31272 Project Management and the Professional

Lecture 10: : Quality Management within projects

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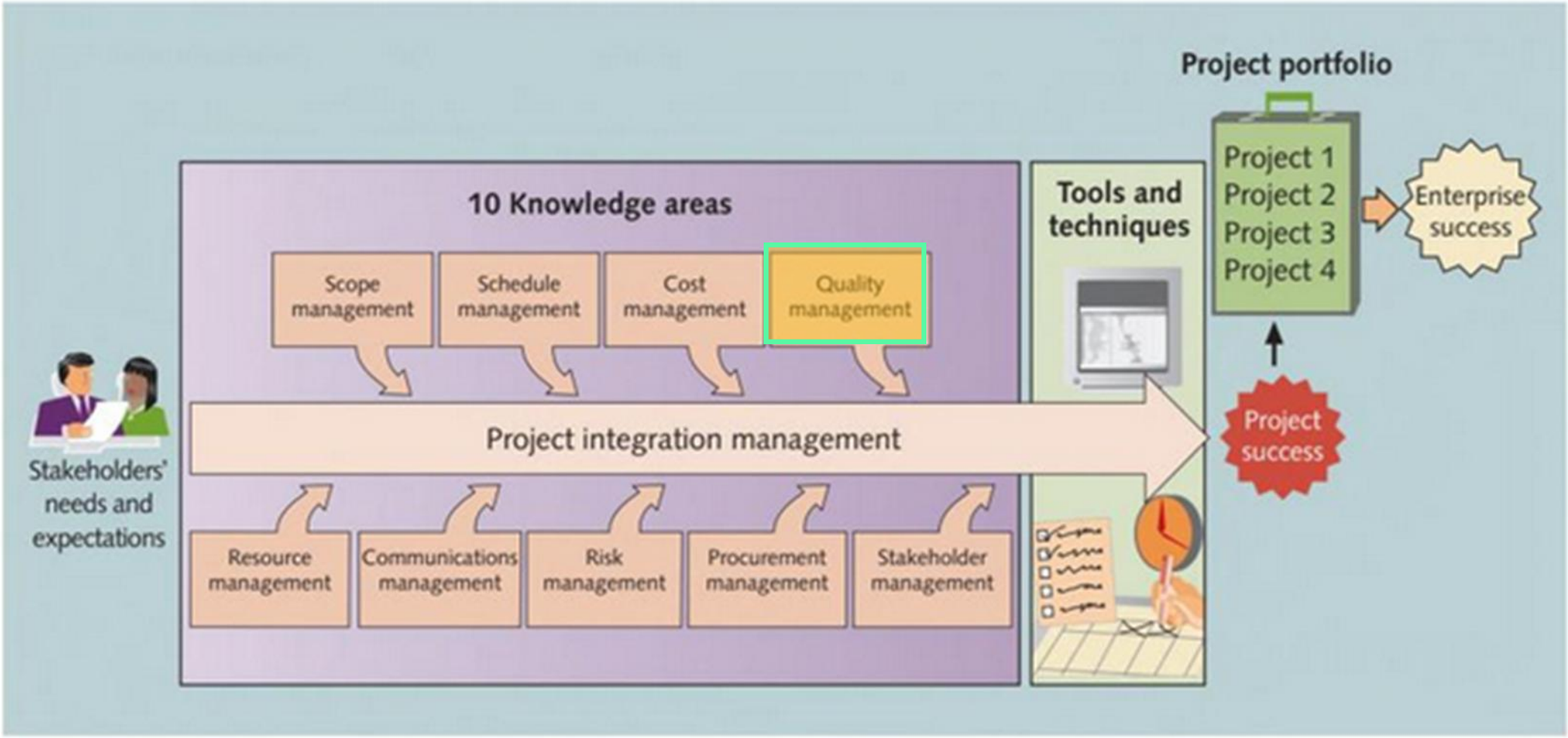
Objectives and Topics

- What is quality?
- History and evolution of quality
- Importance of quality
- Quality management characteristics
- Verification and validation model
- Workplace influence on quality

Project Management Planning: Quality



Definition of Quality

ISO 9000

"Degree to which a set of inherent characteristics fulfils requirements“

The standard defines ‘requirements’ as need or expectation

Ruskin

"Quality is never an accident: it is always the result of intelligent effort"

Manns and Coleman

"Maintainability, is par excellence, a yardstick by which the quality of software can be judged. Paradoxical as it may seem, software that has been developed with a view to being changed is likely to need changing less than any other. It will be quality software” Manns, T., Coleman, M. (1996) *Software Quality Assurance*. 2nd edn. Basingstoke: Macmillan

A History Lesson

< 1700 Products were hand made as individual works where parts were fitted to one another in order to work together

1777 Honore Blanc demonstrated he could make muskets with parts built to a high level of accuracy so as to be interchangeable. This revolutionised the process of manufacturing;

1913 Henry Ford introduces assembly line, and mass production;

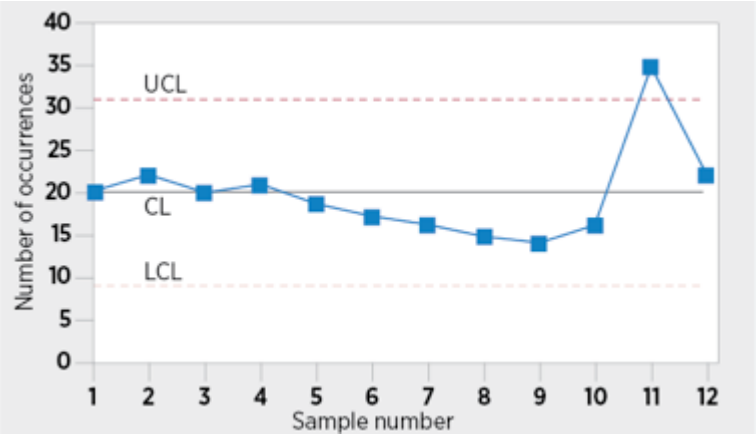
1924 Walter Shewhart introduces statistical control to production processes. Uses control charts with ‘chance cause’ and ‘assigned cause’ to help eliminate cause of defects;

