Quality Management and Improvement

Chapter 2
Quality Management

2021/22

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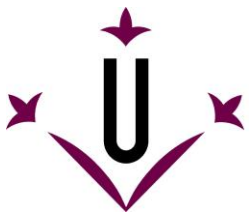

Universitat de Lleida
Departament d'Informàtica
i Enginyeria Industrial

Ch2. Quality Management

Contents

- Overview of software development processes
- When
- Quality Management
- Useful Tools

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- **Overview of software development processes**
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Overview of SW development processes

Definition

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Software development process:

- Set of related activities that leads to the production of a software product.
- There are many different software processes but all must include *four* fundamental activities:
  - *Software specification*.
  - *Software design and implementation.*
  - *Software validation.*
  - *Software evolution.*

Overview of SW development processes

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Software development process model:

- It is a *simplified* representation of a software process.
- Each process model represents a process from a particular perspective, and thus provides only partial information about the process.
- For example: to show activities and their sequence without roles of the people involved.

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Most SQA activities take place together with activities defined in software development process models.

THE WATERFALL DEVELOPMENT MODEL

- 1960's and 1970's
  - SW development projects were characterized by massive cost overruns and schedule delays; the focus was on planning and control. [Basili, 1991]

Basili, V.R., Musa, J.D. (1991): "The Future Engineering of Software: A Management Perspective". IEEE Computer, 1991, 90-96.

Boehm, B.W. (1976): "Software Engineering". IEEE Transactions on Computer, vol. C-25, December 1976, 1226-1241.

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  - *First step* -> Gathering and analysis of customers' requirements.
  - *Then*, the design and development work begins.
  - The model **assumes** that requirements are known, and once requirements are defined, they will not change or any change will be insignificant.

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  - *First step* -> Gathering and analysis of customers' requirements.
  - *Then*, the design and development work begins.
  - The model **assumes** that requirements are known, and once requirements are defined, they will not change or any change will be insignificant.
  - If requirements **change significantly** between the end of system's specifications and the completion of product's development … waterfall may not be the best model.

THE PROTOTYPING APPROACH

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Prototype:

- Partial implementation of the product expressed either logically or physically with all external interfaces presented.
- To be used by potential customers.
- To provide feedback to the development team.

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Seeing is believing -> That is what prototyping intends to achieve.

- By using this approach, the *customers* and *development team* are able to clarify requirements and their interpretation.

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Rapid Throwaway Prototyping

-> High-risk items

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Rapid Throwaway Prototyping

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Evolutionary Prototyping

-> The prototype is built based on some known requirements and understanding.

-> The prototype is then refine and evolved instead of thrown away.

Overview of SW development processes

THE SPIRAL MODEL

- By Boehm [Boehm, 1988]

Boehm, B.W. (1988): “A Spiral Model of Software Development and Enhancement”. IEEE Computer, May 1988, 61-72.

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THE SPIRAL MODEL

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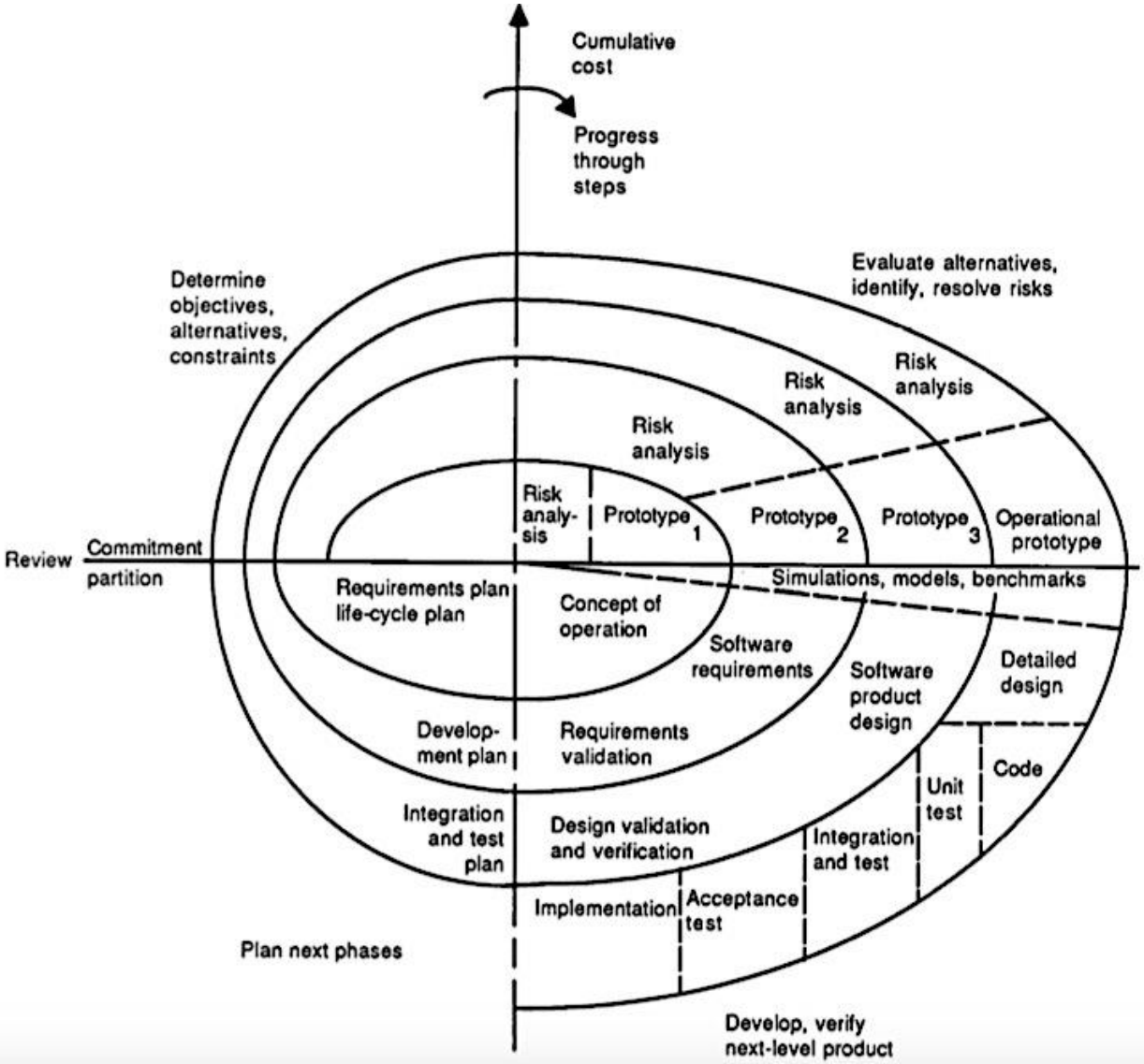
- Based on experience with various refinements of the waterfall model.
- **Essential:** each portion of the product and each level of elaboration *involves the same sequence of steps (cycle)*.
- Starting at the centre of the **spiral**, one can see that each development phase (concept of operation, software requirements, product design and implementation) involves one cycle of spiral.

Overview of SW development processes

THE SPIRAL MODEL



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- Branson and Herness proposed an OO development process that centres on an eight-step methodology. [Branson, 1992]

Branson, M.J., Herness, E.N. (1992): Process for Building Object-Oriented Systems from Essential and Constrained System Models: Overview". Proceedings of the Fourth Worldwide MDQ Productivity and Process Tools Symposium, Volume 1 of 2, Thornwood, N.Y.: International Business Machines Corp., March 1992, 577-598.

Overview of SW development processes

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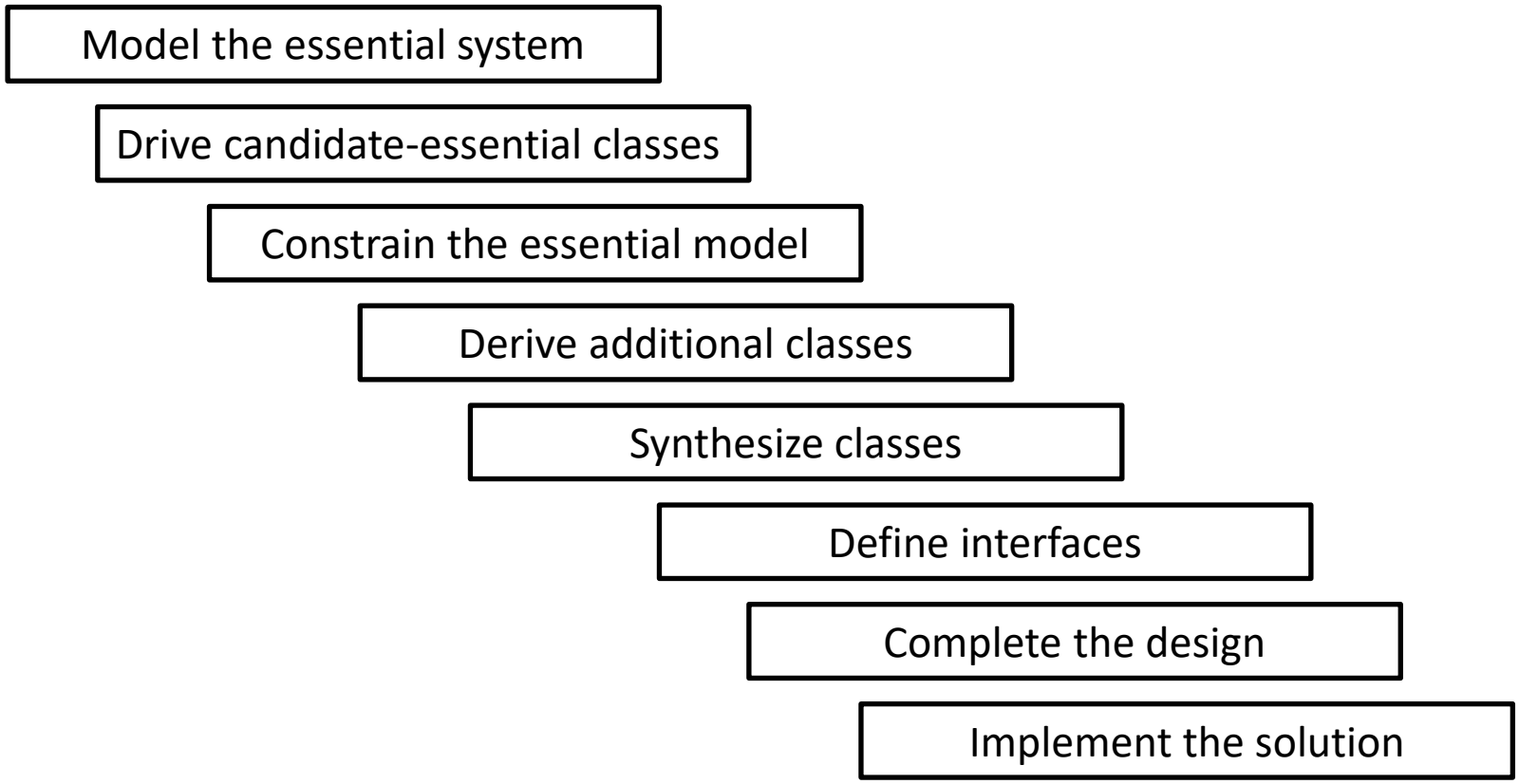

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- Rapid software developments processes are designed to **produce useful software quickly**.
- Agile methods are **incremental** development methods in which the increments are small and typically, new releases of the system are created and made available to customers.
  - *Customers are involved* in the development process to get rapid feedback on changing requirements.

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"We are uncovering better ways of developing software by doing it and helping others to do it. Through this work we have come to value:

- ***Individuals and interactions*** *over processes and tools.*
- ***Working software*** *over comprehensive documentation.*
- ***Customer collaboration*** *over contract negotiation.*
- ***Responding to change*** *over following a plan.*

That is, while there is value in the items on the right, we value the items on the left more."

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AGILE SOFTWARE DEVELOPMENT

- Customer Satisfaction
- Adaptation
- Frequent Deliveries
- Team Work
- Motivation
- Face to Face Communication

https://agilemanifesto.org/principles.html

Overview of SW development processes

AGILE SOFTWARE DEVELOPMENT

- Functional Prototypes
- Constant Work
- Technical Excellence
- Simplicity
- Self-Management
- Quality and Improvement

https://agilemanifesto.org/principles.html

Extreme programming (XP)

- Requirements are expressed as scenarios (stories) implemented directly as a series of tasks.
- Programmers work in pairs.
  - Develop tests for each task before writing the code.
  - All test must be successfully executed when new code is integrated into the system.
- There is a short time gap between releases of the system.
- Customers are intimately involved in specifying and prioritizing system requirements.

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https://www.agilealliance.org/glossary/xp/

http://www.extremeprogramming.org/

SCRUM

http://www.scrumguides.org/

SCRUM

- Framework for developing and sustaining complex products.
- A framework within which people can address complex adaptive problems, while productively and creatively delivering products of the highest possible value.
- The Scrum framework consists of Scrum Teams and their associated roles, events, artefacts, and rules.
- Scrum employs an iterative, incremental approach to optimize predictability and control risk.

http://www.scrumguides.org/

SCRUM

- The heart of Scrum is a Sprint, a time-box of one month or less during which a "Done", useable, and potentially releasable product Increment is created.
- Sprints best have consistent durations throughout a development effort.
- A new Sprint starts immediately after the conclusion of the previous Sprint.
- A Sprint Review is held at the end of the Sprint to inspect the increment and adapt the Product Backlog if needed. During the Sprint Review, the Scrum Team and stakeholders collaborate about what was done in the Sprint.

