Software Quality Engineering:

Testing, Quality Assurance, and Quantifiable Improvement

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Chapter 5. Quality Engineering

- SQE: Software Quality Engineering
- Key SQE Activities
- SQE in Software Process

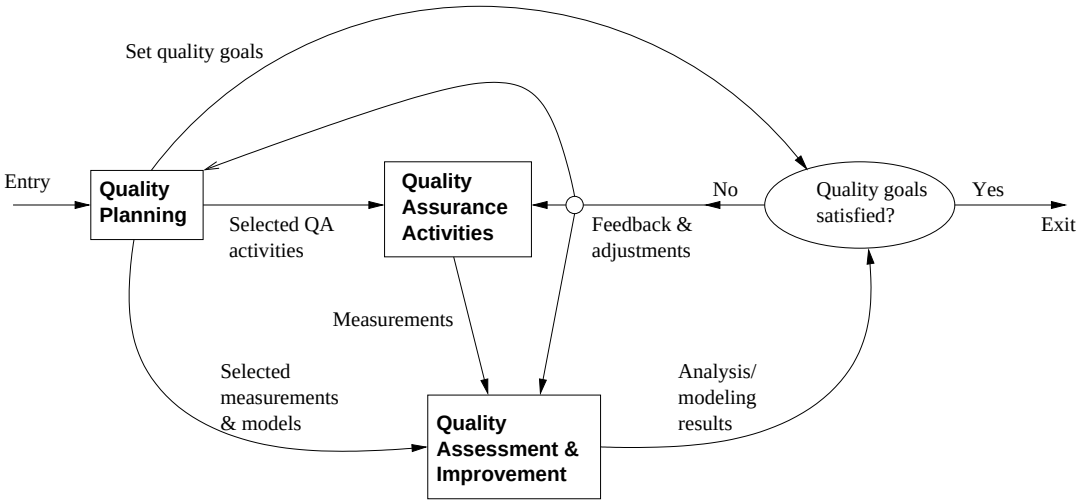
QA to SQE

- QA activities need additional support:
  - ▷ Planning and goal setting
  - ▷ Management:
    - when to stop?
    - adjustment and improvement, etc.
    - all based on assessments/predictions

- Assessment of quality/reliability/etc.:
  - ▷ Data collection needed
  - ▷ Analysis and modeling
  - ▷ Providing feedback for management

- QA + above
  $\Rightarrow$ software quality engineering (SQE)

SQE Process



- SQE process to link major SQE activities: Fig 5.1 (p.54)
  - ▷ Pre-QA planning;
  - ▷ QA: covered previously (Ch.3 & 4);
  - ▷ Post-QA analysis and feedback (maybe parallel instead of "post-")

SQE and QIP

- QIP (quality improvement paradigm):
  - ▷ Step 1: *understand* baseline
  - ▷ Step 2: change then *assess* impact
  - ▷ Step 3: *package* for improvement
- QIP support:
  - ▷ overall support: experience factory
  - ▷ measurement/analysis: GQM (goal-question-metric paradigm)
- SQE as expanding QA to include QIP ideas.

Pre-QA Planning

- Pre-QA planning:
  - ▷ Quality goal
  - ▷ Overall QA strategy:
    - – QA activities to perform?
    - – measurement/feedback planning
- Setting quality goal(s):
  - ▷ Identify quality views/attributes
  - ▷ Select direct quality measurements
  - ▷ Assess quality expectations vs. cost

Setting Quality Goals

- Identify quality views/attributes
  - ▷ customer/user expectations,
  - ▷ market condition,
  - ▷ product type, etc.
- Select direct quality measurements
  - ▷ direct: reliability
  - ▷ defect-based measurement
  - ▷ other measurements
- Assess quality expectations vs. cost
  - ▷ cost-of-quality/defect studies
  - ▷ economic models: COCOMO etc

Forming QA Strategy

- QA activity planning
  - ▷ evaluate individual QA alternatives
    – strength/weakness/cost/applicability/etc.
  - ▷ match against goals
  - ▷ integration/cost considerations

- Measurement/feedback planning:
  - ▷ define measurements (defect & others)
  - ▷ planning to collect data
  - ▷ preliminary choices of models/analyses
  - ▷ feedback & followup mechanisms, etc.