1950 W. Edward Deming introduces his 14 points to Japan;

1982 Ford Motor Company and Total Quality Management (TQM);

1986 Motorola and Six-Sigma (approx 3.4 defects per million products)

1987 International Standards Organisation publishes ISO 9000.

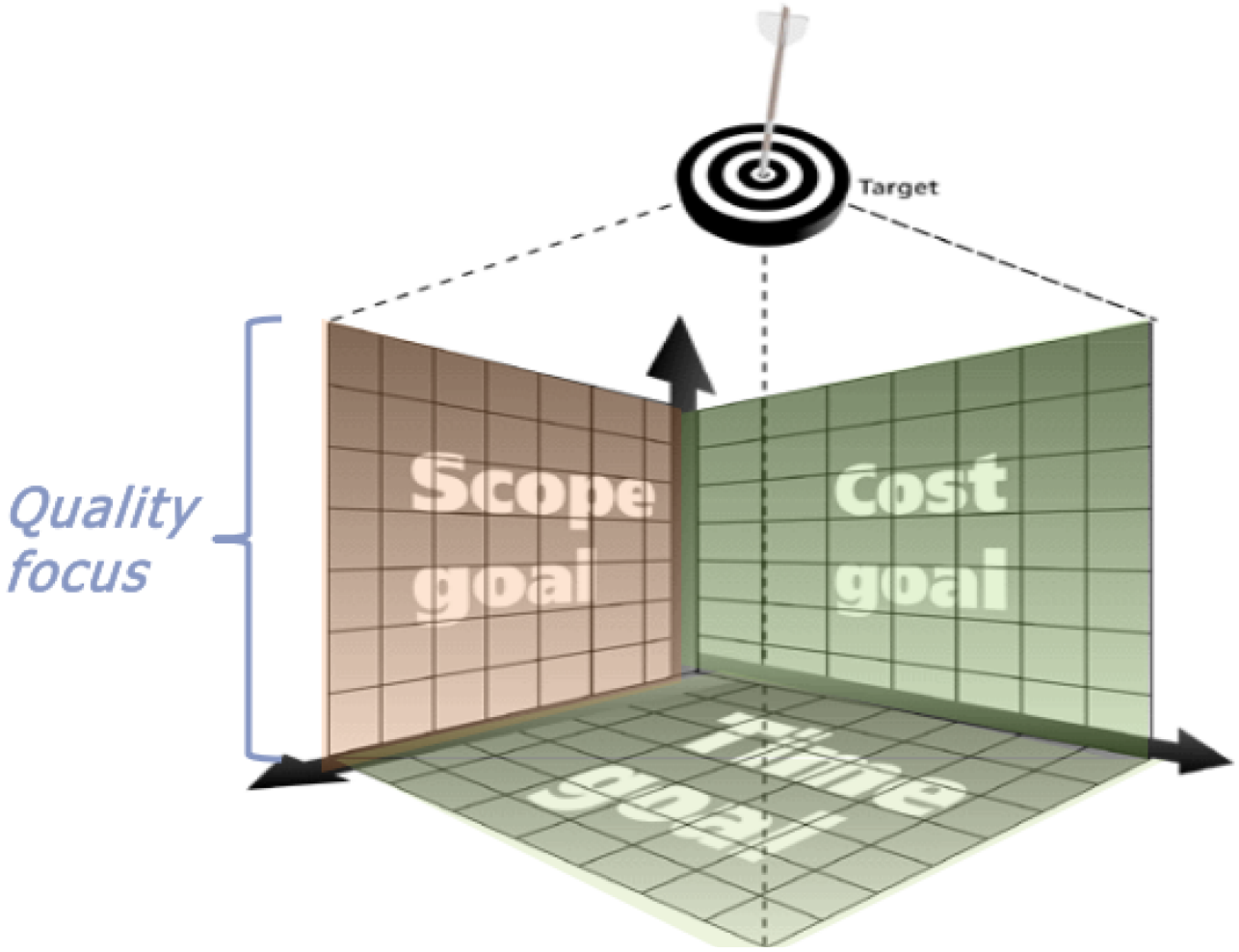


Demings 14 points for the transformation of management

1. Create constancy of purpose for improving products and services
2. Adopt the new philosophy
3. Cease dependence on inspection to achieve quality
4. End the practice of awarding business on price alone; instead, minimize total cost by working with a single supplier
5. Improve constantly and forever every process for planning, production, and service
6. Institute training on the job
7. Adopt and institute leadership
8. Drive out fear
9. Break down barriers between staff areas
10. Eliminate slogans, exhortations, and targets for the workforce
11. Eliminate numerical quotas for the workforce and numerical goals for management
12. Remove barriers that rob people of pride of workmanship, and eliminate the annual rating or merit system
13. Institute a vigorous program of education and self-improvement for everyone
14. Put everybody in the company to work accomplishing the transformation

https://deming.org/explore/fourteen-points/

The Triple Constraint and the Importance of Quality



- Increasing criticality of software
- The intangibility of software
- Accumulating errors during software development

A Quality Philosophy for Projects

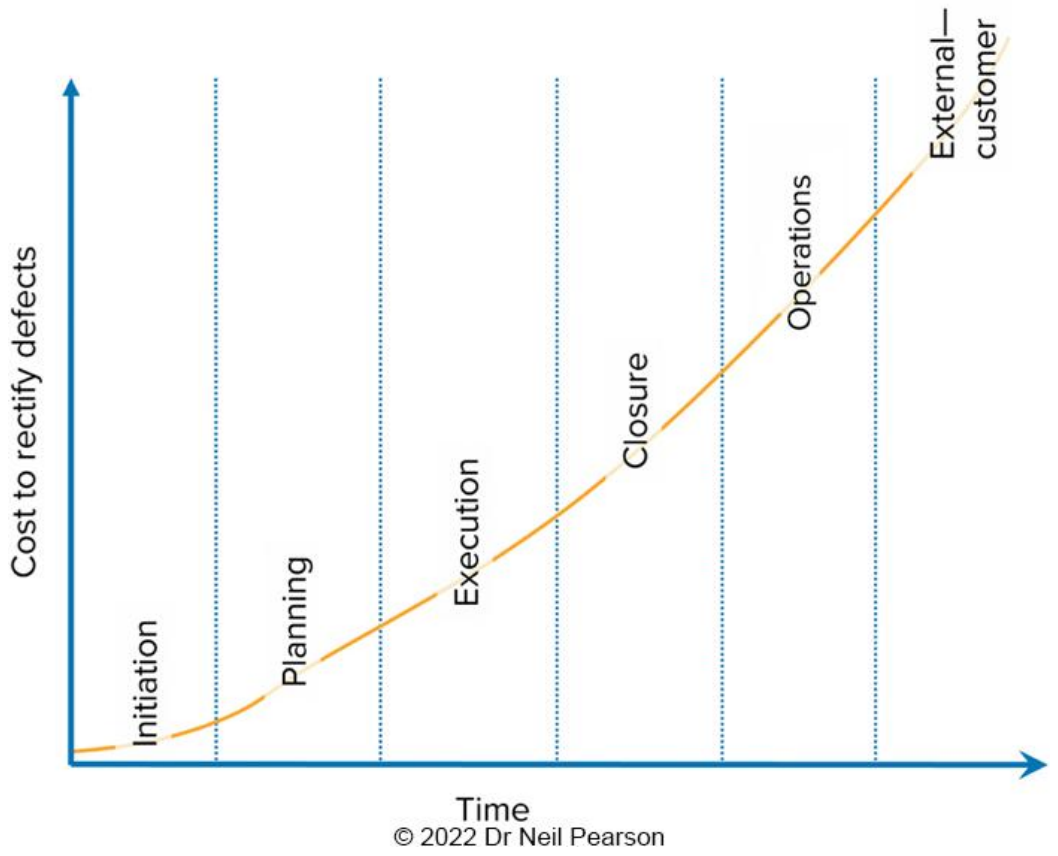
Mistakes should be prevented rather than detected