http://www.scrumguides.org/

SCRUM

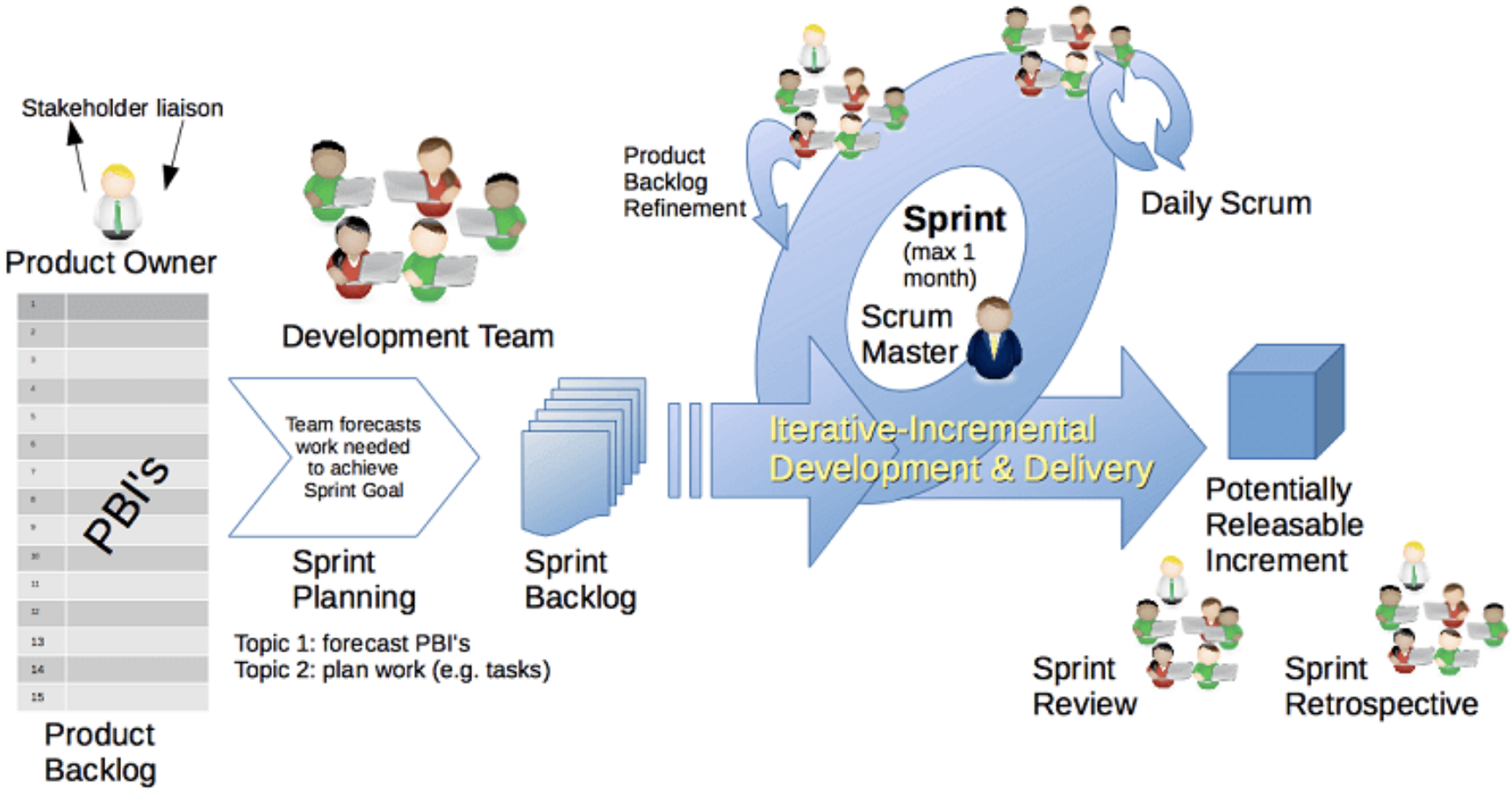
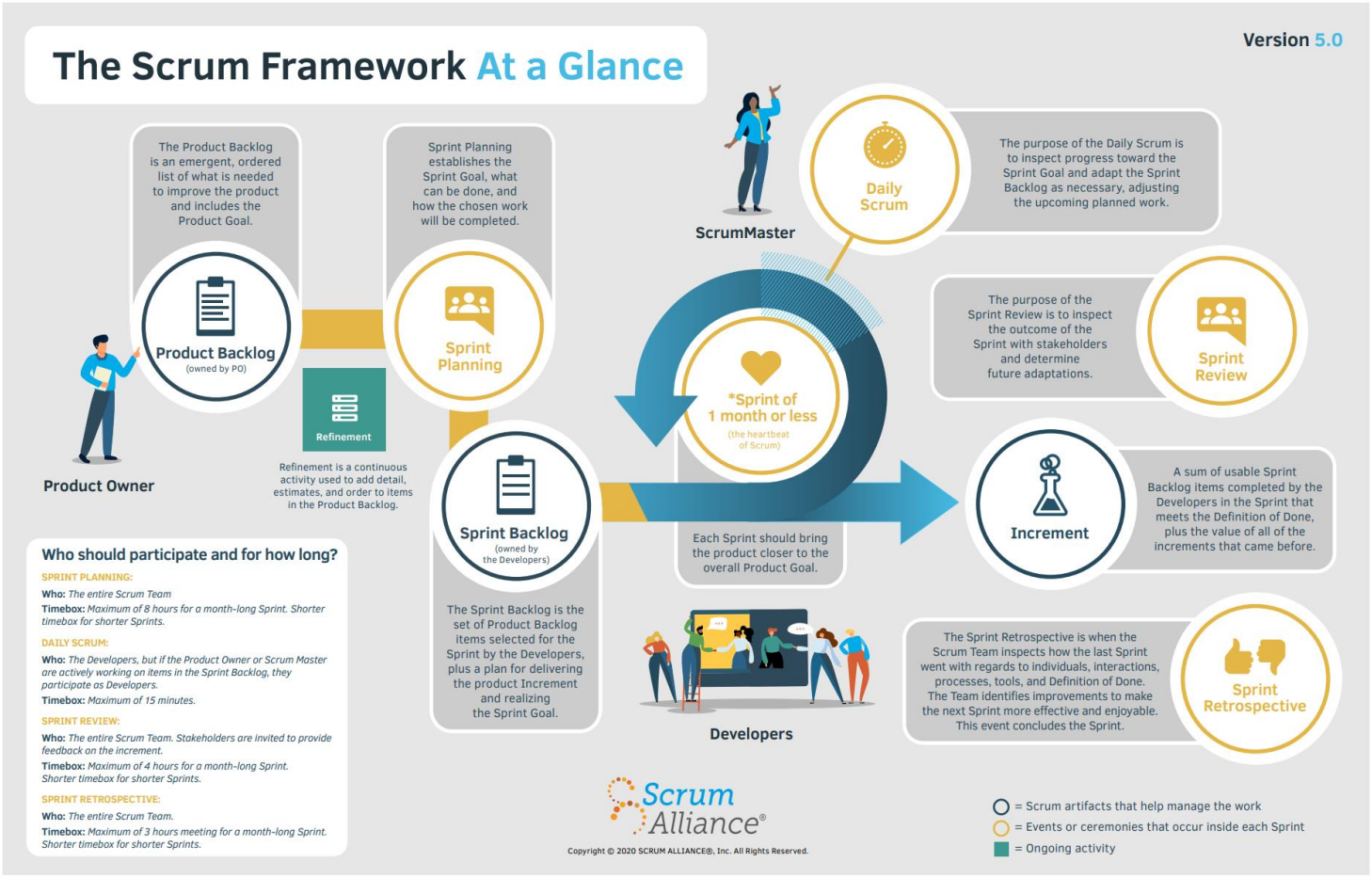


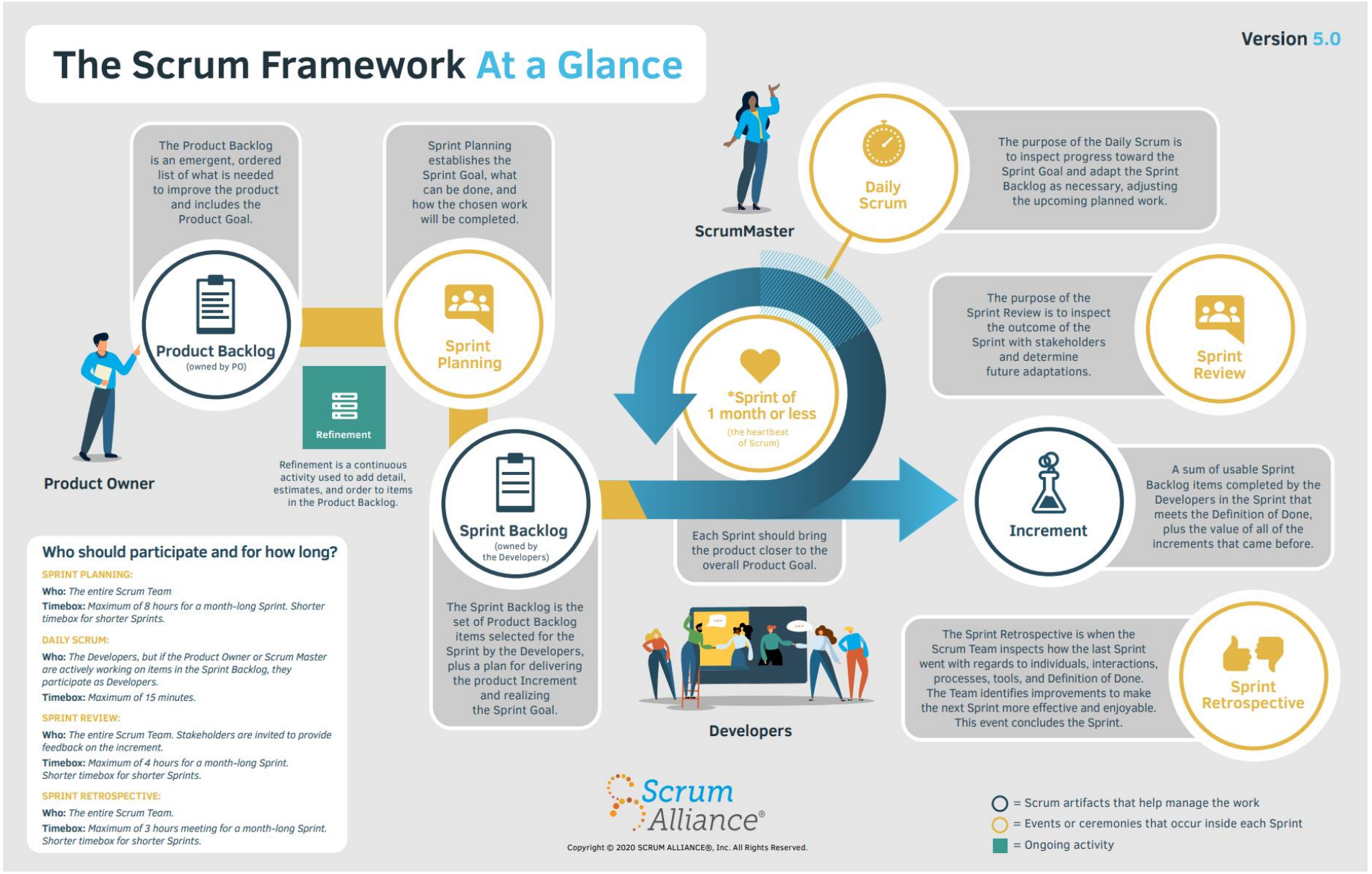
Image via Wikimedia Commons

SCRUM

– Not clear? https://www.scrumalliance.org/about-scrum/overview



Overview of SW development processes



Contents

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- **When**
- Quality Management
- Useful Tools

When

- When? -> Software Quality Assurance

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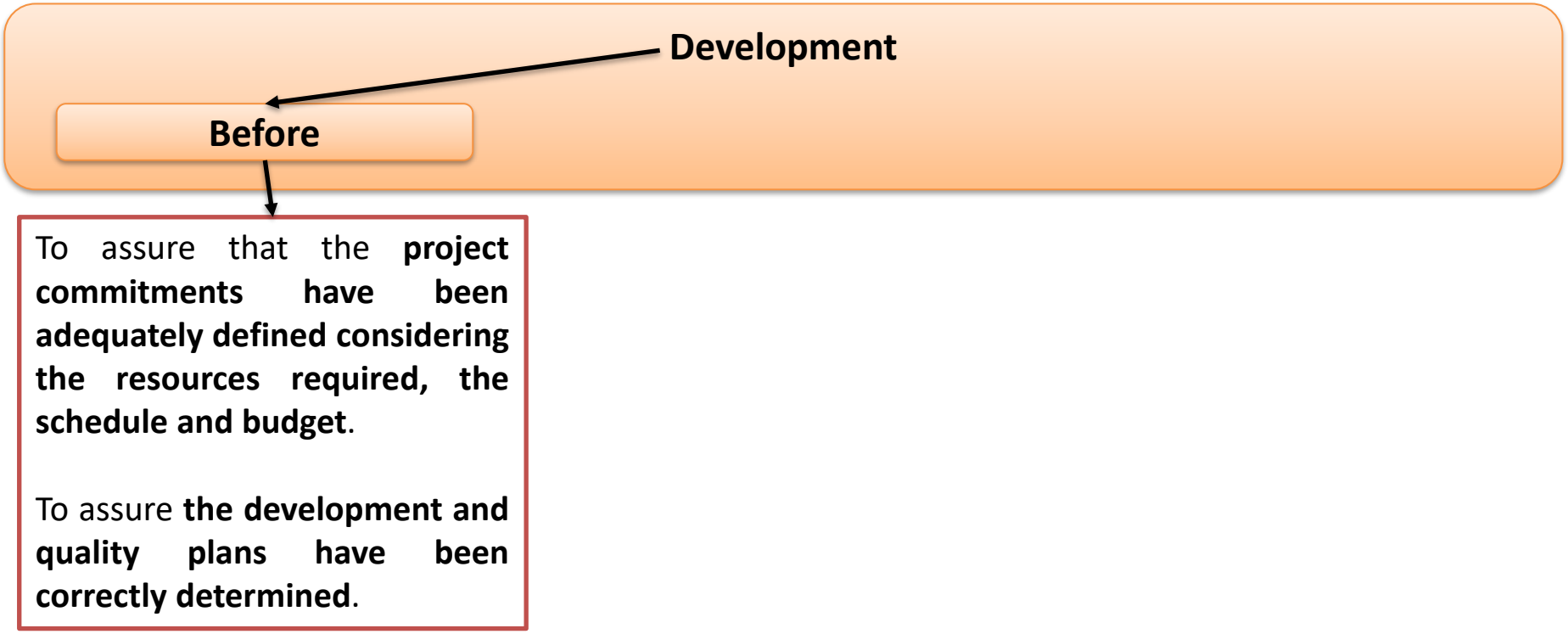

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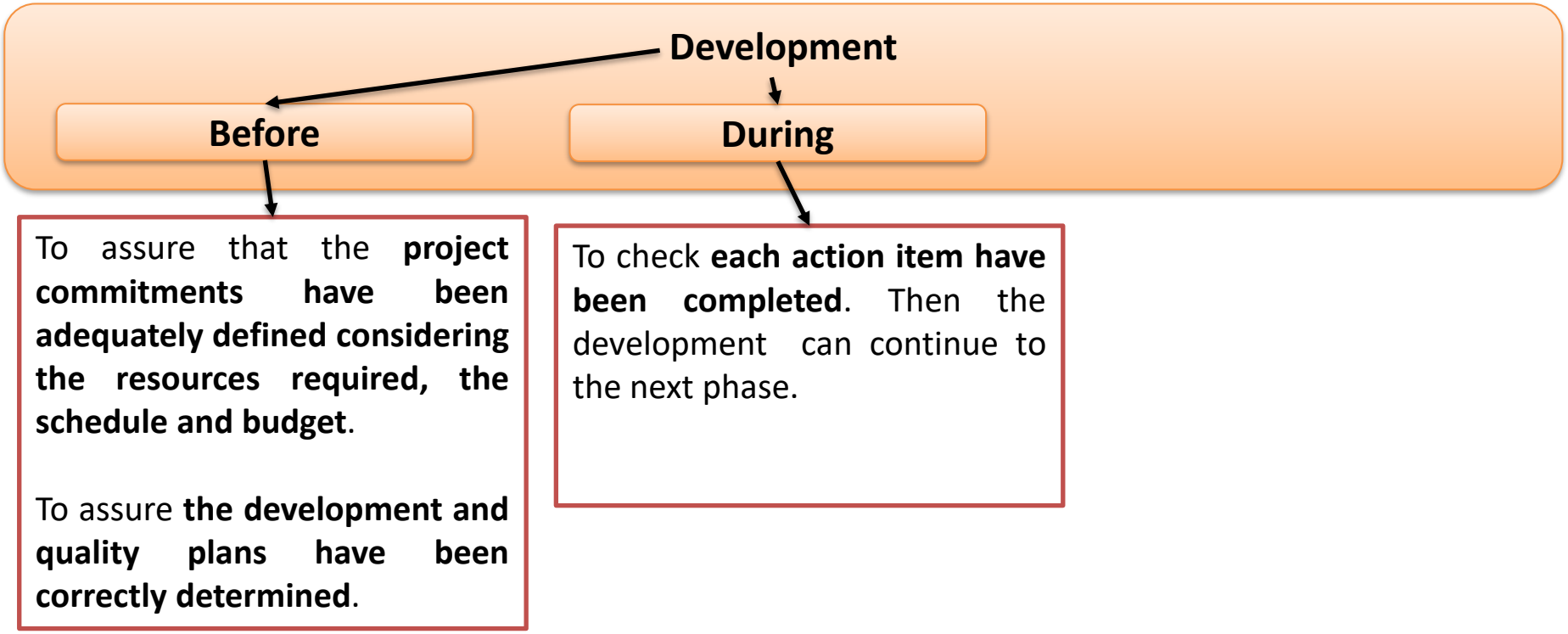

