Development and Quality Plans

The main issues treated in the project's *quality plan* are:

- Quality goals, expressed in the appropriate measurable terms
- Criteria for starting and ending each project stage
- Lists of reviews, tests, and other scheduled verification and validation activities

2. Project Life Cycle Components

- The project life cycle is composed of two stages: the *development l*ife cycle stage and the operation *maintenance* stage.
- Several SQA components enter the software development project life cycle at different points. Their use should be planned prior to the project's initiation. The main components are:
  - **Reviews**
  - **Expert opinions**
  - **Software testing**
  - **Software maintenance**

2. Project Life Cycle Components – **Reviews**

Review variety of documents include:

- specs and design reports
- software test documents,
- software installation plans.
- software manuals, among others.

Reviews can be categorized as:

- Formal design reviews (DRs)
- Peer reviews.

2. Project Life Cycle Components – **Reviews**

❑ Formal design reviews (DRs)

- These documents requires formal professional approval of their quality as stipulated in the development contract.
- The developer can continue to the next phase of the development process only on receipt of formal approval of these documents.
- Ad hoc committees whose members examine the documents
- The committees are composed of senior professionals, including the project leader and, usually, the department manager, the chief software engineer,
- The DR report itself includes a list of required corrections (termed “action items”).

2. Project Life Cycle Components – **Reviews**

❑ **Peer reviews.**

- Reviewing short documents, chapters or parts of a report.
- The reviewers are all peers,
- Inspections and walkthroughs can take several forms and use many methods;
- The main objective of inspections and walkthroughs is to detect as many design and programming faults as possible.

2. Project Life Cycle Components – Expert opinions

- Expert opinions support quality assessment efforts.
- Turning to outside experts may be particularly useful in the following situations:
  - ✓ Insufficient in–house professional capabilities in a given area.
  - ✓ In small organizations in many cases it is difficult to find enough suitable candidates to participate in the design review teams. In such situations, outside experts may join a DR committee or, alternatively, their expert opinions may replace a DR.
  - ✓ Temporary unavailability of internal experts (waiting will cause substantial delays in the project completion schedule).
  - ✓ In cases of major disagreement among the organization's senior professionals, an outside expert may support a decision.

2. Project Life Cycle Components – Software Testing

- Software tests are formal SQA components that are targeted toward review of the actual running of the software.
- The tests are based on a prepared list of test cases that represent a variety of expected scenarios.
- Software tests examine software modules, software integration, or entire software packages (systems).

2. Project Life Cycle Components – Software Testing

- Software testing programs are constructed from a variety of tests, some manual and some automated.
- It is recommended that software tests be carried out by an independent, NOT by the project team.

2. Project Life Cycle Components – Software Maintenance

Software maintenance services vary in range and are provided for extensive periods, often several years. These services fall into the following categories:

- ***Corrective maintenance*** – User's support services and correction of software code and documentation failures.

2. Project Life Cycle Components – Software Maintenance

- ***Adaptive maintenance*** – Adaptation of current software to new circumstances and customers without changing the basic software product. These adaptations are usually required when the hardware system or its components undergo modification (additions or changes).

- ***Functionality improvement maintenance*** – The functional and performance related improvement of existing software.

3. Infrastructure components for error prevention and improvement

- The goals of SQA infrastructure are the prevention of software faults or, at least, the lowering of software fault rates.
- The improvement of productivity. SQA infrastructure components are developed specifically to this end.

3. Infrastructure components for error prevention and improvement

- **This class of SQA components includes:**
  - ✓Procedures and work instructions
  - ✓Templates and checklists
  - ✓Staff training, retraining, and certification
  - ✓Preventive and corrective actions
  - ✓Configuration management
  - ✓Documentation control

3. Infrastructure components for error prevention and improvement

Procedures and work instructions

- ✓provide detailed definitions for the performance of specific types of development activities.
- ✓Procedures are planned to be generally applicable and to serve the entire organization

Templates and checklists

- ✓Using checklists and templates, is one method to achieve both greater efficiency and higher quality.

3. Infrastructure components for error prevention and improvement

Staff training, retraining, and certification

- ✓ keeping an organization's human resources knowledgeable and updated at the level required is achieved mainly by:
  - Training new employees and retraining those employees who have changed assignments.
  - Continuously updating staff with respect to professional developments and the in–house, hands–on experience acquired.

3. Infrastructure components for error prevention and improvement

Preventive and corrective actions

- ✓ Implementation of changes that prevent similar failures in the future.
- ✓ Correction of similar faults found in other projects
- ✓ Implementing proven successful methodologies to enhance the probability of repeat successes.

3. Infrastructure components for error prevention and improvement

Configuration management

- ✓ the issuing of new software versions and releases, the recording of the version and release specifications of the software installed in each site.
- ✓ deals with hazards by introducing procedures to control the change process.
- ✓ These procedures relate to the approval of changes, the recording of those changes performed.
- ✓ the prevention of any changes in approved versions and releases once they are issued.

3. Infrastructure components for error prevention and improvement

Documentation control

- ✓ Definition of the types of controlled documents needed
- ✓ Definition of review and approval processes for each controlled document.
- ✓ Definition of the archive storage methods.

4. Management Components

- Managerial SQA components support the managerial control of software development projects and maintenance services. Control components include:
  - ✓Project progress control (including maintenance contract control)
    - schedules, budgets, risk analysis, ...
  - ✓Software quality metrics
  - ✓Software quality costs.

4. Management Components

Project progress control:

The main objective of project progress control components is to detect the appearance of any situation that may induce deviations from the project's plans and maintenance service performance

Project control activities focus on:

- Resource usage
- Schedules
- Risk management activities
- The budget.

4. Management Components

Software quality metrics:

Measurement of the various aspects of software quality is considered to be an effective tool for the support of control activities and the initiation of process improvements during the development and the maintenance phases.

we can list metrics for:

- Quality of software development and maintenance activities
- Development teams' productivity
- Help desk and maintenance teams' productivity
- Software faults density
- Schedule deviations.

4. Management Components

Software quality Costs:

according to the extended quality costs model,

The costs of control:

prevention costs,

appraisal costs

managerial preparation and control costs.

The costs of failure:

internal failure costs,

external failure costs,

managerial failure costs).

5. SQA standards and assessment components

- The standards available may be classified into two main sub classes: *quality management standards* and *project process standards.*
  - **Quality Management Standards**
    - ✓ SEI CMM assessment standard
    - ✓ ISO 9001 and ISO 9000–3 standards.
  - **Project Process Standards**
    - ✓ EEE 1012 standard
    - ✓ ISO/IEC 12207 standard.

6. Human Components

- Management
- SQA Unit
- SQA committees and forums

The end