Errors are more expensive to correct at later stages

- Need to rework more stages
- Later stages more detailed, less able to absorb change

Barry Boehm

- Error is typically 10 times more expensive to correct at coding stage than at requirements stage
- 100 times more expensive at maintenance stage



Cost of Quality

Costs of prevention

Additional planning
Education of project team / stakeholders
Checking and testing project deliverables
Improving designs
Quality staff
Quality audits
Quality plans and execution

Cost of defects

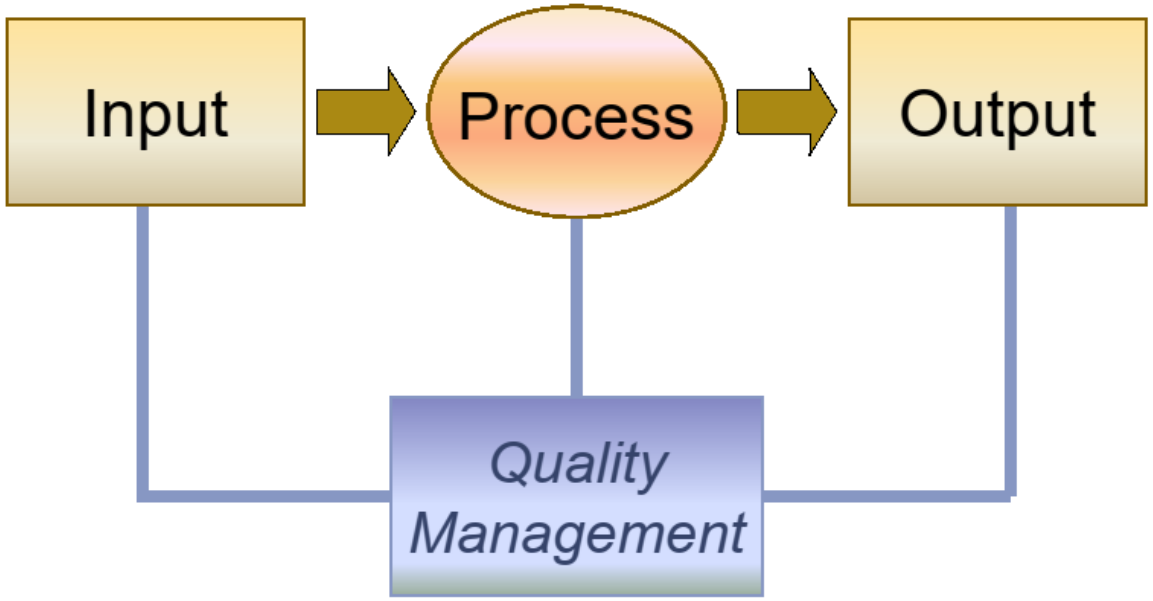
Rework
Repair
Replacing of defective parts/inventory
Repairs after delivery of the product
Loss of future business from stakeholder
Legal issues for non-conformance
Liability for defect
Risk to life and property

Quality Characteristics

ISO 25010 https://iso25000.com

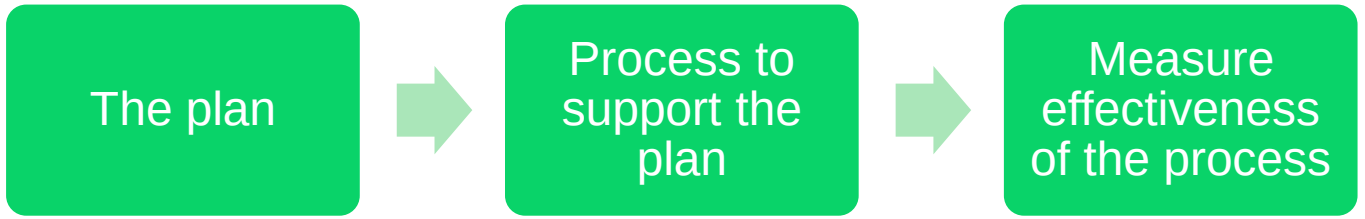
Implementing a Quality Philosophy

- All stakeholders want quality but no common approach exists as PMs approach Project Quality Management differently
- A Project Quality management framework helps guide and integrate quality improvement in support of project's quality objectives
- The Project Quality Plan may be formal or informal but must be well understood and communicated



Project Quality Management: 3 Steps

Quality Planning	Determines what quality standards should be used to ensure scope delivery fulfils stakeholder needs (selection of metrics, targets, methodology and processes)
Quality Assurance	Monitors ability of the project to meet stakeholder expectations. Verifies quality of deliverable is sufficient (process execution to assure key project elements are robust, consistent, timely and with useful outputs)
Quality Control	Measures specific items that must be monitored by quality assurance (compare outputs of QA activities to desired QP targets)



Quality Planning

- Quality policy for the project (reflects the organisation)
- Quality plan
  - Adjusts specific organisation quality standards to fit the project
  - Describes how the quality of project will be assured
  - Functions carried out by the project team to certify it
  - Additional activities added to project scope, budget and schedule

Risk management and quality management overlap.
Areas high in risk should also influence the quality plan.

Quality Planning Template: Example

Review Area	Quality Measure to be Used	Evaluation Methods
Project requirements collection, definition and documentation (process area)	1. Customer acceptance/signoff of the requirements traceability table as accurate and complete. 2. Customer acceptance/signoff of requirements specification document as accurate and complete	1. Analyst presentation to (and requirements traceability review with) the customer. 2. Detailed review by customer of submitted requirements specification document.
…	…	…

'Review Area' would apply to both the project as a whole (*project deliverables*) as well as individual project process areas (*process deliverables*)

Quality Assurance (defect prevention)

- Activities to satisfy relevant quality standards
  - Testing, internal reviews, audits, performance benchmarking, etc
- Audits review important areas of the project in depth to assess if (and how) standards are being met
  - Functionality, reliability, usability, efficiency, maintainability, portability
- Focus upon continuous quality/capability improvement
  - Improve the maturity of the organisation over time (capture lessons learned to improve later projects)
  - No witch hunts or scapegoating