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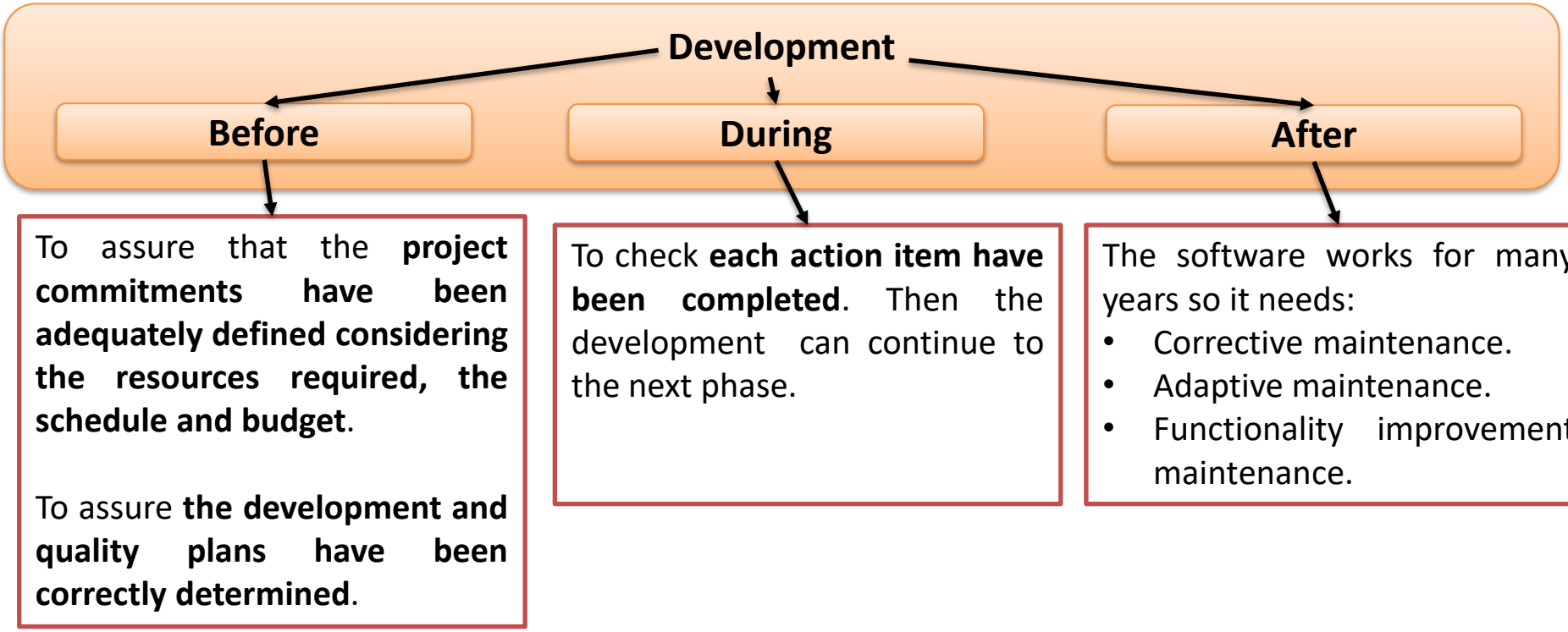

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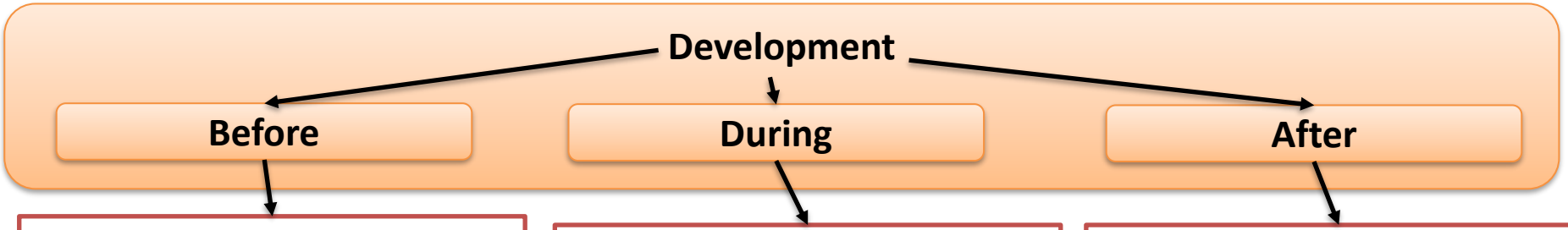

To assure that the **project commitments have been adequately defined considering the resources required, the schedule and budget**.

To check **each action item have been completed**. Then the development can continue to the next phase.

The software works for many years so it needs:

- Corrective maintenance.
- Adaptive maintenance.
- Functionality improvement maintenance.

Lehman, M.M. (1996): "Laws of Software Evolution Revisited". Proc. European Workshop on Software Process Technology (EWSPT'96). Springer-Verlag, 108-24.

Lehman, M.M., Perry, D.E., Ramil, J.F. (1998): "On Evidence Supporting the FEAST Hypothesis and the Laws of Software Evolution". Proc. Metrics'98, Bethesda. Maryland: IEEE Computer Society Press, 84-8.

Lehman, M.M., Ramil, J., Sandler, U. (2001): "An Approach to Modelling Long-term Growth Trends in Software Systems". Proc. Int. Conf. on Software Maintenance, Florence, Italy, 219-28.

A LEHMAN'S LAW ***Continuing change***: a program that is used in a real-world environment must necessarily change, or else become progressively less useful in that environment.

Ch2. Quality Management

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Quality Management

- A **project** is a temporary effort that is carried out to create a product, service or unique result.

PMI. (2013): *Guía de los Fundamentos de la Dirección de Proyectos: Guía del PMBOK (Project Management Body of Knowledgde).* 5th edition, Project Management Institute.

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The application of knowledge, skills, tools and techniques to project activities for meeting project requirements.

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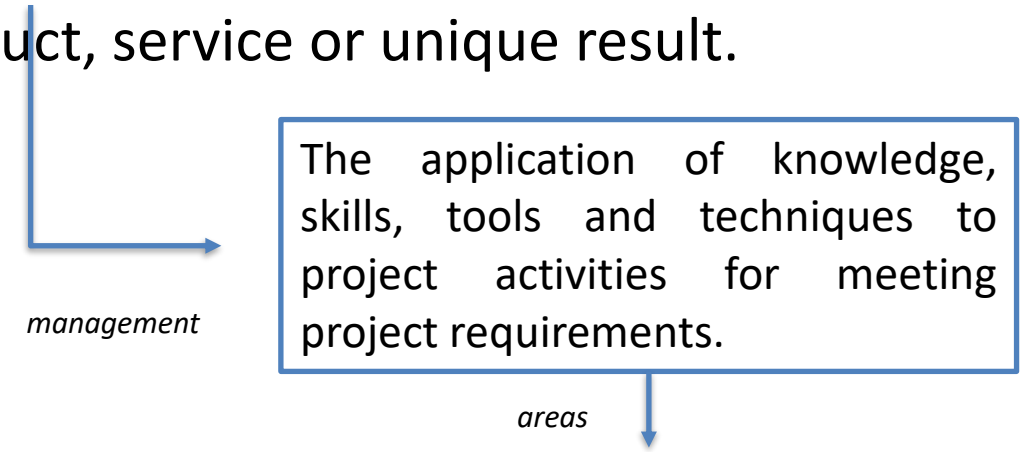

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areas

Integration	Scope	Time
Costs	**Quality**	Human resources
Communications	Risks	Acquisitions
	Stakeholders	

It determines the policies, objectives and responsibilities related to quality so that the project meets quality needs.

PMI. (2013): *Guía de los Fundamentos de la Dirección de Proyectos: Guía del PMBOK (Project Management Body of Knowledgde).* 5th edition, Project Management Institute.

Quality Management

Processes

Quality Management

TO PLAN QUALITY MANAGEMENT

Inputs
- Project management plan
- Stakeholders
- Risks
- Requirements document
- Environmental factors (company)
- Assets of the organizational processes

Tools and Techniques
- Cost-benefit analysis
- Quality cost
- 7 basic tools (quality)
- Benchmarking
- Design of experiments
- Statistical sampling
- Additional tool for planning
- Meetings

Outputs
- Quality plan
- Plan for improving processes
- Quality metrics
- Quality checklists
- Updates on project documents

TO CONDUCT QUALITY ASSURANCE

Inputs
- Quality plan
- Plan for improving processes
- Quality metrics
- Quality control measurements
- Project documents

Tools and Techniques
- Tools for quality management and control
- Quality audits
- Process analysis

Outputs
- Requests for changes
- Updates on the project management plan
- Updates on project documents
- Updates on assets of the organizational processes

CONTROL QUALITY

Inputs
- Project management plan
- Quality metrics
- Quality checklists
- Performance data of the work
- Approved requests for change
- Deliverable
- Project documents
- Assets of the organizational processes

Tools and Techniques
- 7 basic tools (quality)
- Statistical sampling
- Review of the approved requests for change

Outputs
- Quality control measurements
- Validated changes
- Validated deliverables
- Information about performance
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Objective –> to identify quality requirements and the deliverables to confirm the compliance with them.

When? -> At the same time the others planning processes of the project are done.

To Plan Quality Management

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Scope, description, main deliverables …

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- Quality plan
- Plan for improving processes
- Quality metrics
- Quality checklists
- Updates on project documents

Scope, description, main deliverables …

The people who are interested in or influenced the quality.

To Plan Quality Management

TO PLAN QUALITY MANAGEMENT

Inputs
- Project management plan
- Stakeholders
- Risks
- Requirements document
- Environmental factors (company)
- Assets of the organizational processes

Tools and Techniques
- Cost-benefit analysis
- Quality cost
- 7 basic tools (quality)
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Scope, description, main deliverables …

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Threats and opportunities that can impact the quality.

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Factors to be considered … can affect project quality.
Government regulations, laws, rules, standards that are specific for the application area, working conditions …

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Policies, procedures, guidelines of the company, historical database or lessons learned (previous projects).

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Quality Management

To Plan Quality Management

Cost vs benefits

TO PLAN QUALITY MANAGEMENT

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Quality Management

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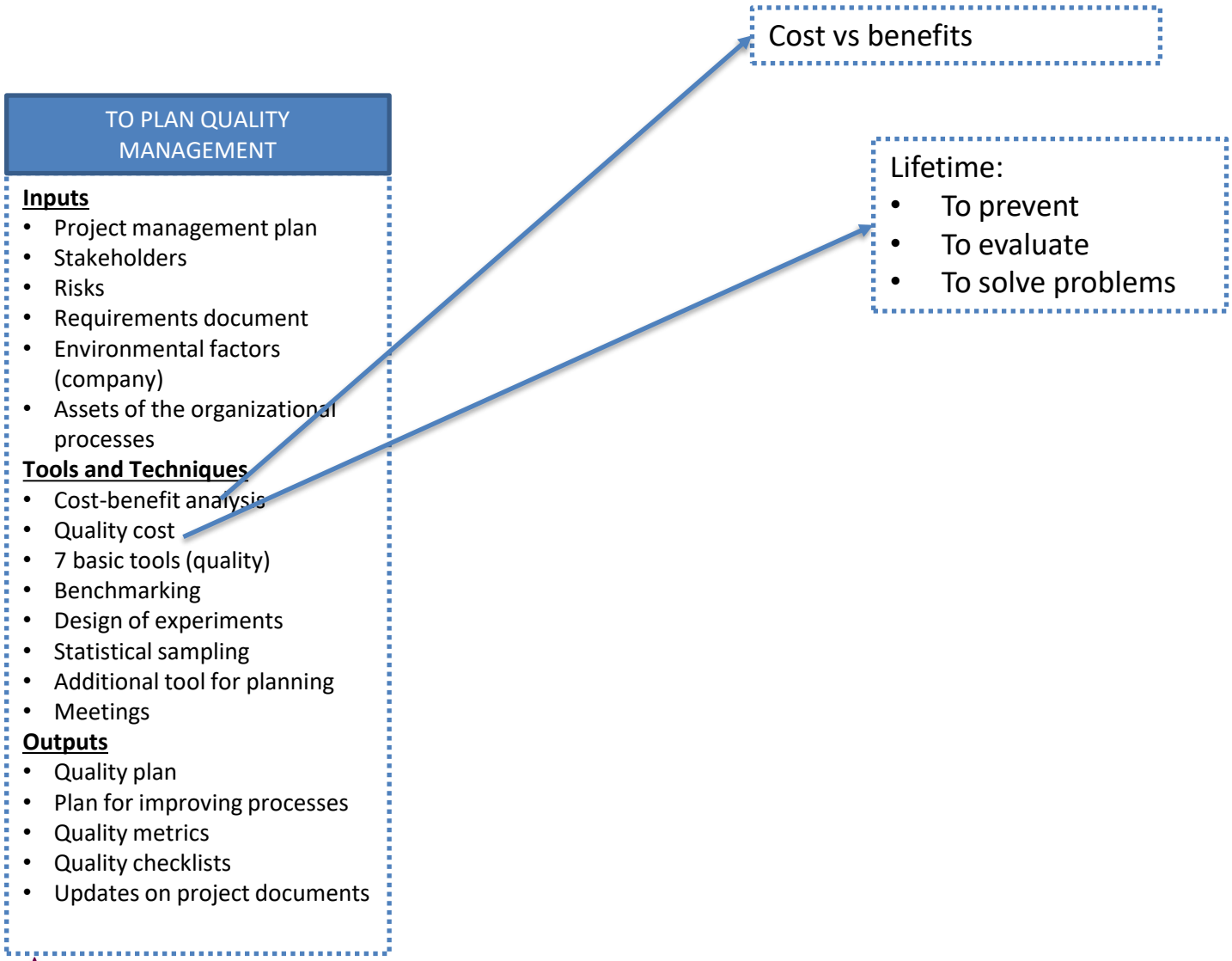

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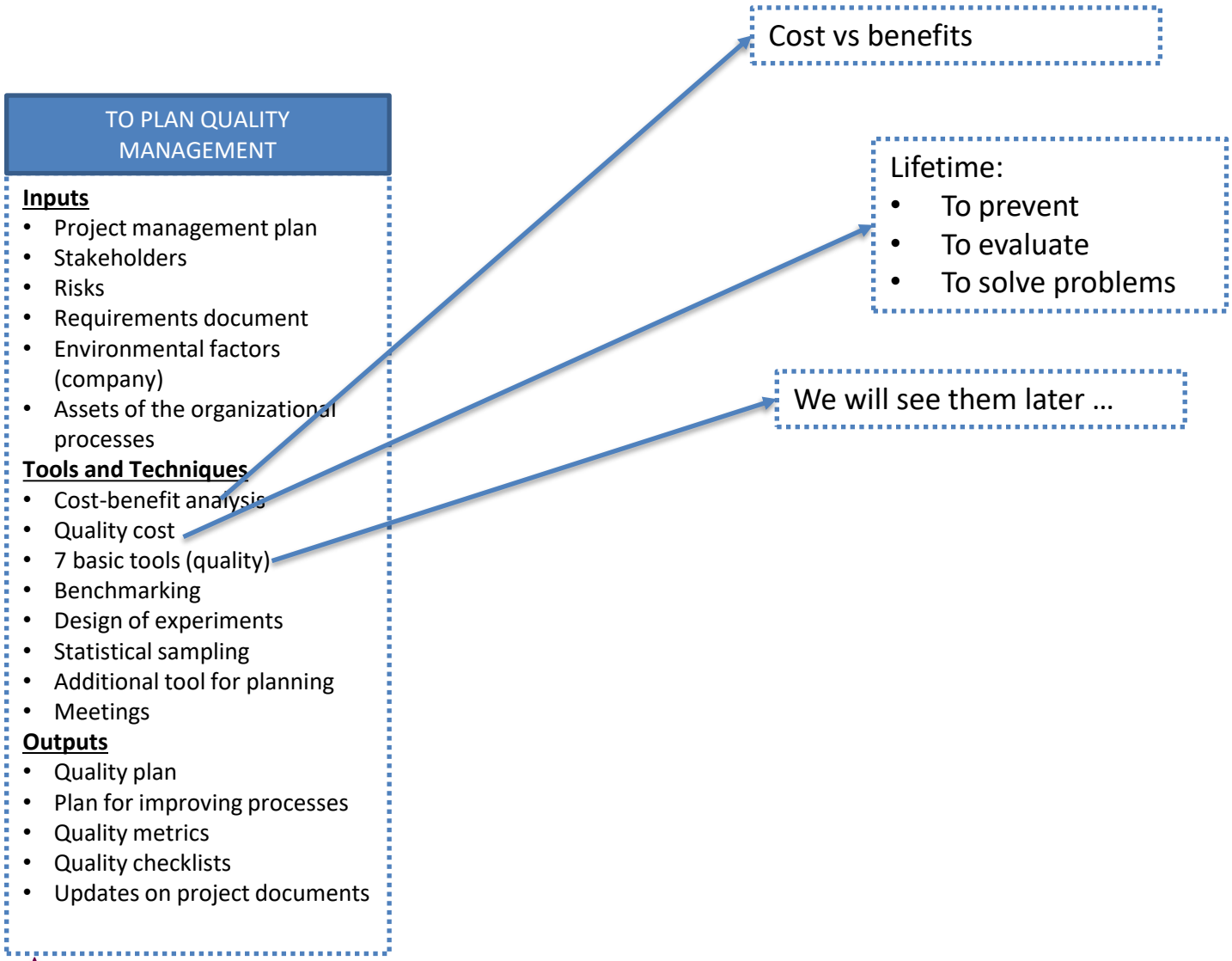