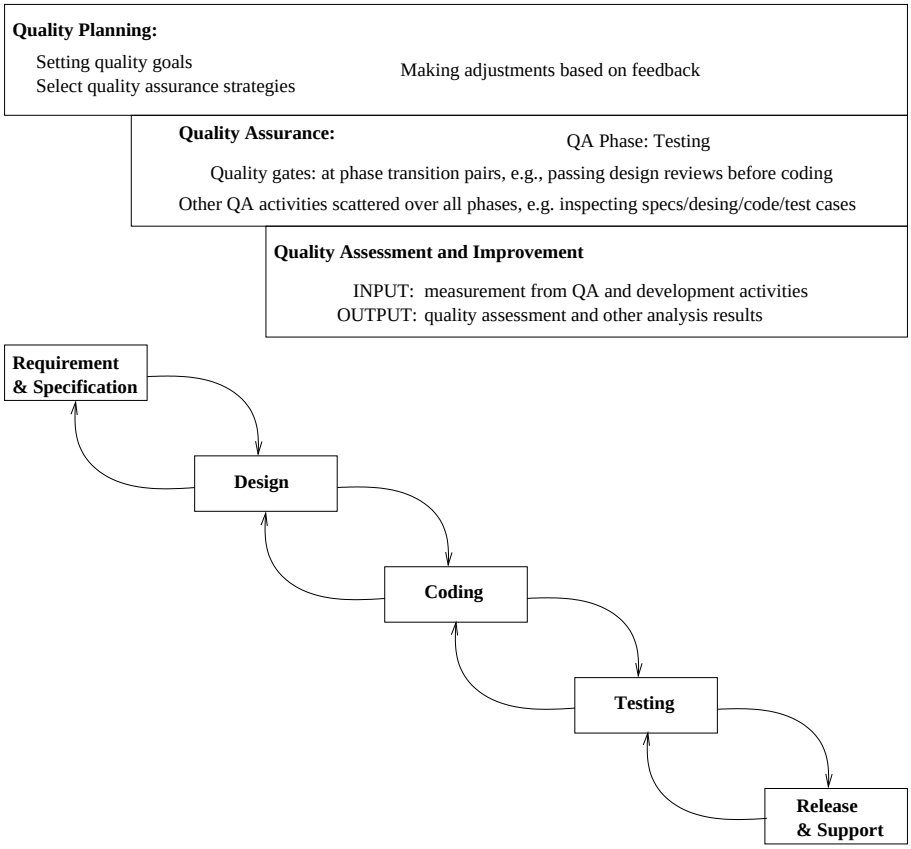
Analysis and Feedback

- Measurement:
  - ▷ defect measurement as part of defect handling process
  - ▷ other data and historical baselines
- Analyses: quality/other models
  - ▷ input: above data
  - ▷ output/goal: feedback and followup
  - ▷ focus on defect/risk/reliability analyses
- Feedback and followup:
  - ▷ frequent feedback: assessments/predictions
  - ▷ possible improvement areas
  - ▷ project management and improvement
- Details in Part IV.

SQE in Software Processes

- SQE activities $\subset$ development activities:
  - ▷ quality planning $\subset$ product planning
  - ▷ QA activities $\subset$ development activities
  - ▷ analysis/feedback $\subset$ project management
- Fitting SQE in software processes:
  - ▷ different start/end time
  - ▷ different sets of activities, sub-activities, and focuses
  - ▷ in waterfall process: more staged (planning, execution, analysis/feedback)
  - ▷ in other processes: more iterative or other variations

SQE in Waterfall Process



- Fig 5.2 (p.61) above
  - ▷ activity start/finish line
  - ▷ different focus and effort (later)

SQE Effort Profile

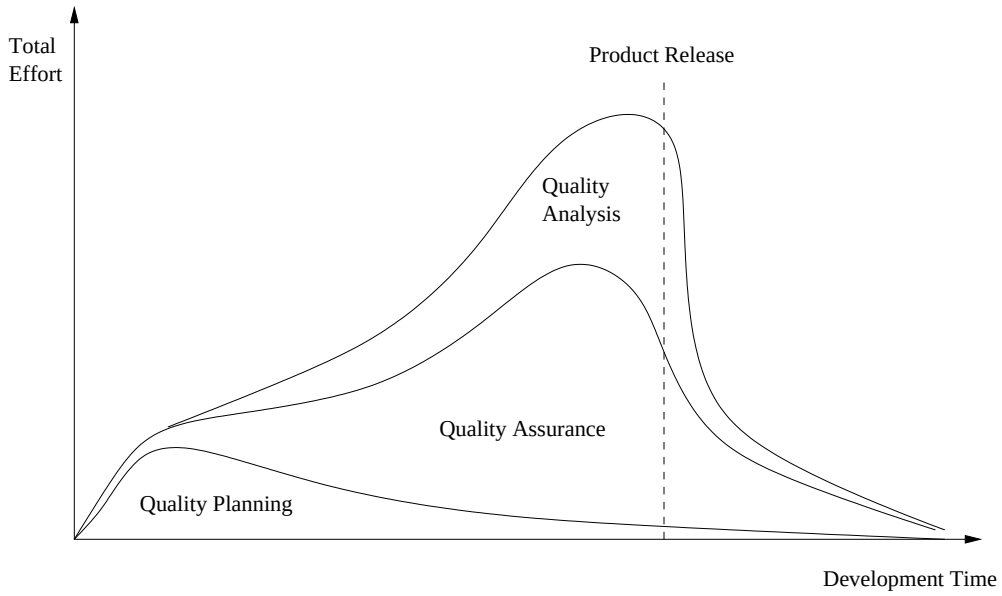
- QE activity/effort distribution/dynamics:
  - ▷ different focus in different phases
  - ▷ different levels (qualitatively)
  - ▷ different build-up/wind-down patterns
  - ▷ impact of product release deadline (deadline-driven activities)

- planning: front heavy

- QA: activity mix
  (early vs. late; peak variability? deadline?)

- analysis/feedback: tail heavy
  (often deadline-driven or decision-driven)

SQE Effort in Waterfall Process



- Effort profile above (Fig 5.3, p.63)
  - ▷ planning/QA/analysis of total effort
  - ▷ general shape/pattern only
    (actually data would not be as smooth)
  - ▷ in other processes:
    - similar but more evenly distributed