Quality Assurance Template: Example

Project Process	Quality Standard Expected	Quality Assurance Activity	Frequency / Interval	Person Responsible
Requirements collection, definition and documentation	1. Analysts have completely captured software requirements.	Software Analyst peer review of requirements specification.	Weekly review during requirements definition.	B.B. Wolf (Team Lead, Analysis)
	2. Requirements align to business case. Creation of traceability table and requirement specification	Customer review of requirements traceability and specification.	Fortnightly joint review (customer + analyst) during requirements definition	B.B. Wolf (Team Lead, Analysis)
	3. Accuracy/completeness of final requirements specification document.	Customer signoff of requirements traceability and specification documents.	Final review at conclusion of requirements definition.	B. Bunny (PM)
…	…	…	…	…

Quality Control (defect identification)

- Monitors specific project results to ensure they match standards set for the project
- Uses tools / techniques based on statistical analysis

Pareto analysis (80/20 rule)	Testing checklists
Statistical sampling	Walk-through of process deliverables
Quality control charts	Reviews (project and peer)
Inspection	Audit compliance
Benchmark comparisons	Kaizen (continuous improvement)

- The main outputs of quality control are acceptance decisions, rework and/or process adjustments

Quality Control Example (Pareto analysis)

- Vilfredo Pareto (1848–1923), an Italian economist, studied the distributions of wealth in different countries, concluding that fairly consistent minority – about 20% – of people controlled the large majority – about 80% – of a society's wealth. This same distribution has been observed in other areas and has been termed the Pareto effect.

- Pareto charts are used to display the Pareto principle in action, arranging data so that the few vital factors that are causing most of the problems reveal themselves. Concentrating improvement efforts on these few will have a greater impact and be more cost-effective than undirected efforts.

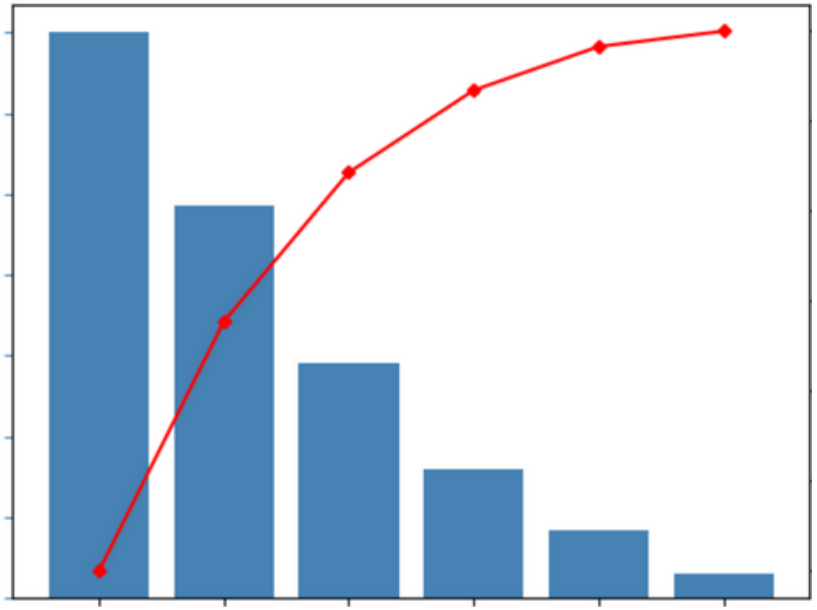
Quality Control Example (Pareto analysis)

A Pareto Chart is a bar graph with the frequency value on the vertical axis and the type of problem or clues to the problem on the horizontal axis.

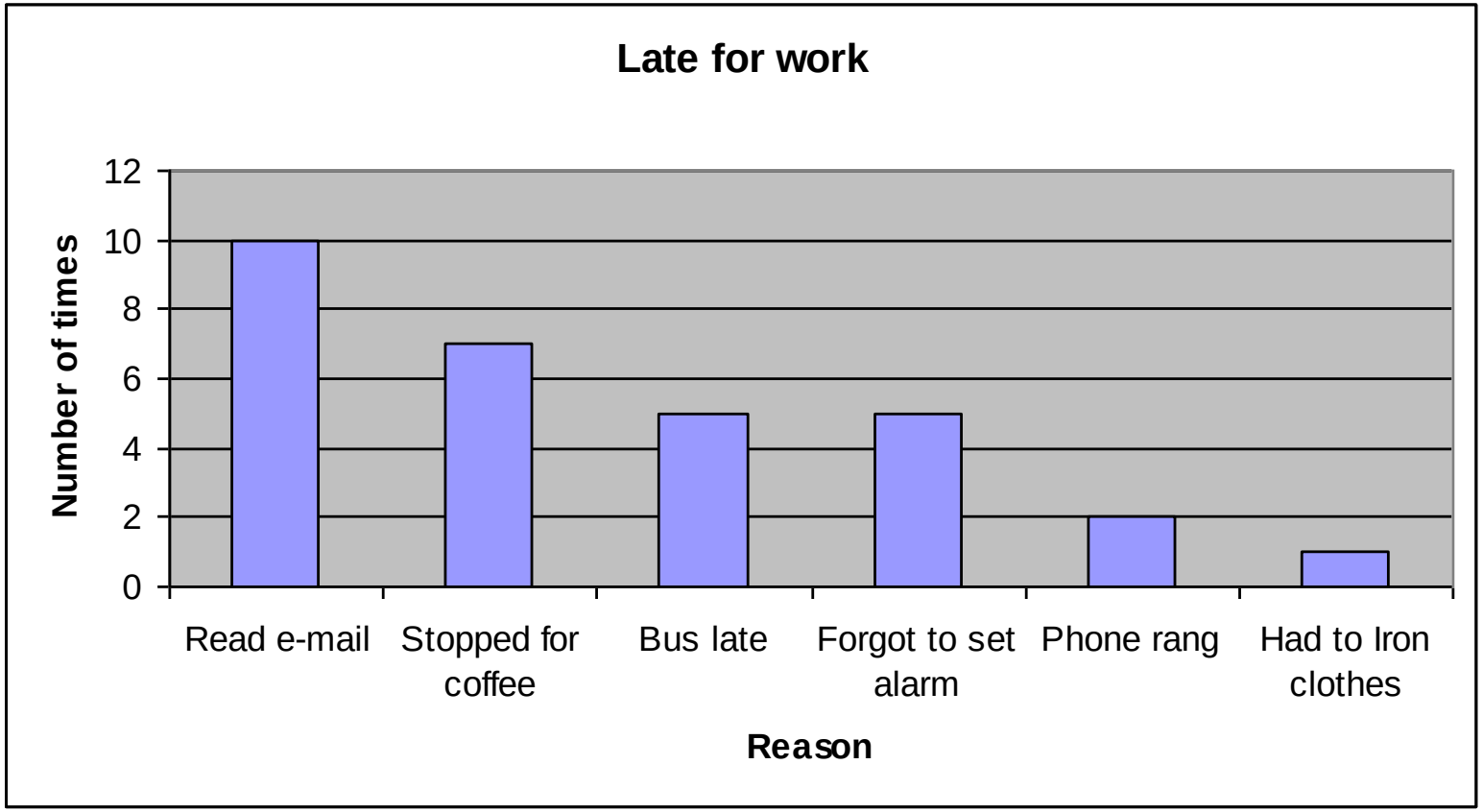
Pareto Charts are built on data (not opinion) that displays the number of times (frequency) "trouble" pops up in relation to certain categories of conditions.