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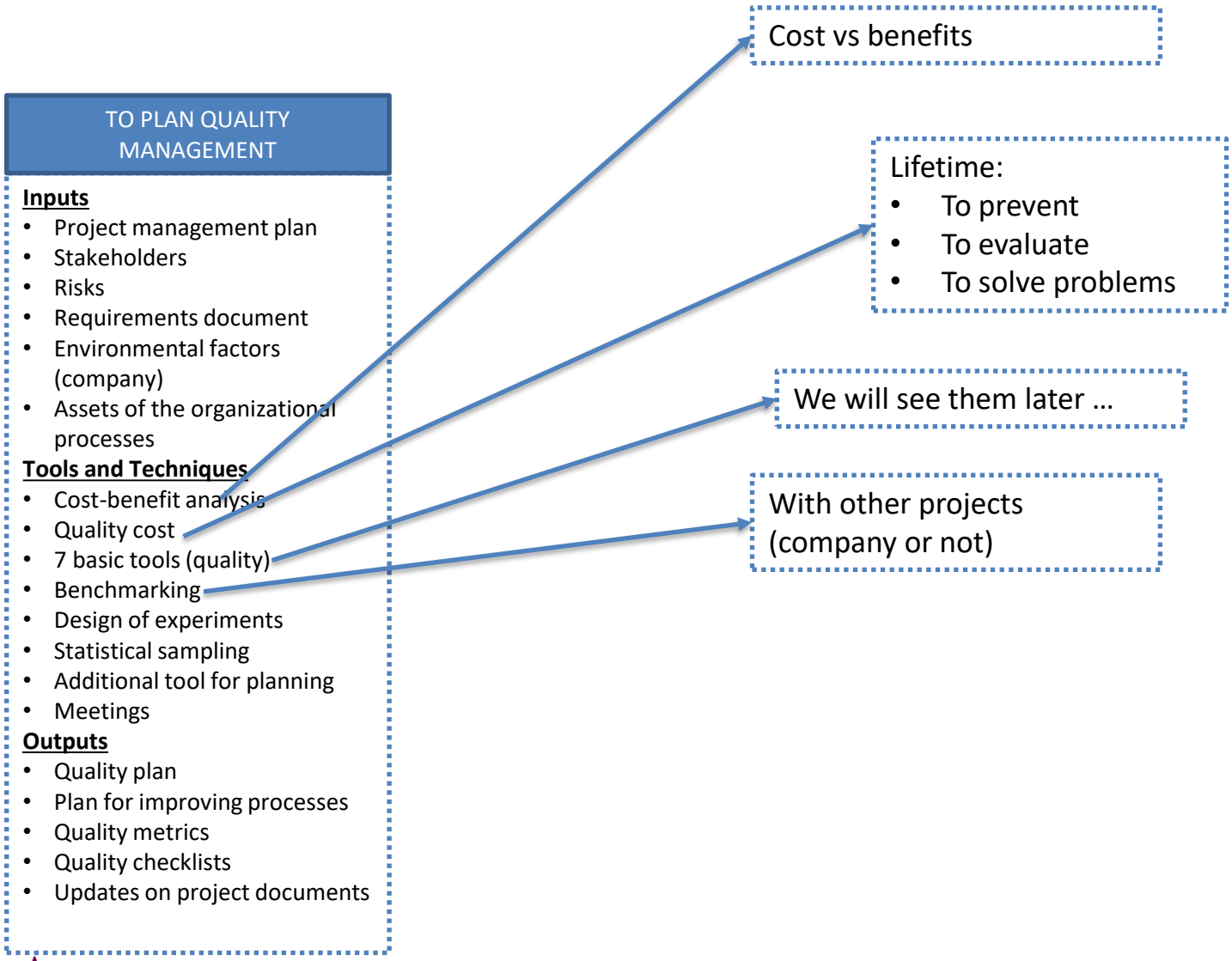

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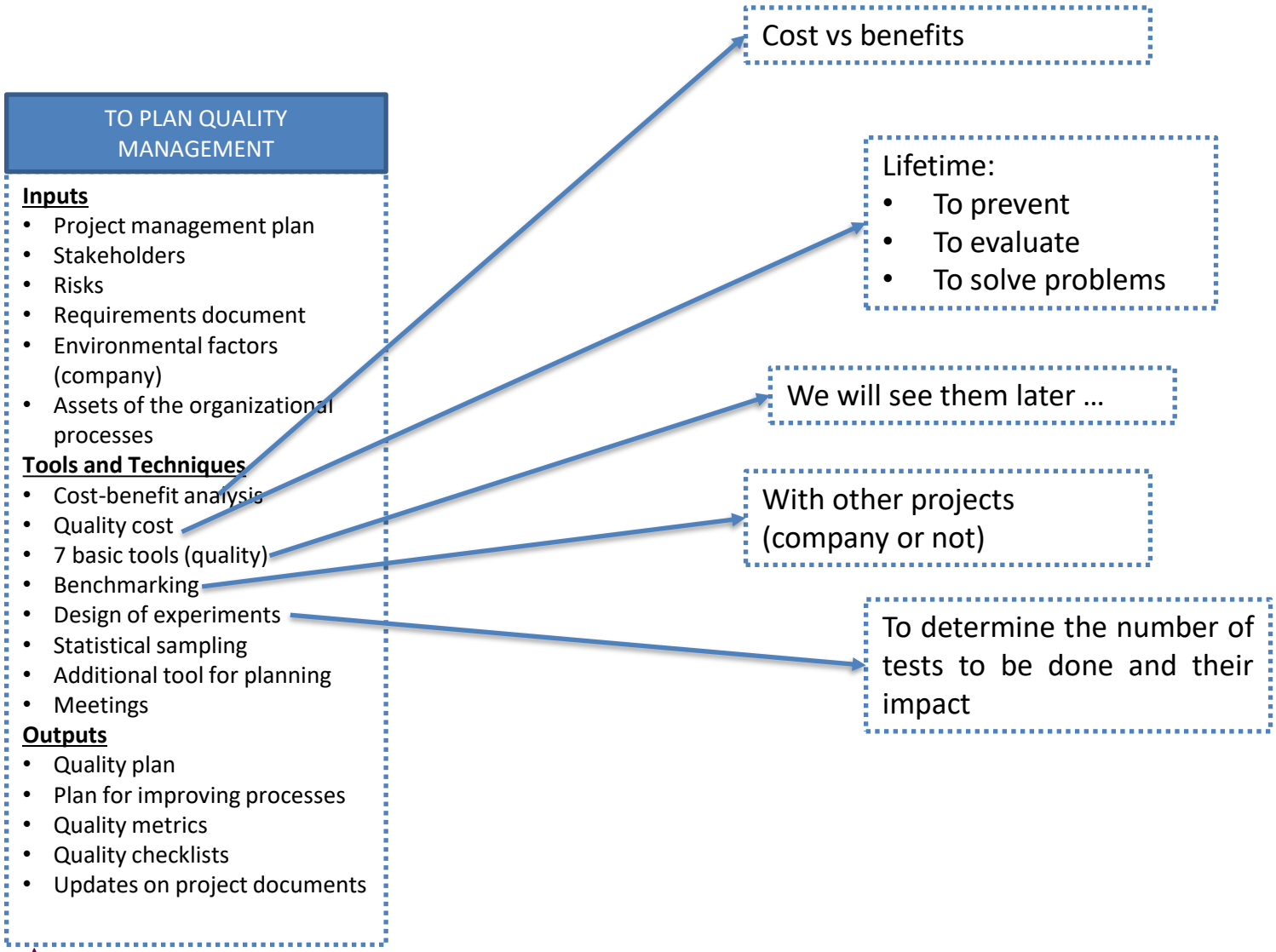

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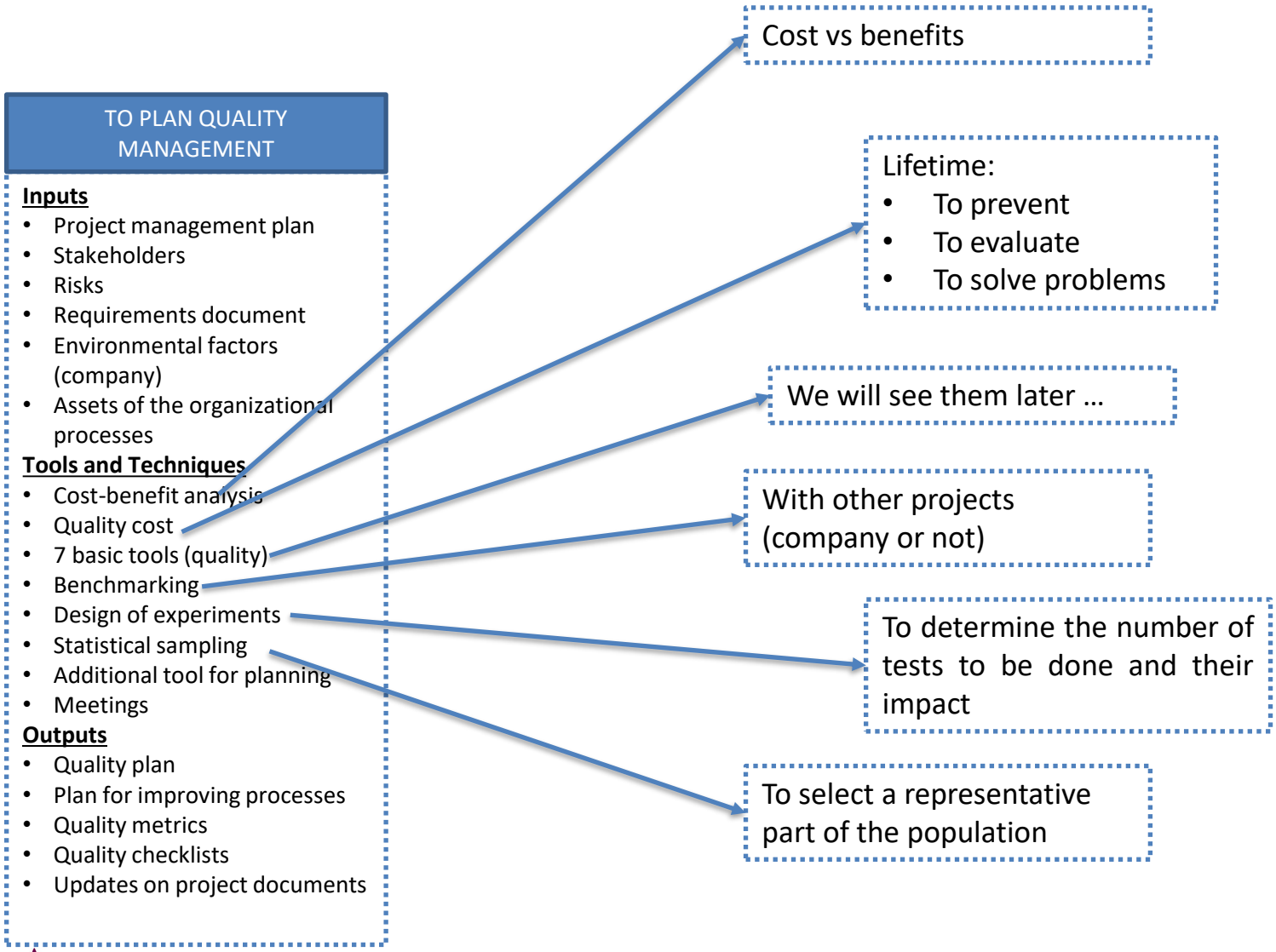

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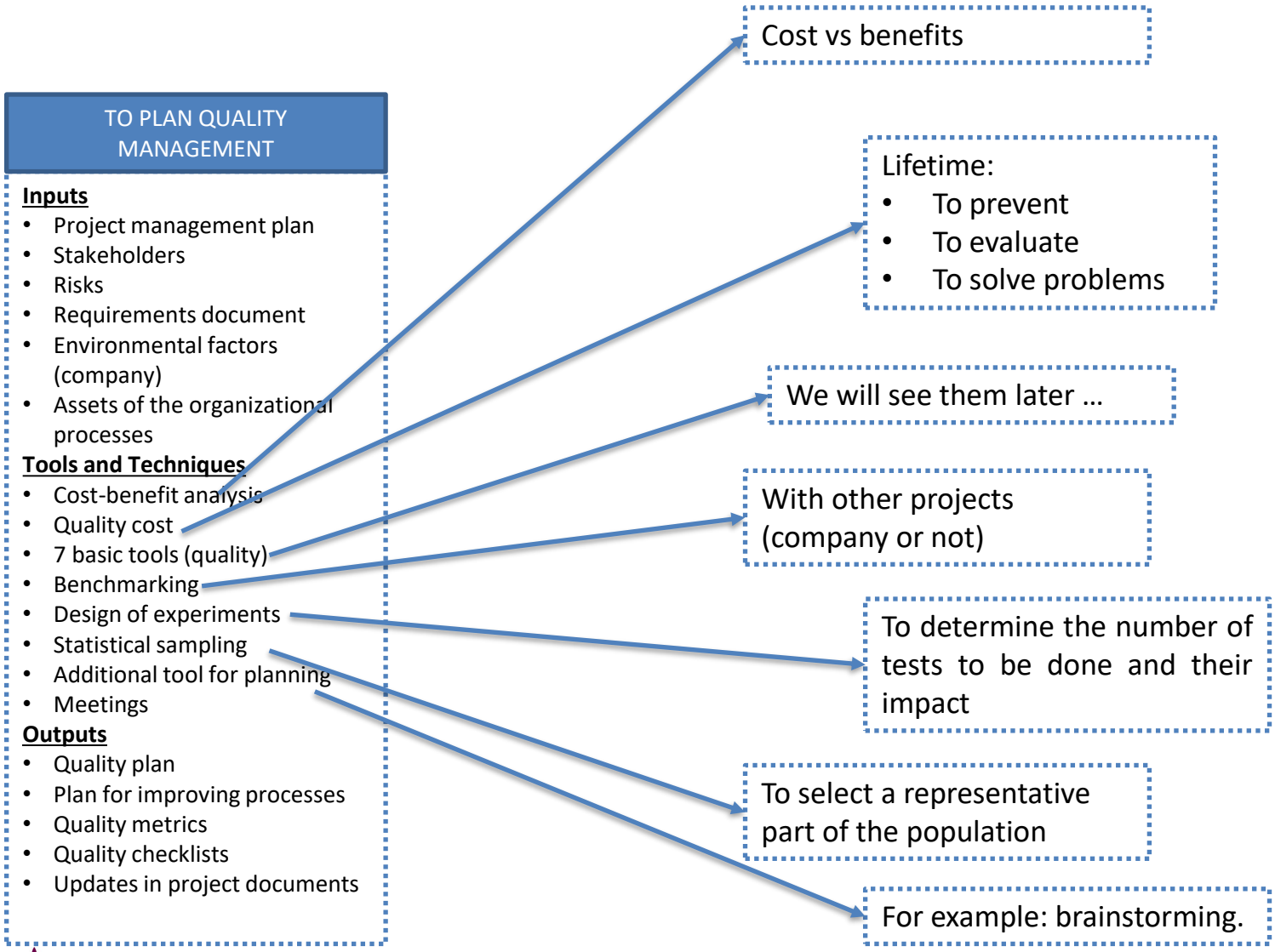

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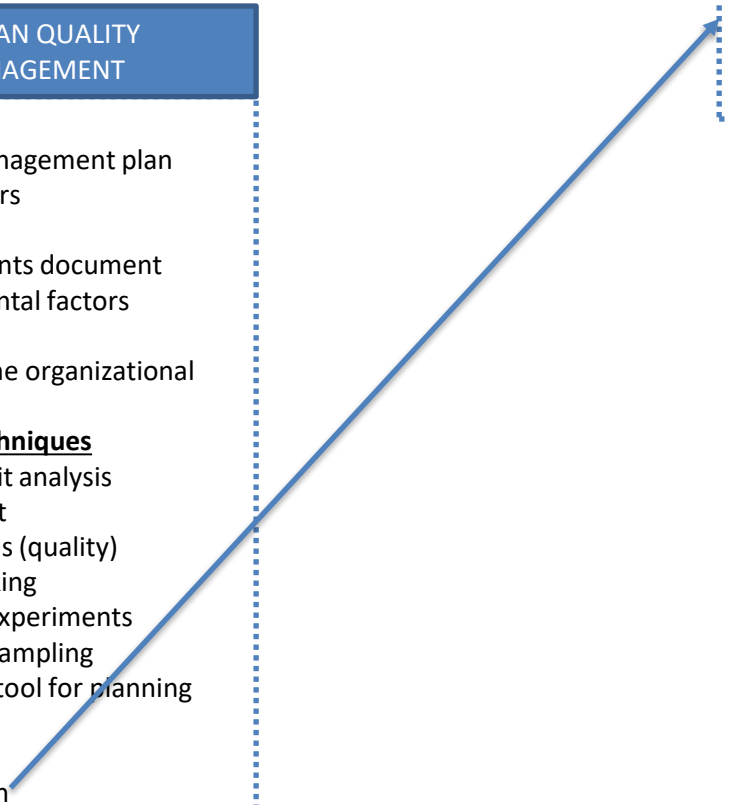

It describes how the project management team will implement the quality policy.