These conditions might be related to:

- Who -- Who is involved
- What -- Resources used
- Where -- Physical location
- When -- Date or time
- Which -- Areas
- How -- How things are done
- Why -- Reasons



Quality Control Example (Pareto analysis)



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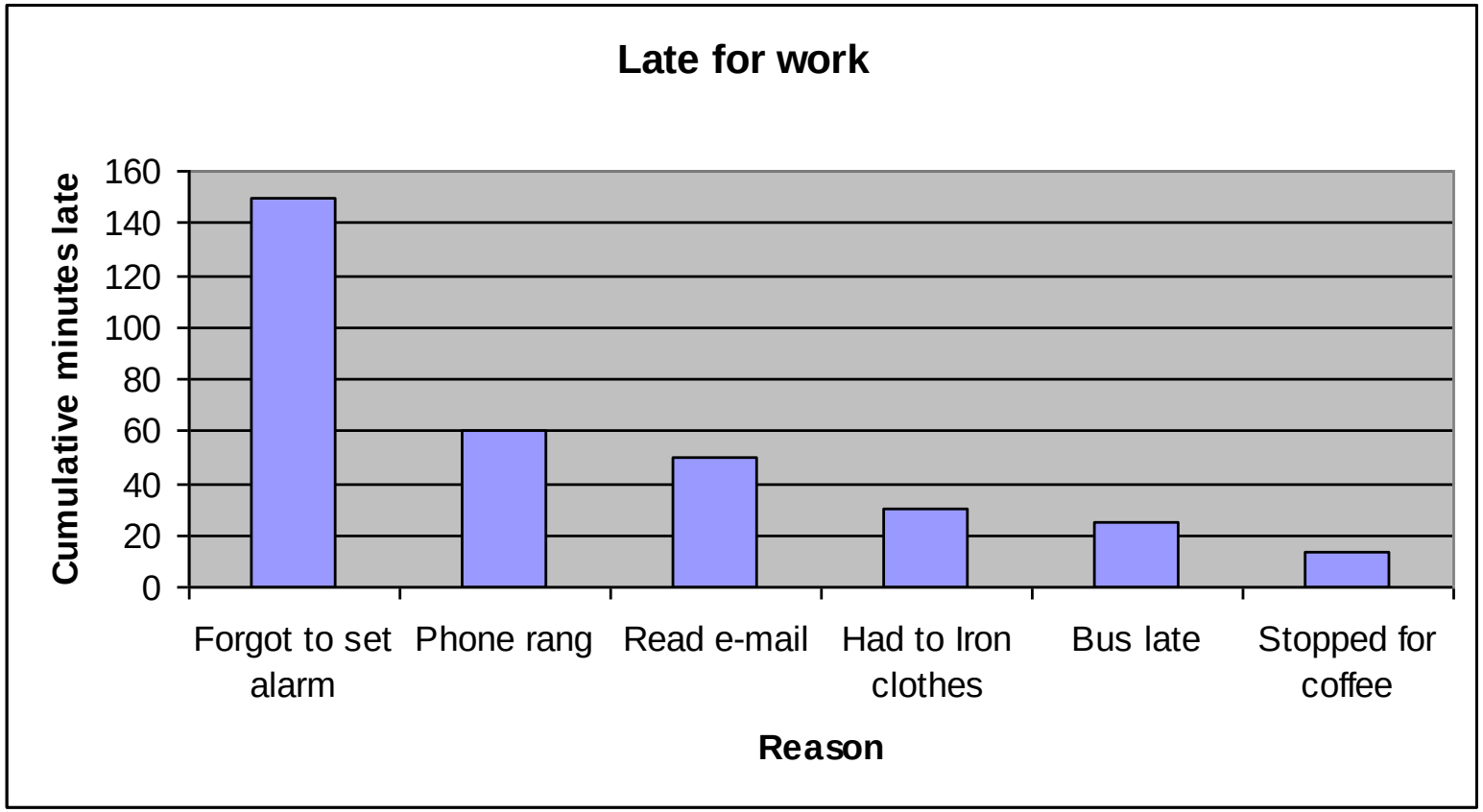
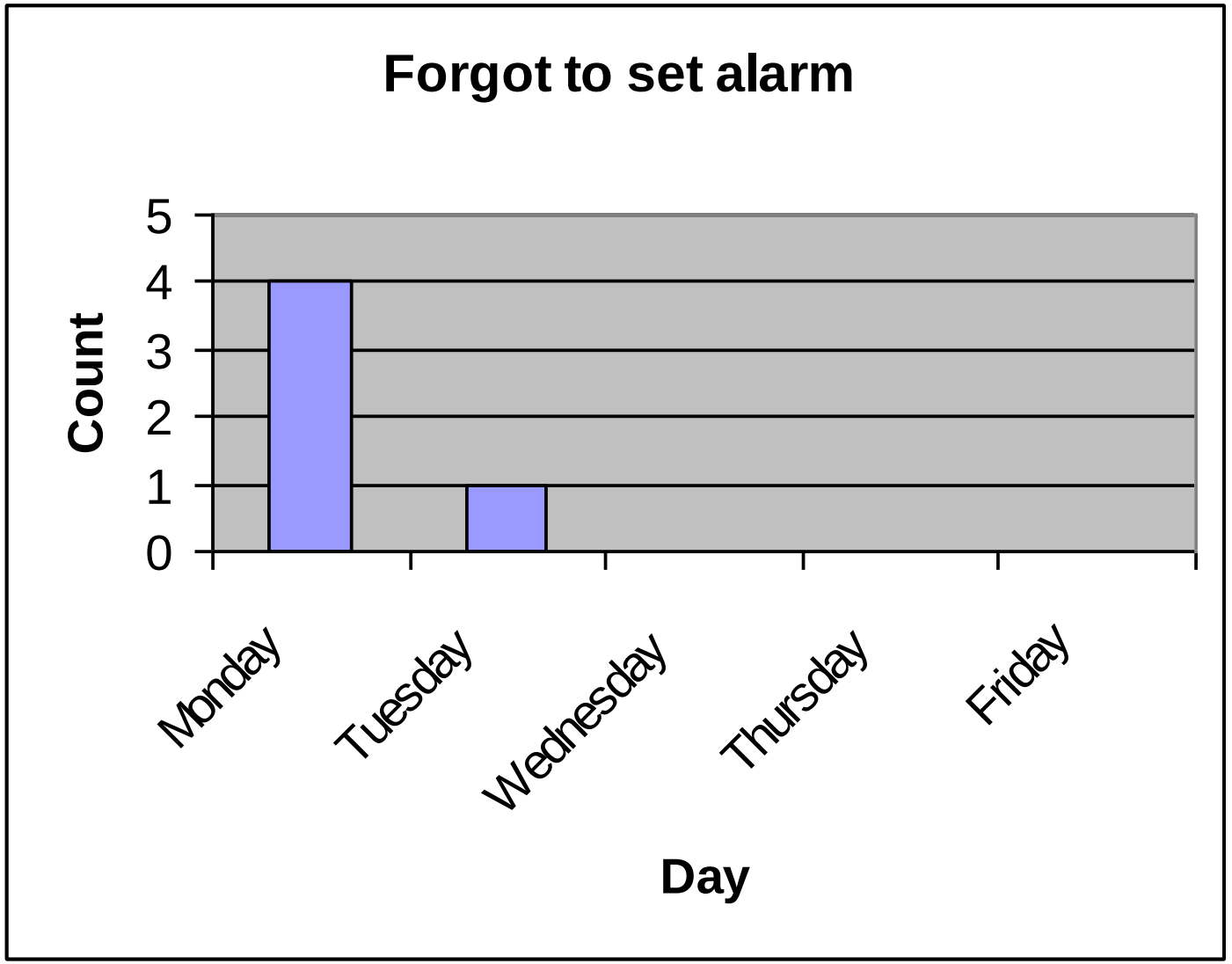
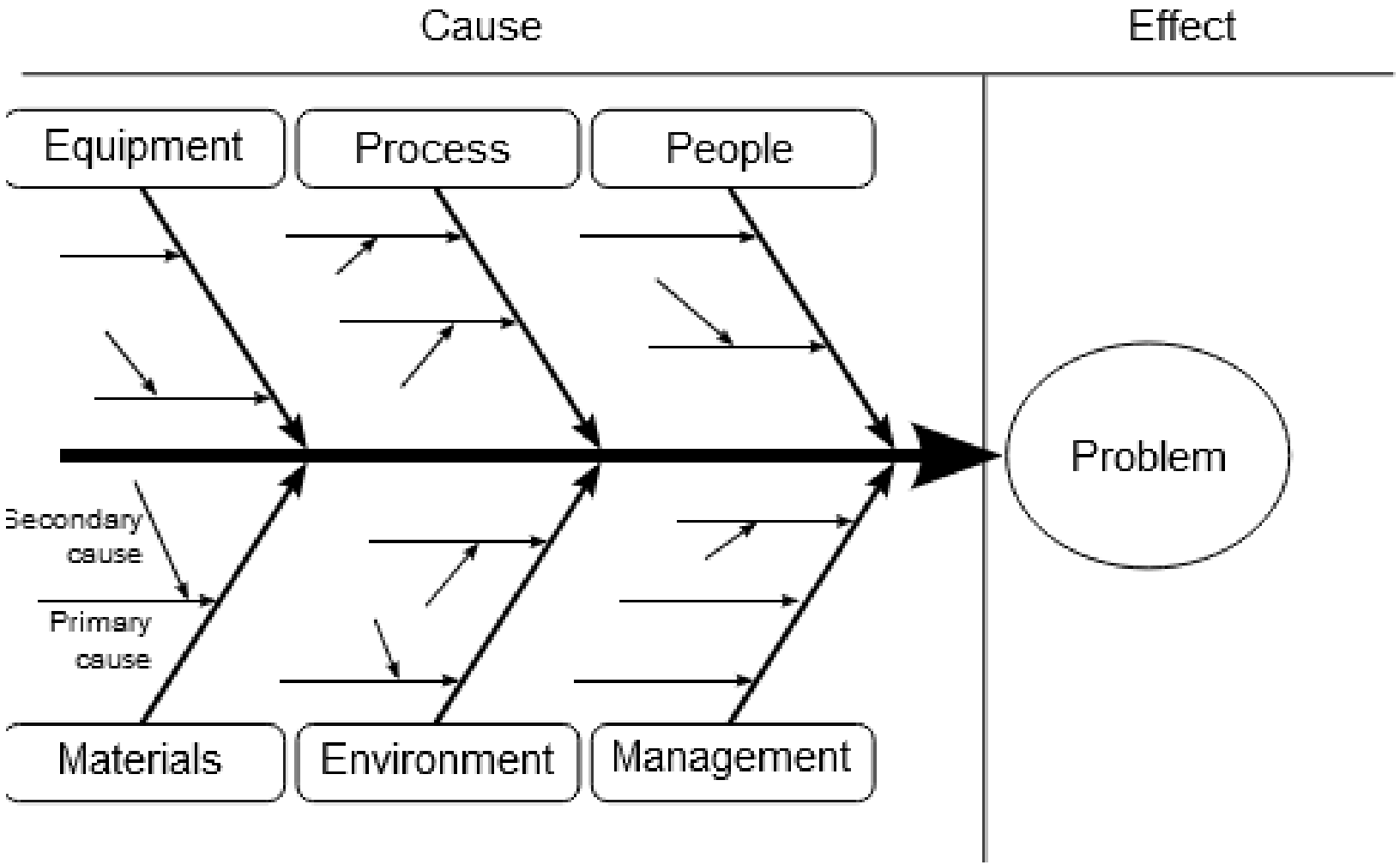