Quality Management

To Plan Quality Management

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It describes how the project management team will implement the quality policy.

It describes how to analyse the processes to facilitate the identification of activities that will improve those processes.

Quality Management

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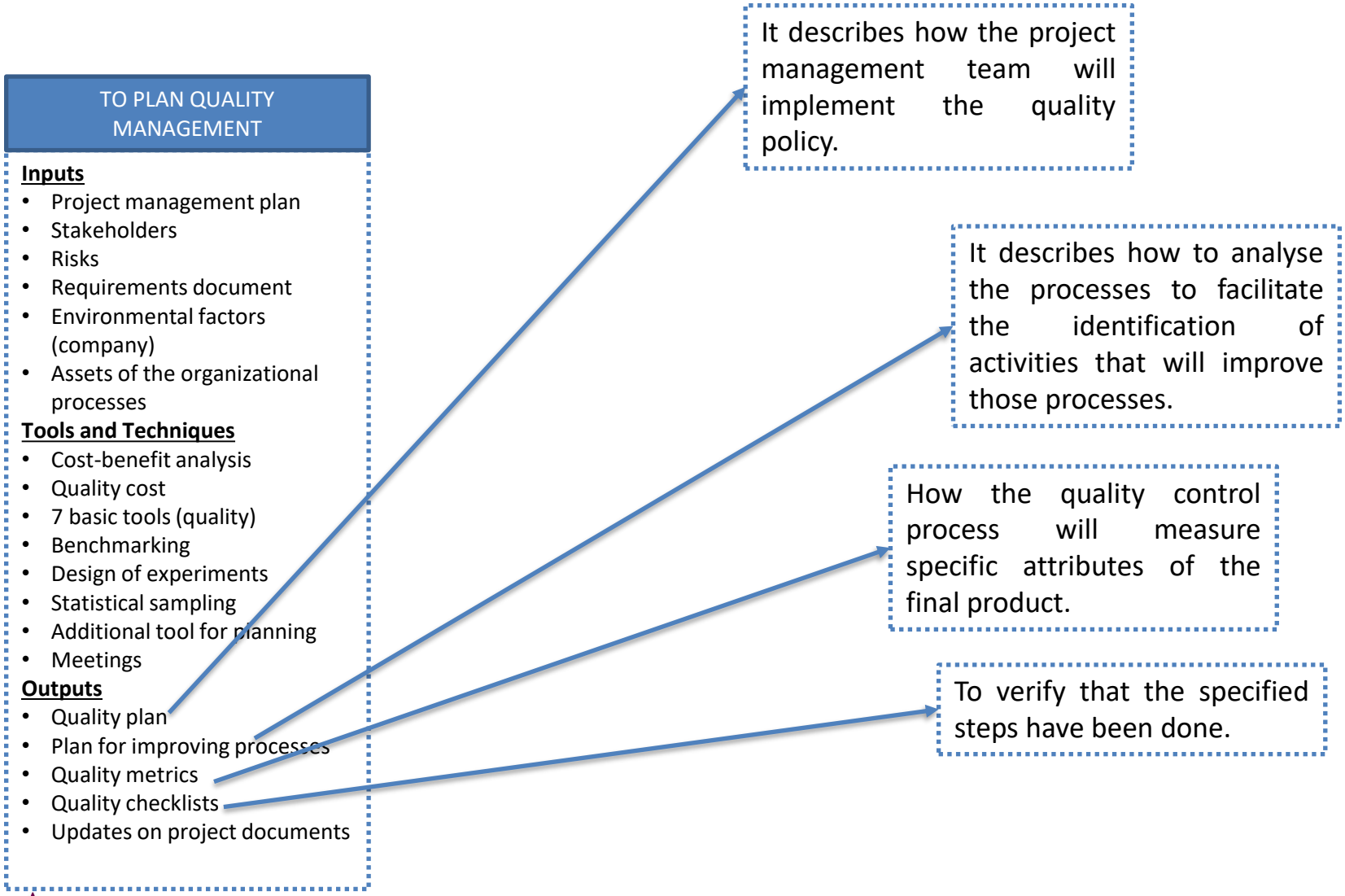
It describes how the project management team will implement the quality policy.

It describes how to analyse the processes to facilitate the identification of activities that will improve those processes.

How the quality control process will measure specific attributes of the final product.

Quality Management

To Plan Quality Management



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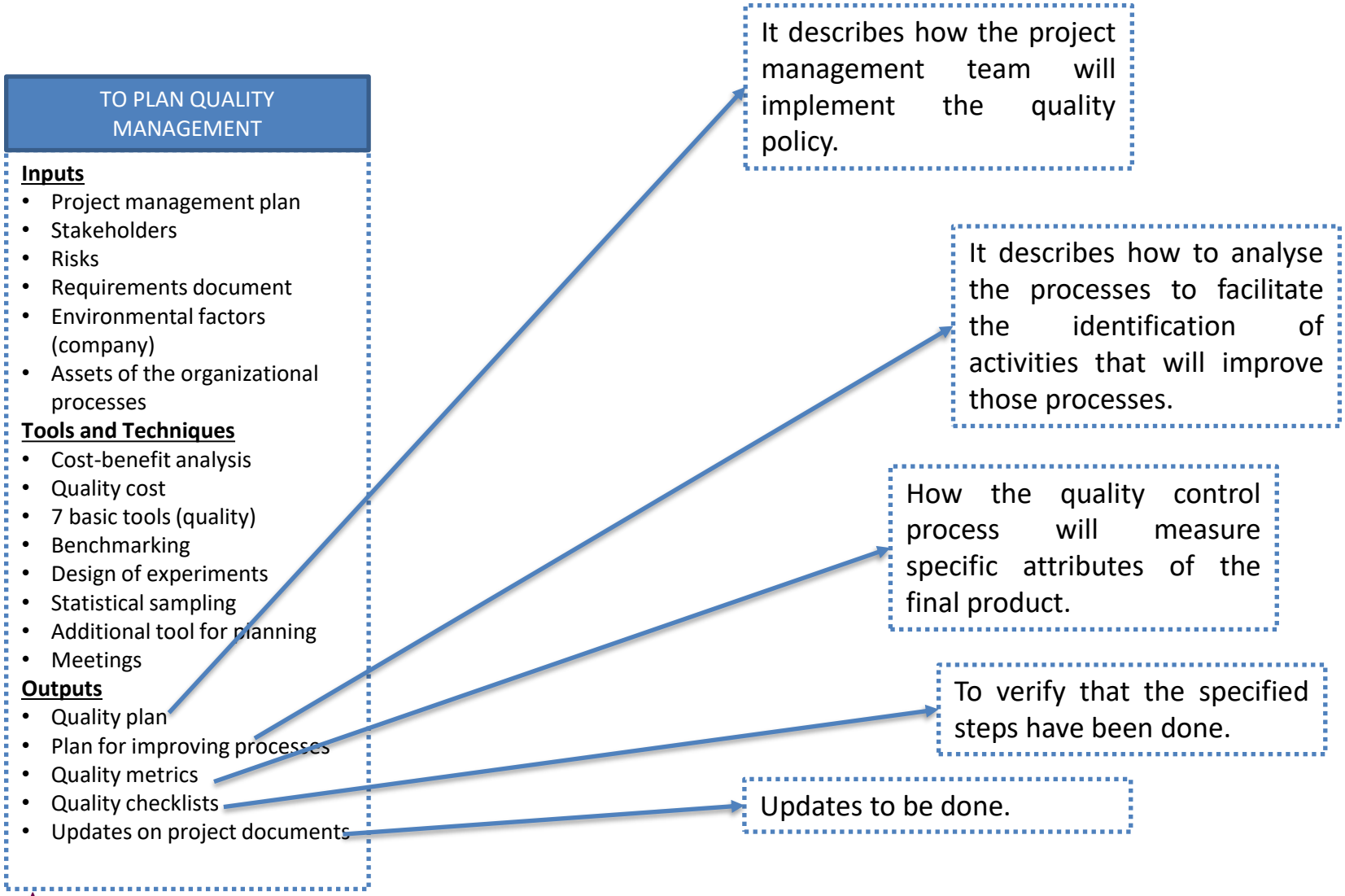

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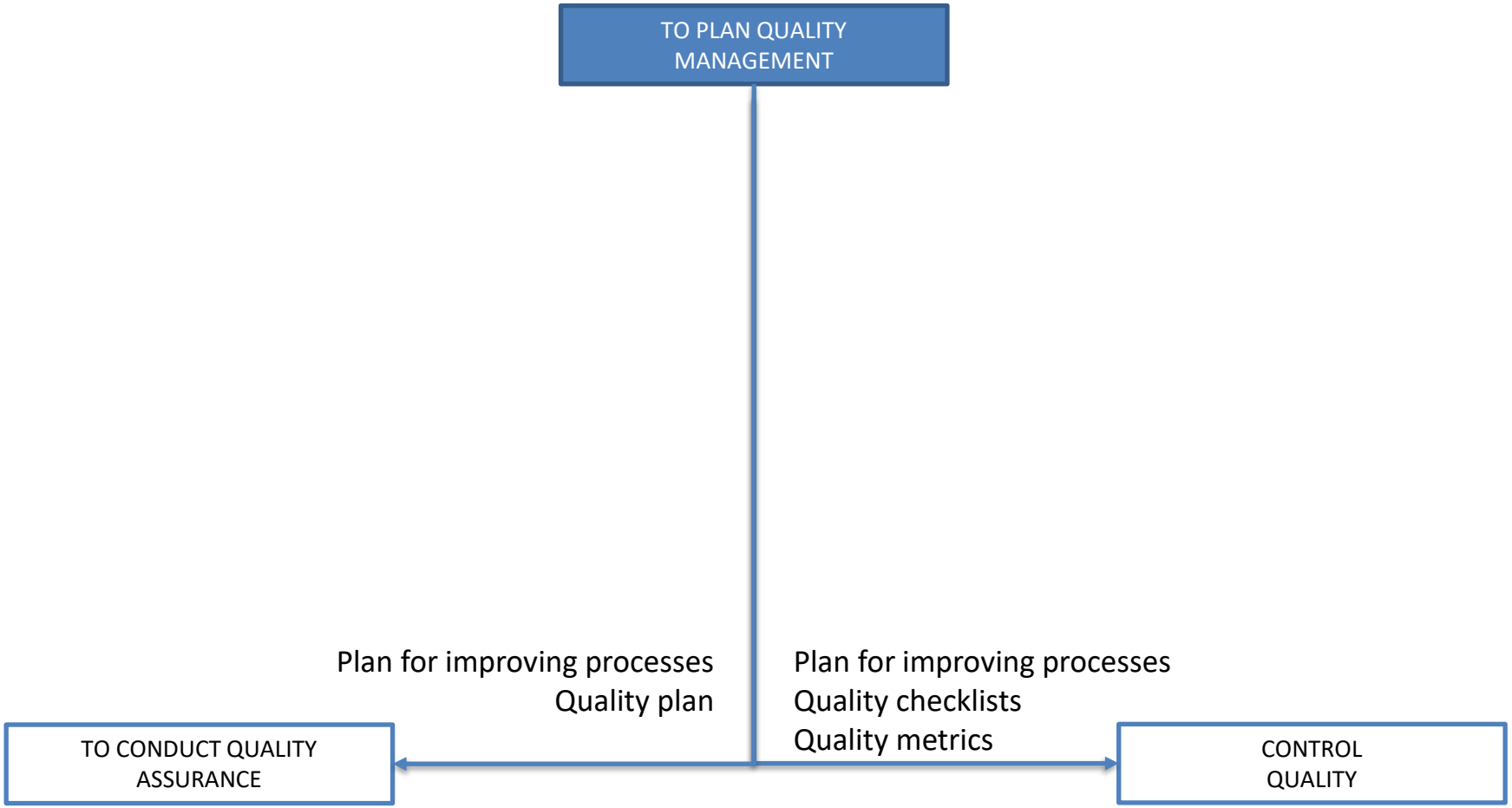

Quality Management

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TO CONDUCT QUALITY ASSURANCE

Inputs
- Quality plan
- Plan for improving processes
- Quality metrics
- Quality control measurements
- Project documents

Tools and Techniques
- Tools for quality management and control
- Quality audits
- Process analysis

Outputs
- Requests for changes
- Updates on the project management plan
- Updates on project documents
- Updates on assets of the organizational processes

CONTROL QUALITY

Inputs
- Project management plan
- Quality metrics
- Quality checklists
- Performance data of the work
- Approved requests for change
- Deliverable
- Project documents
- Assets of the organizational processes

Tools and Techniques
- 7 basic tools (quality)
- Statistical sampling
- Review of the approved requests for change

Outputs
- Quality control measurements
- Validated changes
- Validated deliverables
- Information about performance
- Requests for changes
- Updates on the project management plan
- Updates on project documents
- Updates on assets of the organizational processes

Quality Management

To Conduct Quality Assurance

TO CONDUCT QUALITY ASSURANCE

Inputs

- Quality plan
- Plan for improving processes
- Quality metrics
- Quality control measurements
- Project documents

Tools and Techniques

- Tools for quality management and control
- Quality audits
- Process analysis

Outputs

- Requests for changes
- Updates on the project management plan
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To Conduct Quality Assurance

Objective –> to audit the requirements of quality and the results obtained from quality control measurements. **Why?** To ensure the quality (standards and definitions).

TO CONDUCT QUALITY ASSURANCE

Inputs
- Quality plan
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Outputs
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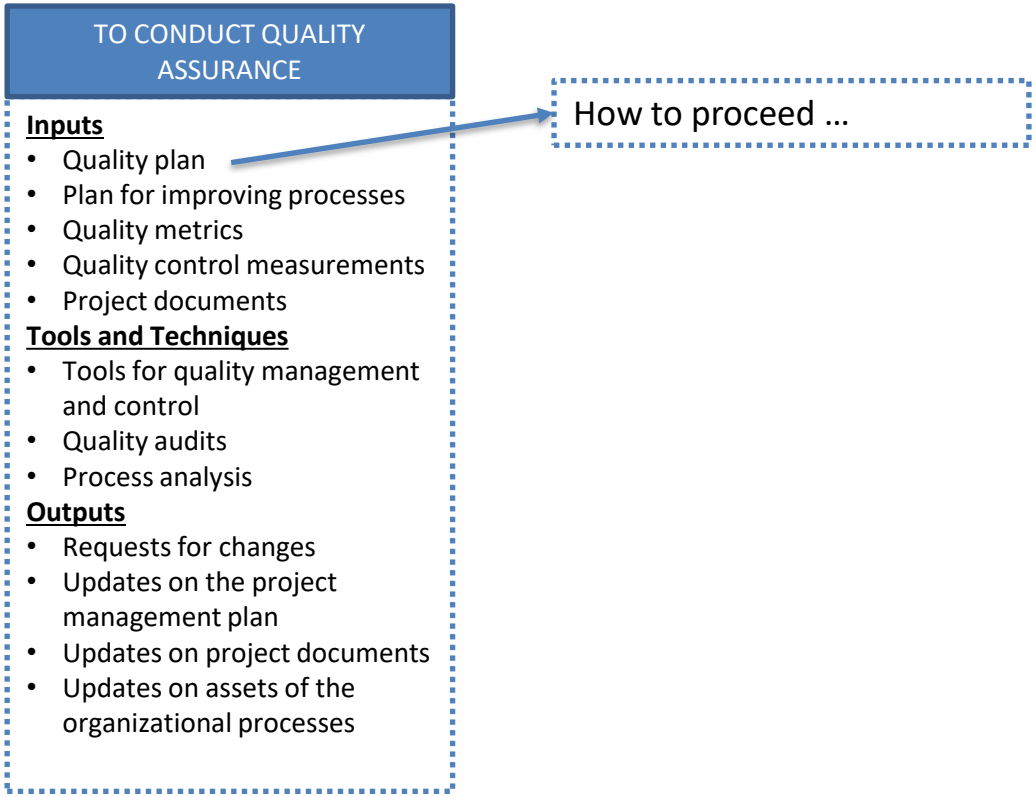
Quality Management

To Conduct Quality Assurance



Quality Management

To Conduct Quality Assurance

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Inputs
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Outputs
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To be aligned
To offer support
To be consistent

Quality Management

To Conduct Quality Assurance

TO CONDUCT QUALITY ASSURANCE

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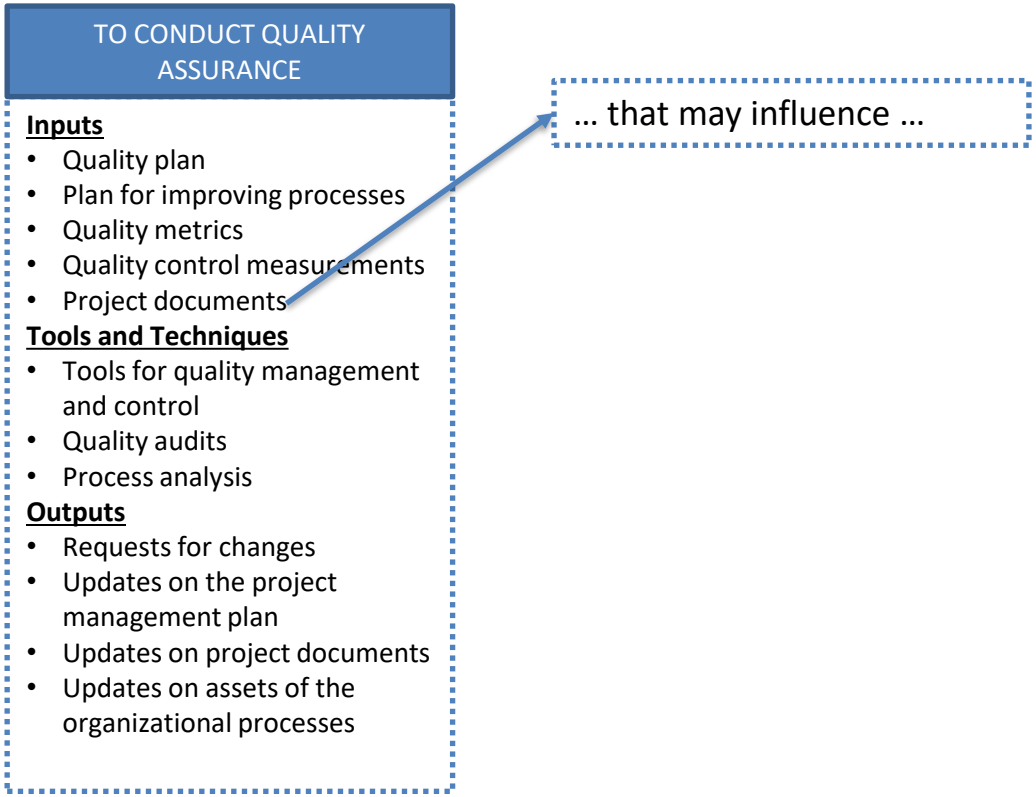
Results from the quality control and helps to analyse and evaluate the quality rules and processes of the organization.

Quality Management

To Conduct Quality Assurance



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Quality Management

To Conduct Quality Assurance

Quality Management

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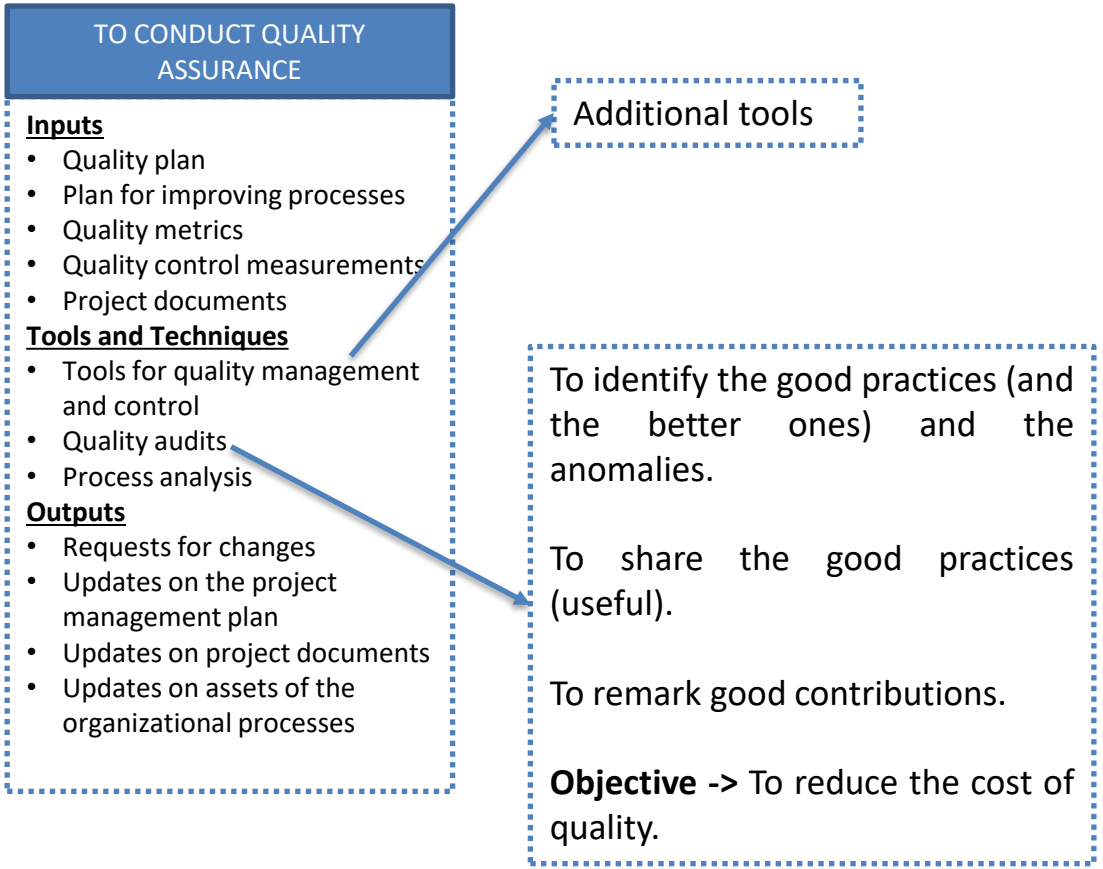

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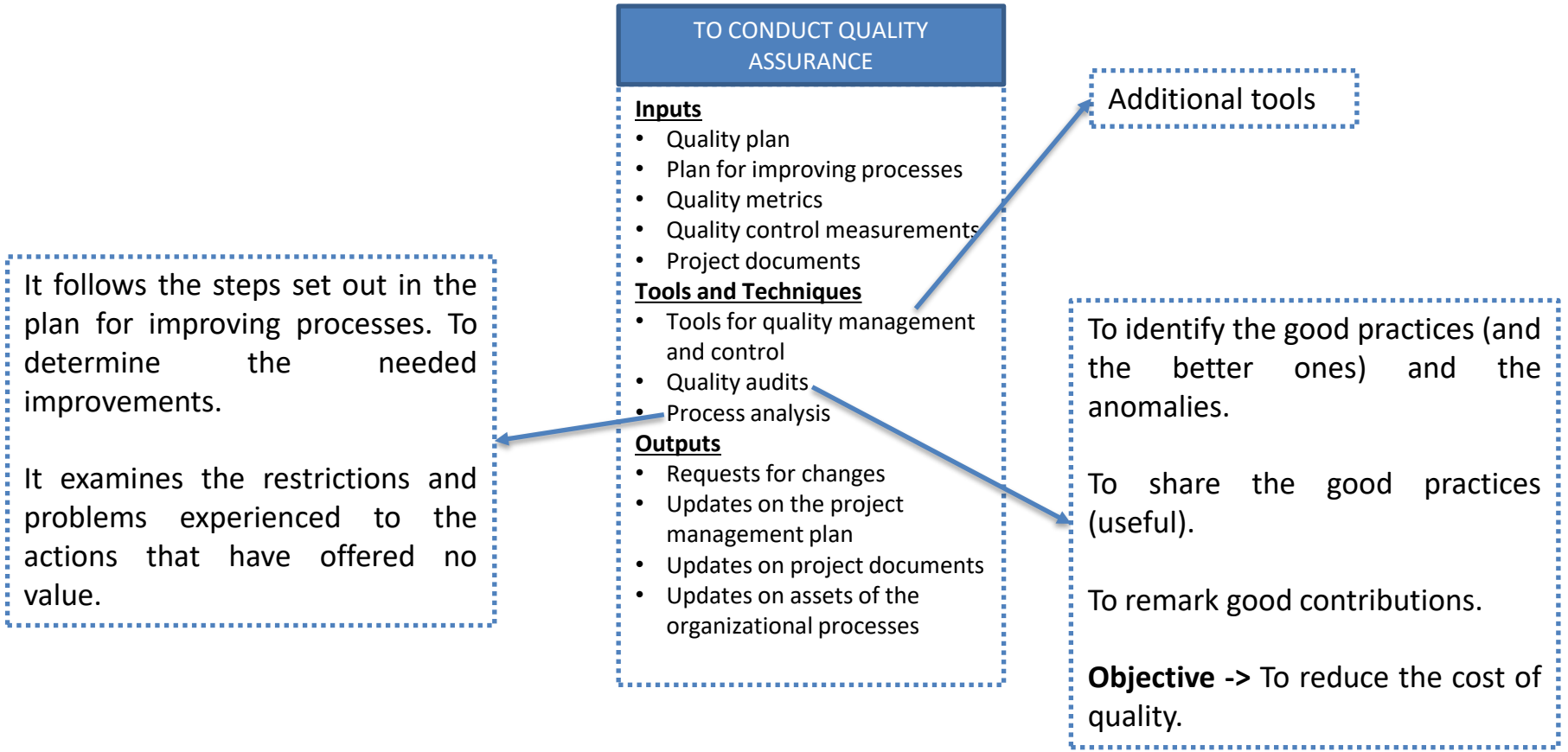

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From actions to increase effectivity or efficiency of policies.

Quality Management

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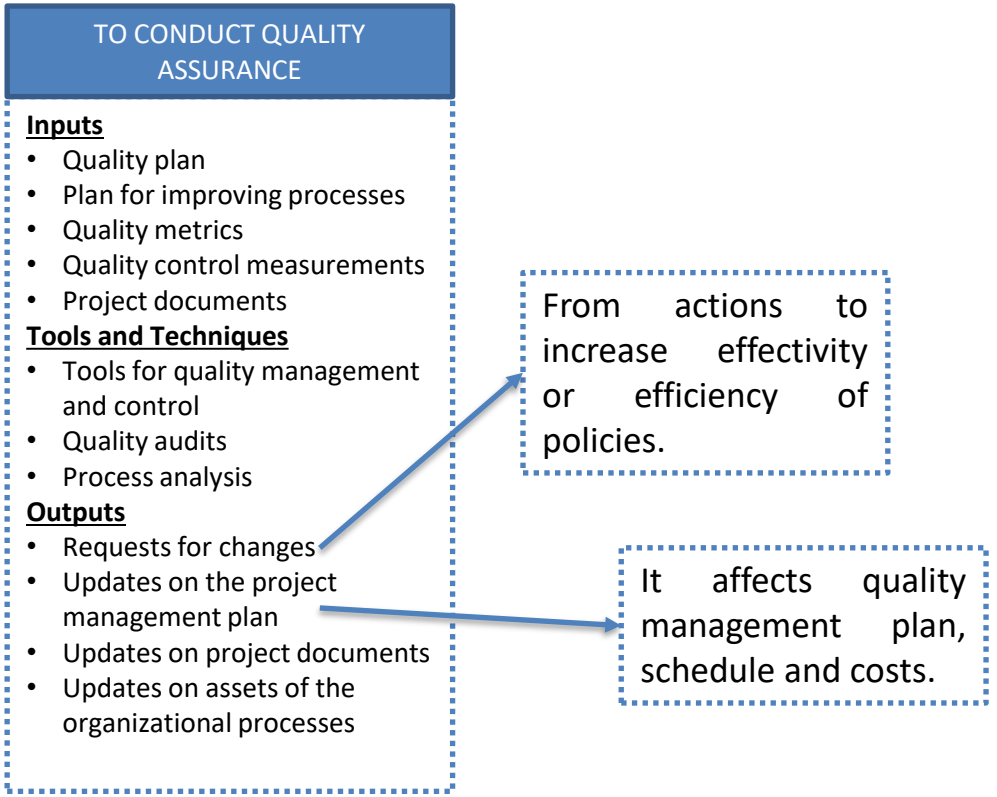