Quality Control Example (Pareto analysis)



Quality Control Example (Ishikawa diagram)



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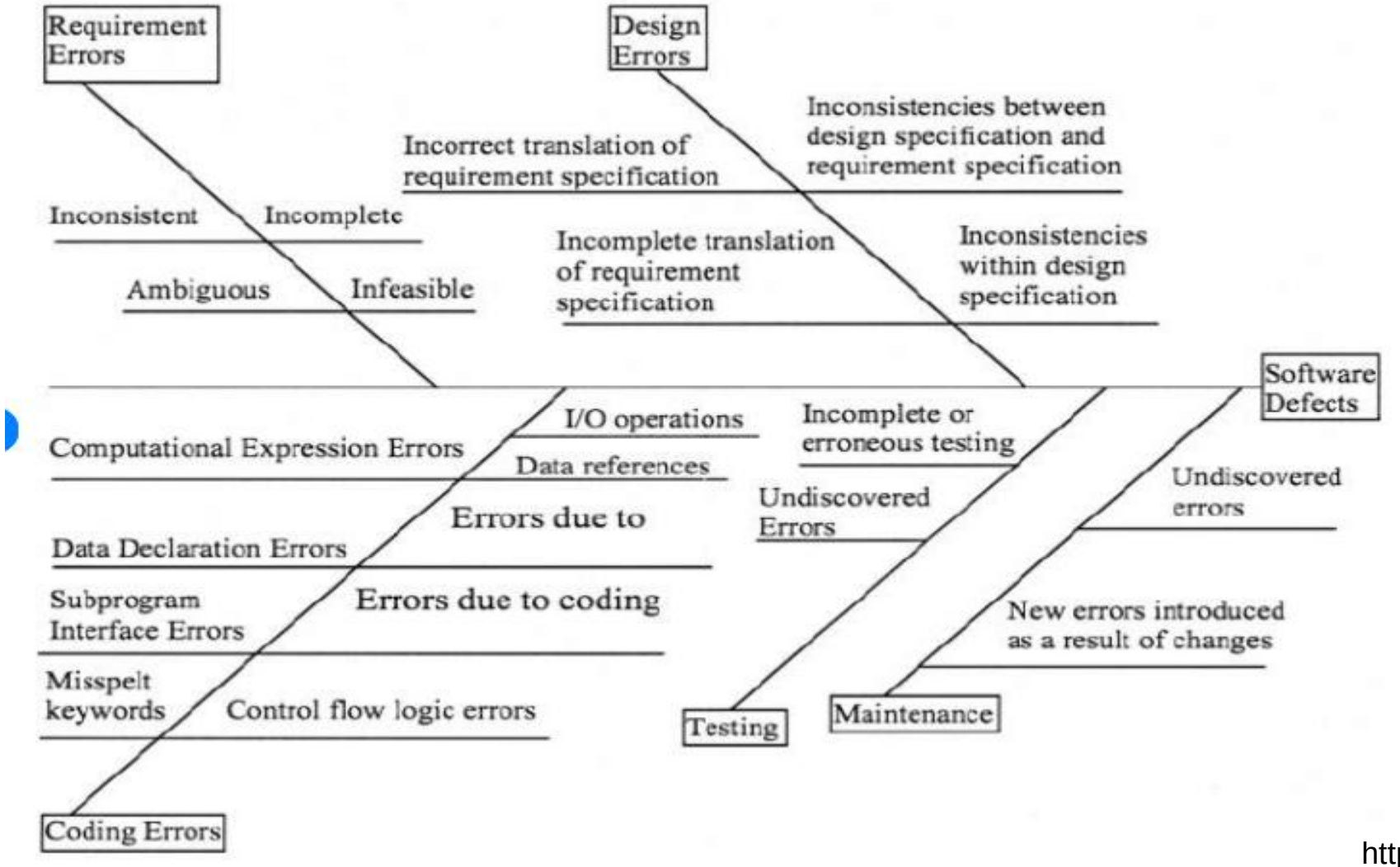
Quality Control Example (Ishikawa diagram)



https://www.researchgate.net

Quality Control Template: Example

Project Deliverable	Quality Standard Expected	Quality Control Activity	Frequency / Interval	Person Responsible
Requirements specification document	Finance Group requirements certified complete and accurate.	Review by Finance Group in consultation with external expert.	Finance spec as released by analyst for customer review	D. Duck (Finance Mgr)
	HR Group requirements certified complete and accurate.	Review by HR Group in consultation with external subject expert.	HR spec as released by software analyst for customer review.	P. Pittstop (HR Mgr)
	Admin Group software requirements certified complete and accurate.	Review by Admin Group in consultation with external subject expert	Admin spec as released by software analyst for customer review.	Q. McGraw (Admin Mgr)
	Requirements document certified complete and accurate.	Approval and signoff by all relevant business managers and the PM.	Verification at the end of the requirements investigation phase.	B. Bunny (PM)
…	…	…	…	…

A problem with software quality

- Measurements for **product** quality can only be taken once the product is operational
  - *This could be too late!!*
- Measurements on **process** quality can be taken at any stage of the development project
- Need to “control” what the final application will be like

Software Testing

- Many IT professionals think of testing as a stage that comes near the end of IT product development (*Validation*)
- However, testing and confirmation should be done during almost every phase of the IT product development life cycle (*Verification*)

Verification and Validation

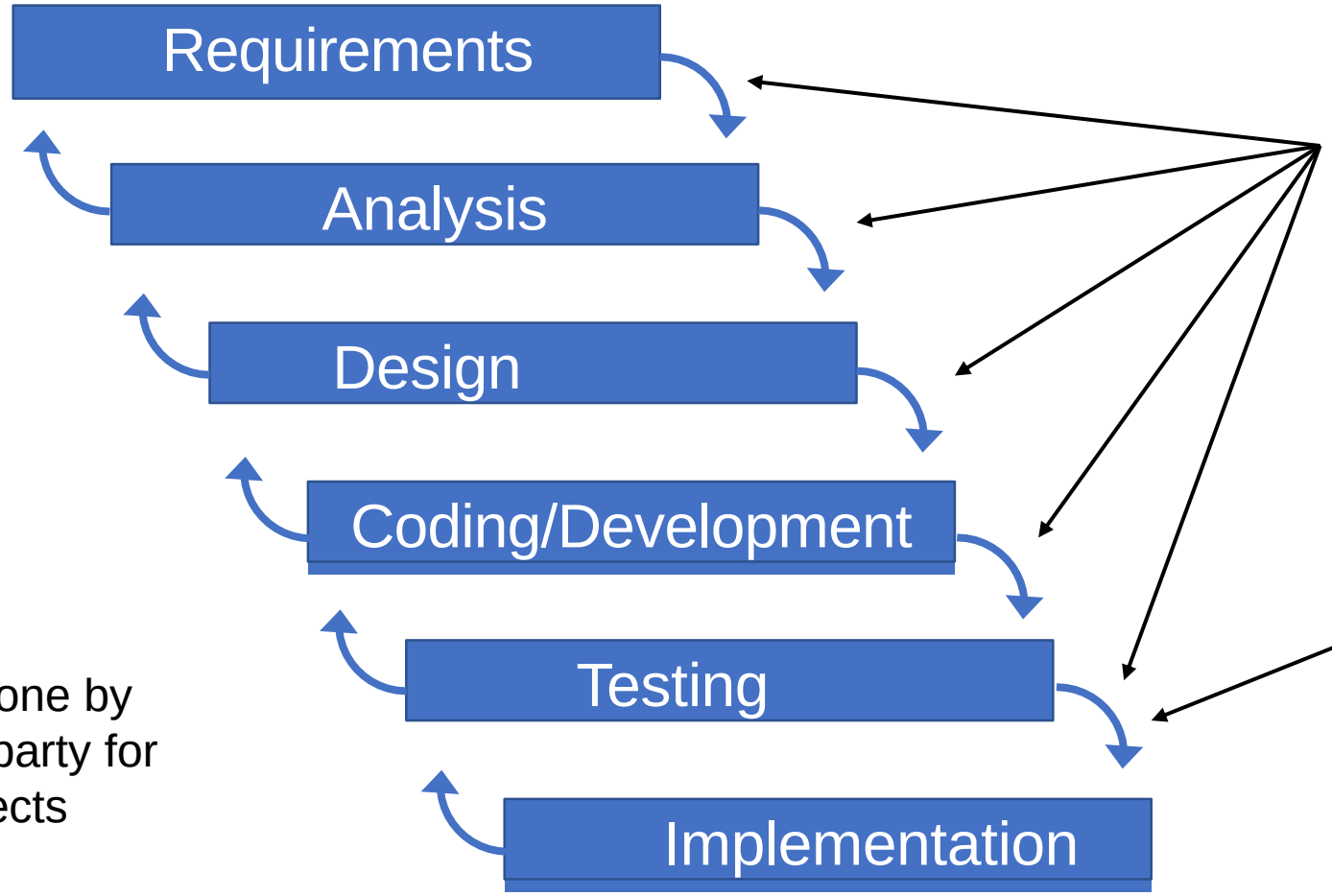
Verification: Are we building the product right? (Building things right)