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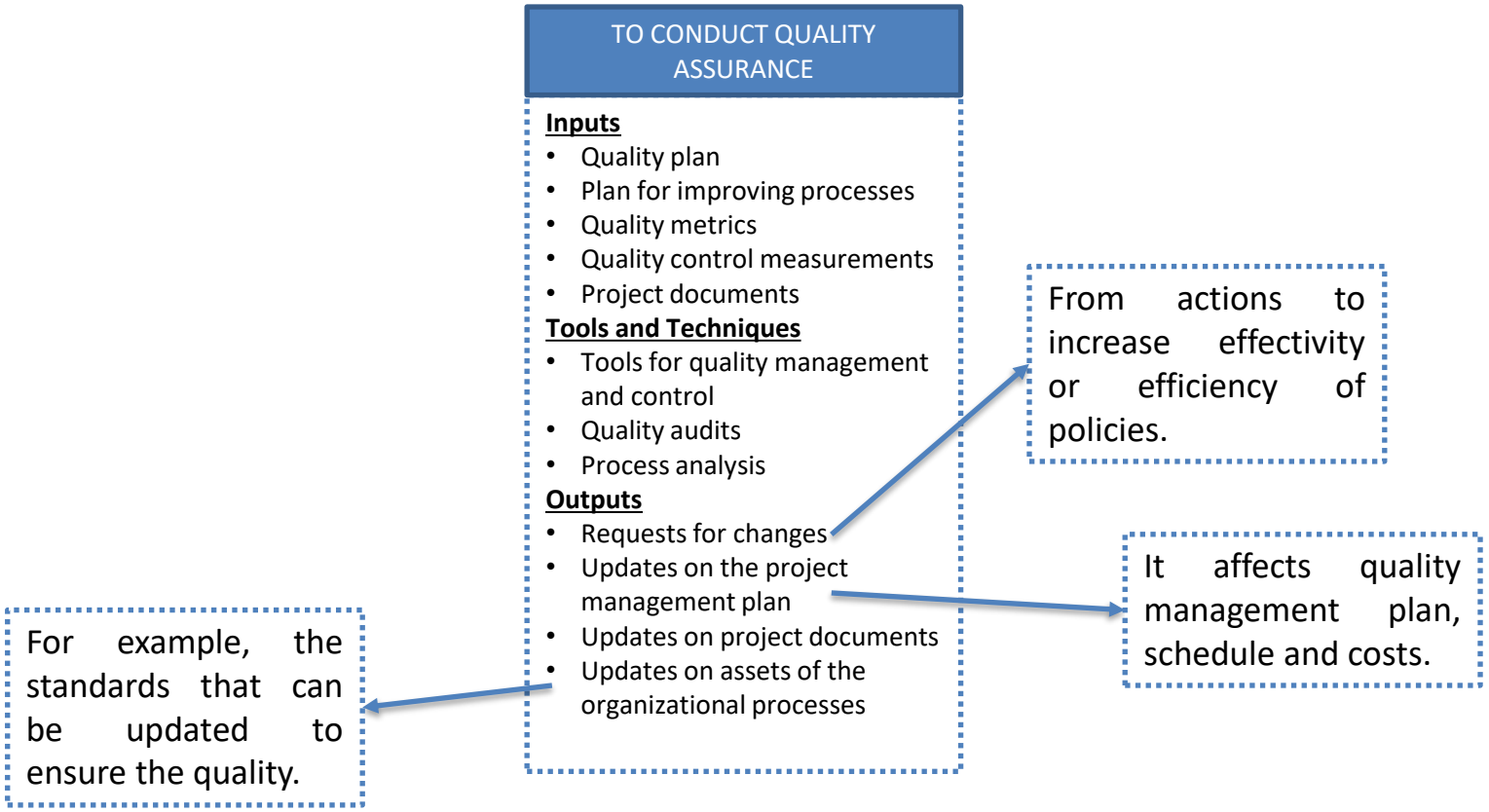

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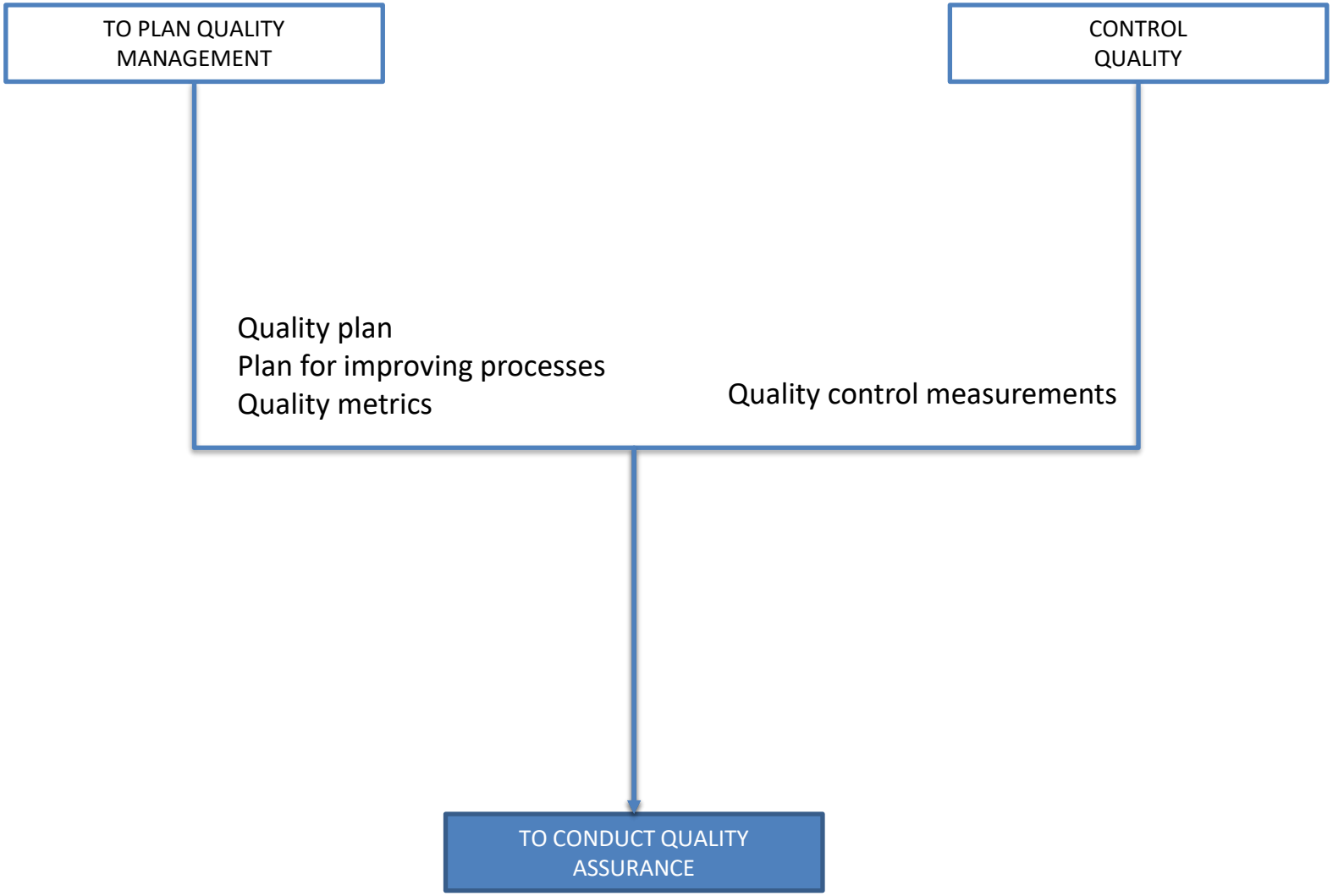

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Control Quality

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Quality Management

Control Quality

When? -> Lifetime

During the control quality the results of the quality management activities are monitored and registered.

These activities help to identify the causes of a deficient quality (product or process) and also, to recommend/develop the actions to eliminate those causes.

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Control Quality

How to …

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Quality Management

Control Quality

To evaluate the progress in comparison with the expected one.

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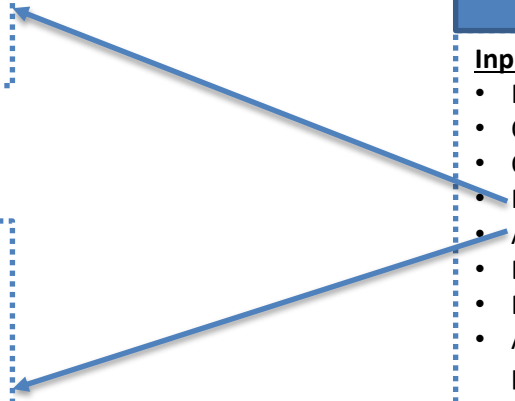
Request of correction(defects, reviews). It is important to check if the changes are developed properly.



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Any product or result that appears when a process, phase or project is completed.

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To check of the requests have been developed as defined.

Quality Management

Control Quality

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Quality Management

Control Quality

With favourable result.

CONTROL QUALITY

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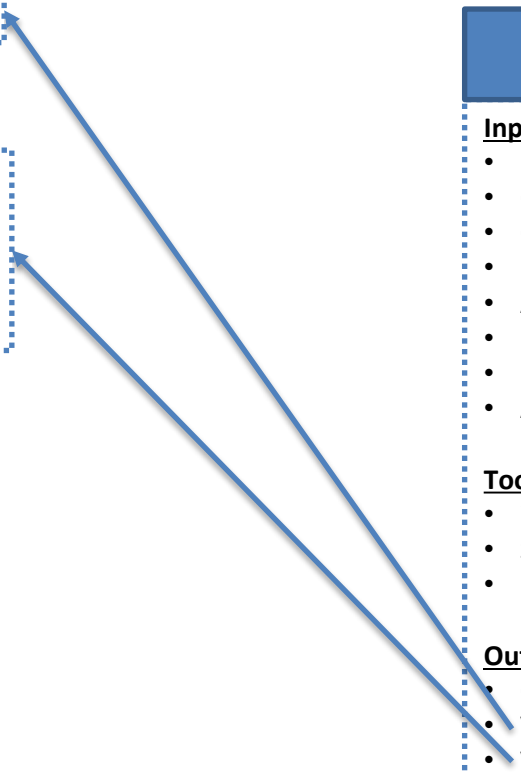
Quality Management

Control Quality

With favourable result.

This point satisfies one of the objectives (quality control) -> correction of deliverables.



CONTROL QUALITY

Inputs
- Project management plan
- Quality metrics
- Quality checklists
- Performance data of the work
- Approved requests for change
- Deliverable
- Project documents
- Assets of the organizational processes

Tools and Techniques
- 7 basic tools (quality)
- Statistical sampling
- Review of the approved requests for change

Outputs
- Quality control measurements
- Validated changes
- Validated deliverables
- Information about performance
- Requests for changes
- Updates on the project management plan
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Quality Management

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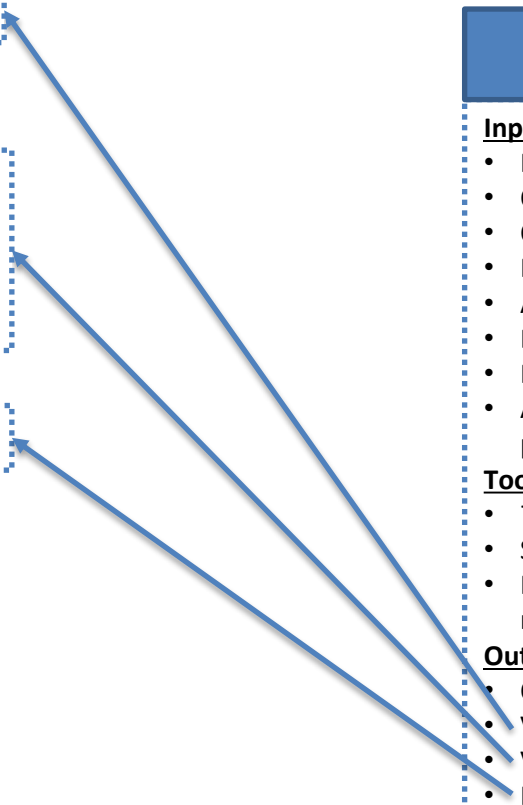

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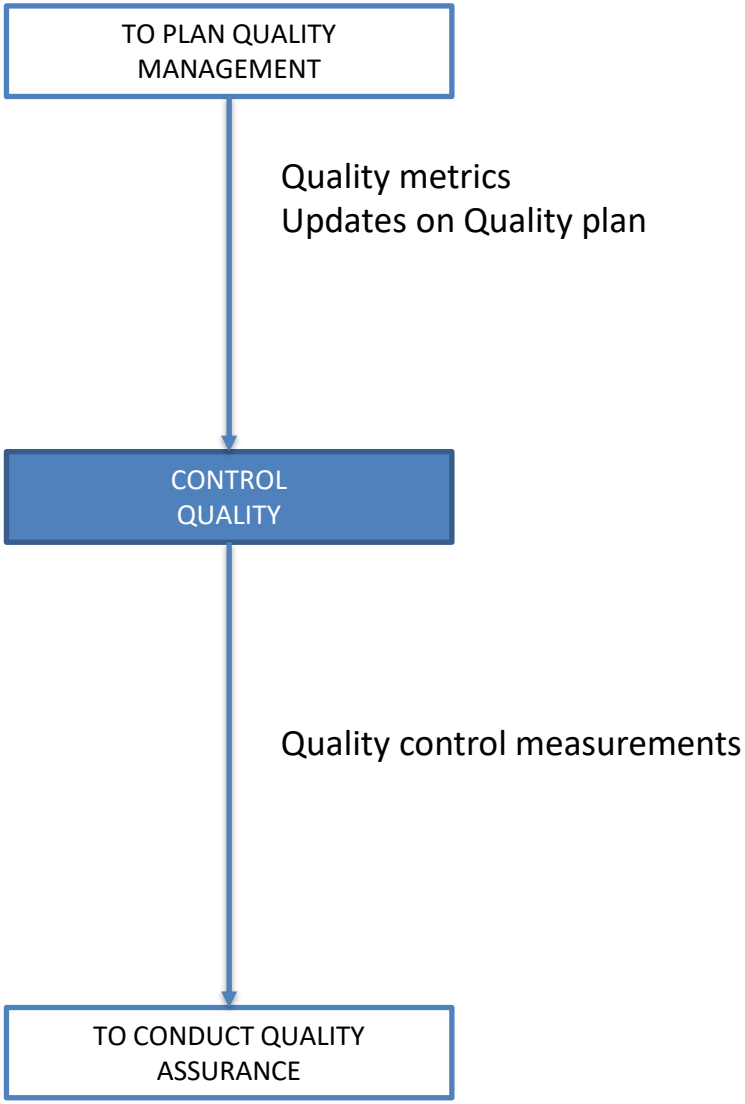
Quality Management



Ch2. Quality Management

Contents

- Overview of software development processes
- When
- Quality Management
- **Useful Tools**

Ishikawa's seven basic tools

- Basic statistical tools for quality control.
- By Ishikawa [Ishikawa, 1989].
- Widely used in manufacturing productions.
- There are many ways to analyse software metrics -> the applications of Ishikawa's seven tools represent a set of basic operations.

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In contrast . . .

They do not provide specific information to software developers on how to improve the quality of their designs or implementation.

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Good use of the Ishikawa's seven basic tools can lead to positive long-term results for process improvement and quality management in software development.

Ishikawa, K. (1989): "Guide to Quality Control". White Plains, N.Y.: Quality Resource, 1971.

Ishikawa's seven basic tools

- Check Sheet (checklist)
- Histogram
- Run chart
- Cause-and-effect diagram
- Pareto diagram
- Scatter diagram
- Control chart

Ishikawa's seven basic tools

Check Sheet or Checklist

- **Paper form with printed items to be checked**.
- Its main purposes are to *facilitate gathering data form and to arrange data while collecting it so the data can be easily used later*.

Ishikawa's seven basic tools

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- Another type . . . is *the check-up confirmation sheet* . . . we have talked about it . . . **checklist**.

Ishikawa's seven basic tools

Check Sheet or Checklist

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- Its main purposes are to *facilitate gathering data form and to arrange data while collecting it so the data can be easily used later*.
- Another type . . . is *the check-up confirmation sheet* . . . we have talked about it . . . **checklist**.
- The use of checklist is pervasive.
- Checklist
  - Used daily by development community.
  - Developed and revised based on accumulated experience.
  - Are often a part of the process documents.
  - Its daily use also keeps the processes alive.

- Example -> common error list

Ishikawa's seven basic tools

Check Sheet or Checklist

Defect/Event occurrence	Day of the Week					TOTAL
	Mon	Tue	Wed	Thu	Frid	
Test error		III	I	II		6
Incorrect output		I	I		II	4
Incorrect reading	I	IIII				5
. . .	II			I		3

Ishikawa's seven basic tools

Pareto diagram

- A pareto diagram is a **frequency chart of bars in descending order**.
- The frequency bars are usually associated with types of problems.
- Pareto analysis helps by identifying areas that cause most of the problems, which normally means you get the best return on investment when you fix them.
- It is most applicable in software quality because software defects or defect density never follow a uniform distribution.
- In software development (usually):
  - X-axis for the defect cause.
  - Y-axis for the defect count.