- Focus on *process* activities to ensure product meets requirements
- Standards, metrics and types of reviews must be clearly defined
- Metrics reviewed/checked at each development stage-gate

Validation: Are we building the right product? (Building the right thing)

- Ensures the *system* functions as intended (i.e. mostly systems testing) and has all features defined in the scope and requirements
- Occurs near the end of the project as a formal, structured and
- traceable process - gives confidence the quality of the system meets expectations prior to handover

Verification and Validation: Waterfall Example

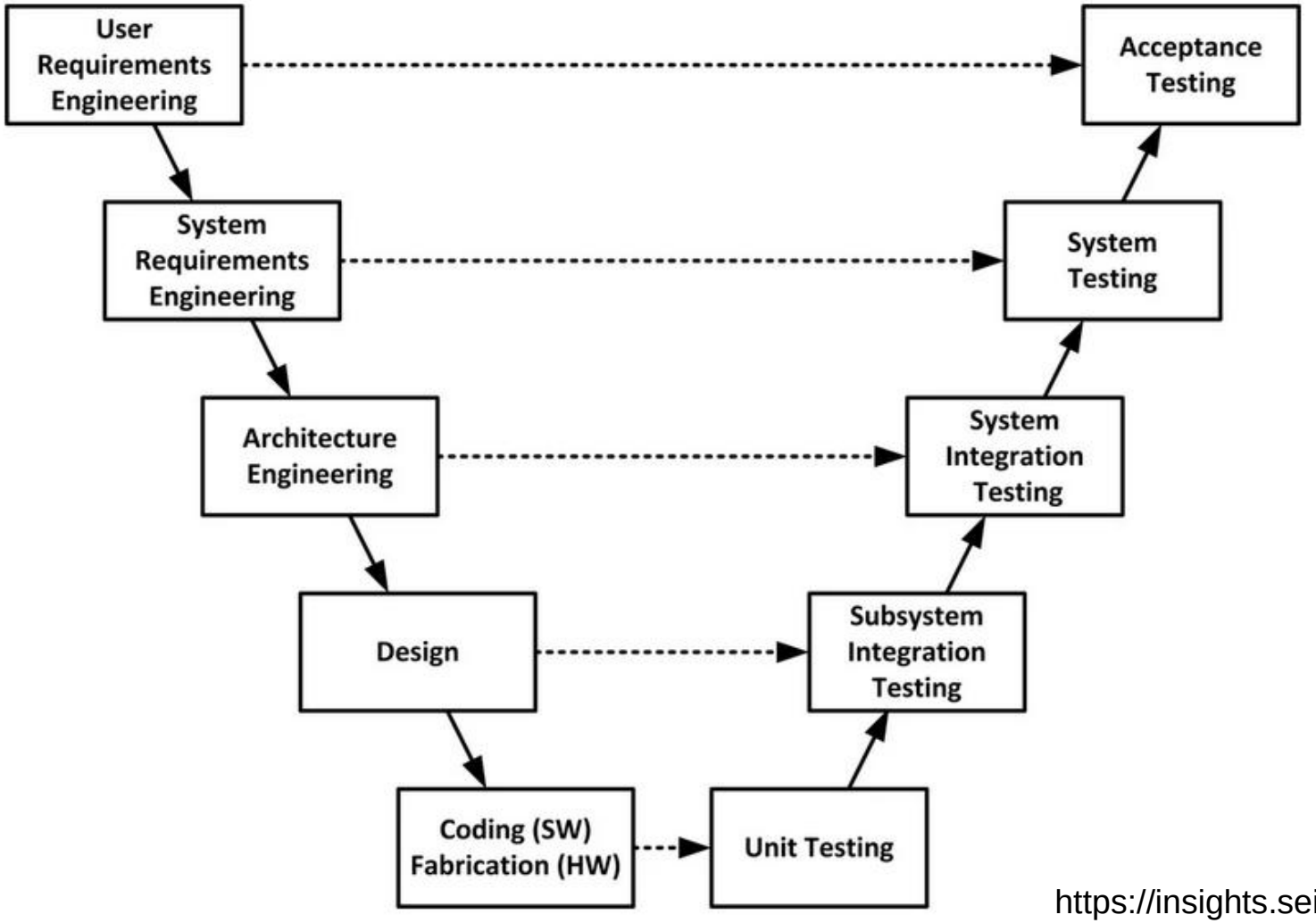


Verification at each stage before proceeding

Validation and acceptance testing at end

V & V often done by independent party for high risk projects

Verification and Validation: V-model of testing



https://insights.sei.cmu.edu/blog/using-v-models-for-testing/

Quality Methods

Agile Quality Methods

- On-site customer (correct misunderstandings at source)
- Pair-programming (double check work as it happens)
- Continuous integration (variation of V&V)
- Acceptance testing (early and often)

Difference for Agile to Waterfall

- Agile activities occur much earlier than in waterfall development
- Frequency of these activities is much greater than in waterfall
- Agile methods have fewer static quality assurance techniques

Enterprise Influences, Workplace Factors and Quality

- Organisational issues have a much greater influence on programmer productivity than technical environment or programming languages (DeMarco and Lister, 1985)
- Developer productivity varied by a factor of one to ten across organisations but only by 21% within the same organisation
- A dedicated workspace and quiet work environment are key factors in improving programmer productivity

A Few Final Words

- Quality means different things to different people
- Quality is not something you add later, it must be incorporated into the project and product from the start
- Continual incremental improvements can make a process more efficient, effective, stable mature and adaptable
- Capture and document lessons learned so that best practices can be identified and disseminated
- The customer is the ultimate judge of quality