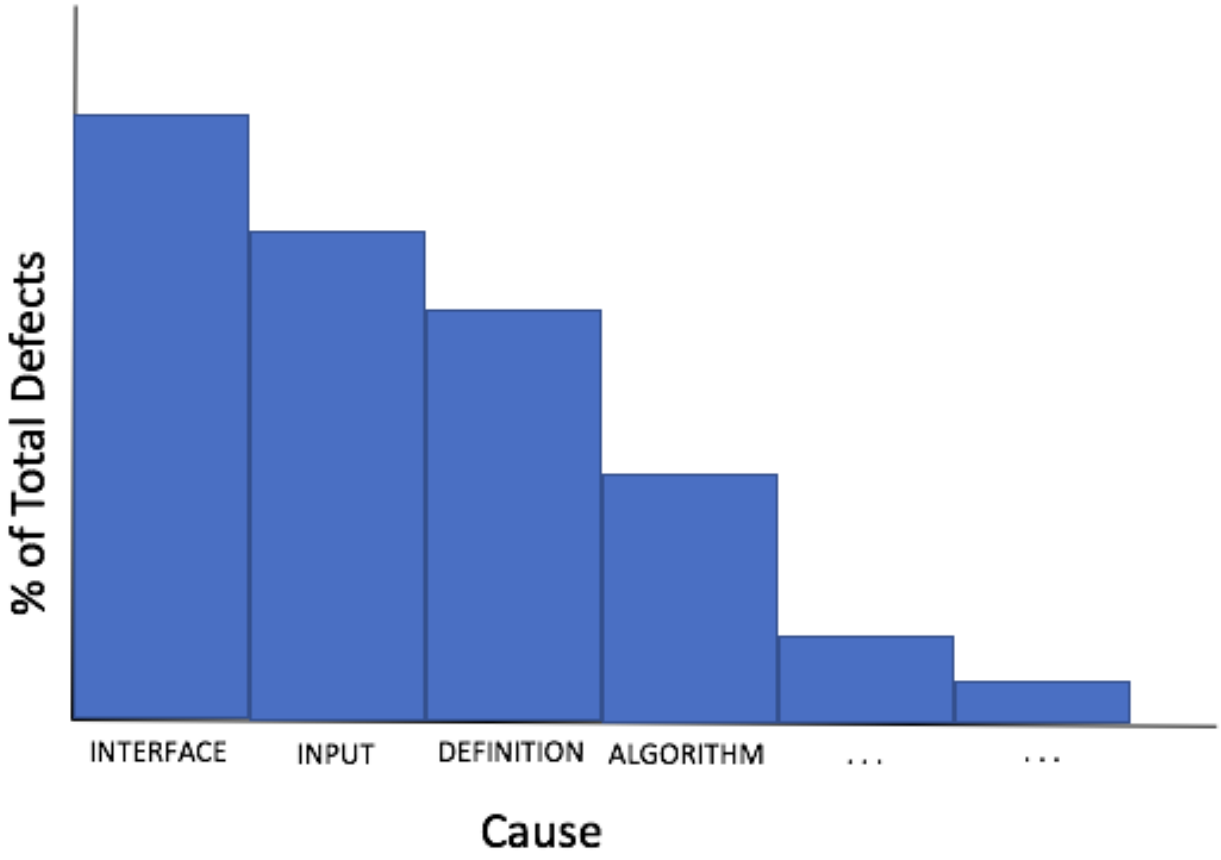
Ishikawa's seven basic tools

Pareto diagram

- By arranging the causes based on data frequency, a Pareto diagram **can identify** the few causes that account for the majority of defects.
- It indicates which problems should be solved first in eliminating defects and improving operation.

Ishikawa's seven basic tools

Pareto diagram



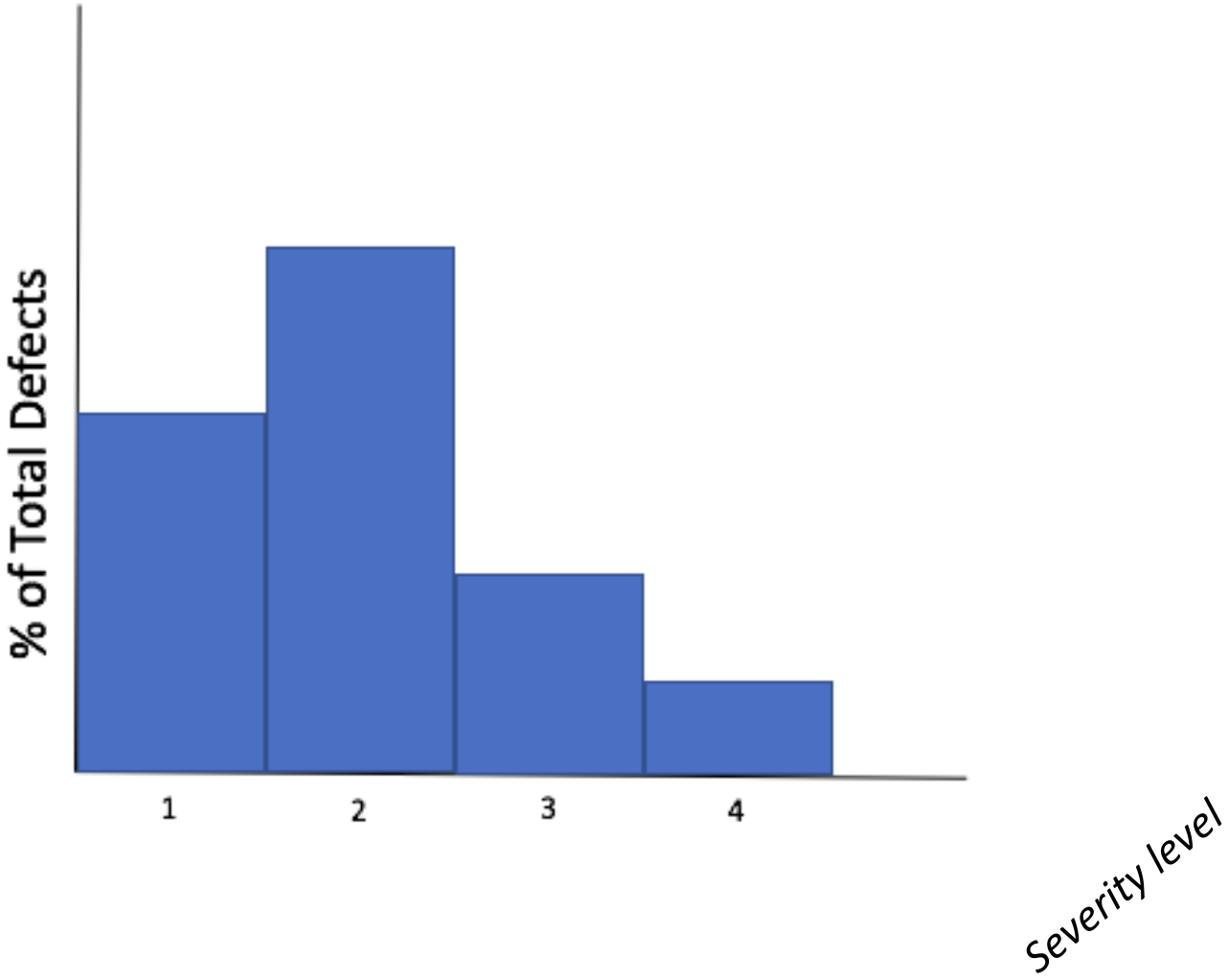
Ishikawa's seven basic tools

Histogram

- An histogram is a **graphic representation of frequency counts of a sample or a population**.
- The X-axis lists the unit intervals of a parameter (e.g. severity level of software defects) ranked in ascending order from left to right.
- The Y-axis contains the frequency counts.
- In a histogram, the frequency bars are shown by order of the X variable, whereas in a Pareto diagram by order of the frequency counts.
- Purpose -> **to show the distribution characteristics of a parameter such as overall shape, central tendency, dispersion and skewness**.
- It enhances **understanding** of the **parameter of interest**.

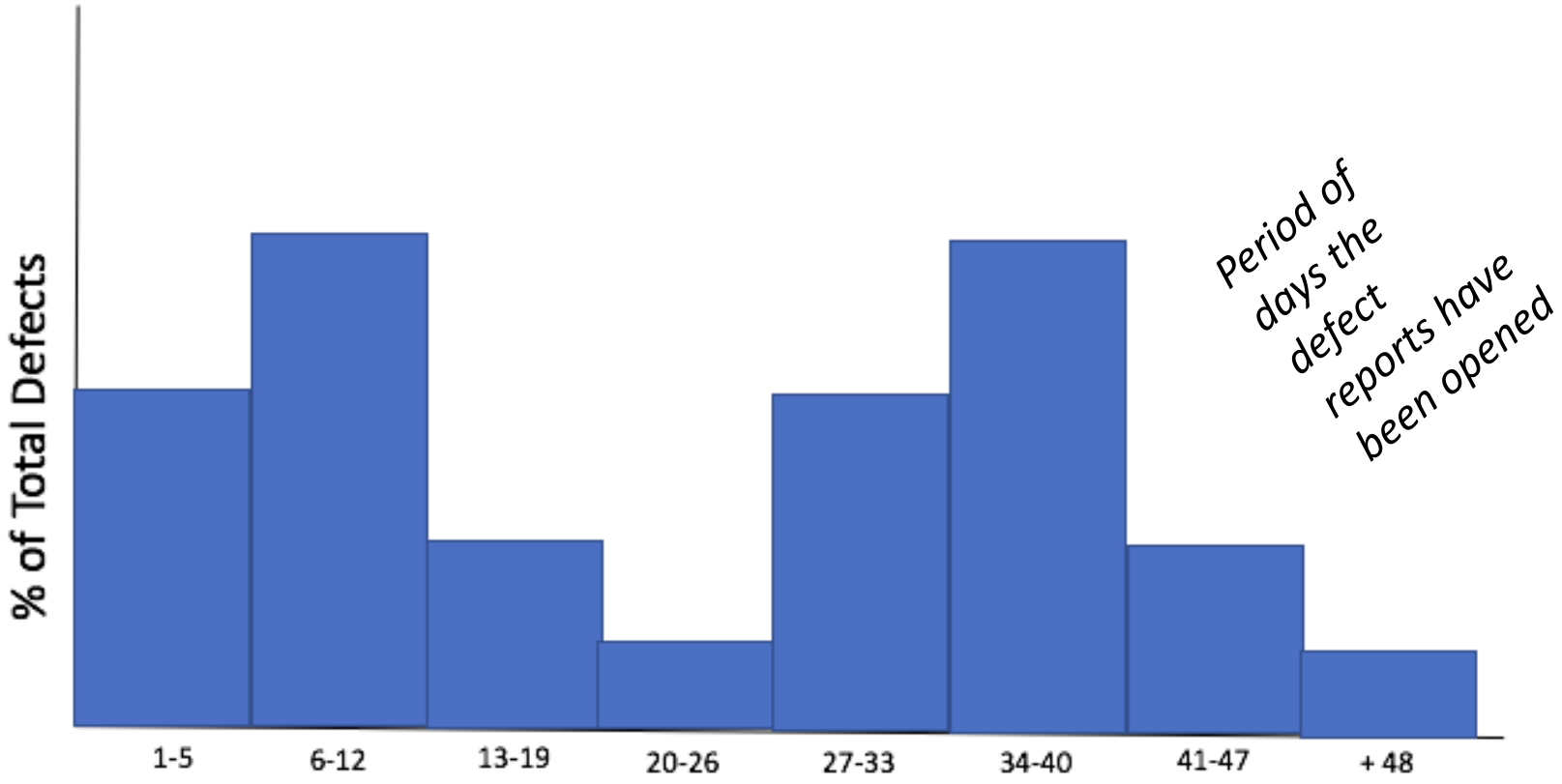
Ishikawa's seven basic tools

Histogram



Ishikawa's seven basic tools

Histogram



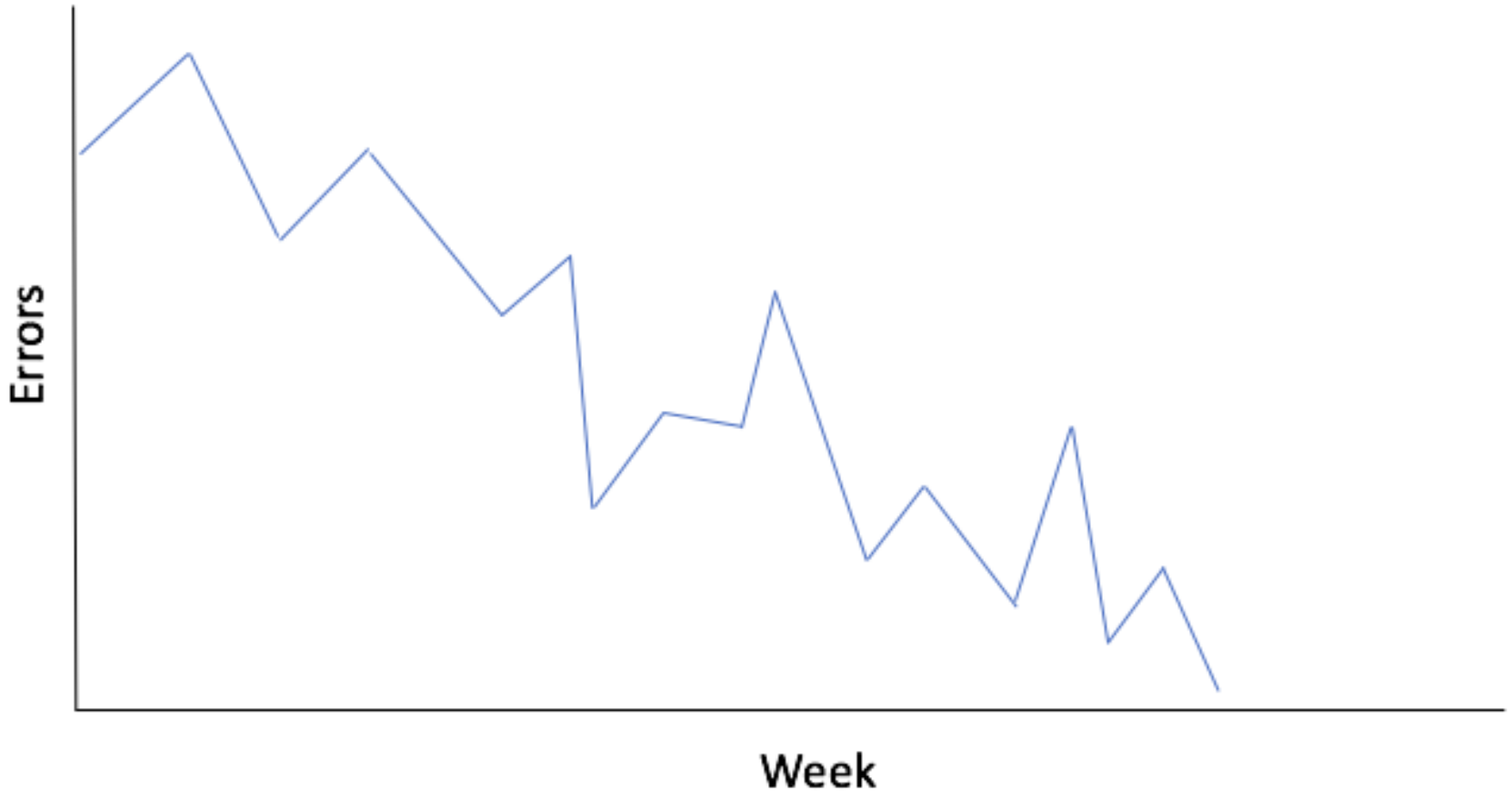
Ishikawa's seven basic tools

Run chart

- A run chart **tracks the performance of the parameter of interest over time.**
- The X-axis is the time.
- The Y-axis is the value of the parameter.
- It is the best used for **trend analysis**, especially if historical data are available for comparisons with the current trend.
- For example, the weekly arrival of defects and defect backlog during the formal machine testing phase can be monitored via run charts.

Ishikawa's seven basic tools

Run chart



Ishikawa's seven basic tools

Control chart

- A control chart can be considered as **an advanced form of a run chart for situations where the process capability can be defined**.
- It consists of
  - A central line
  - A pair of control limits
  - Values of the parameter of interest plotted on the chart.
- It represents the state of a process.
- The X-axis is real time.

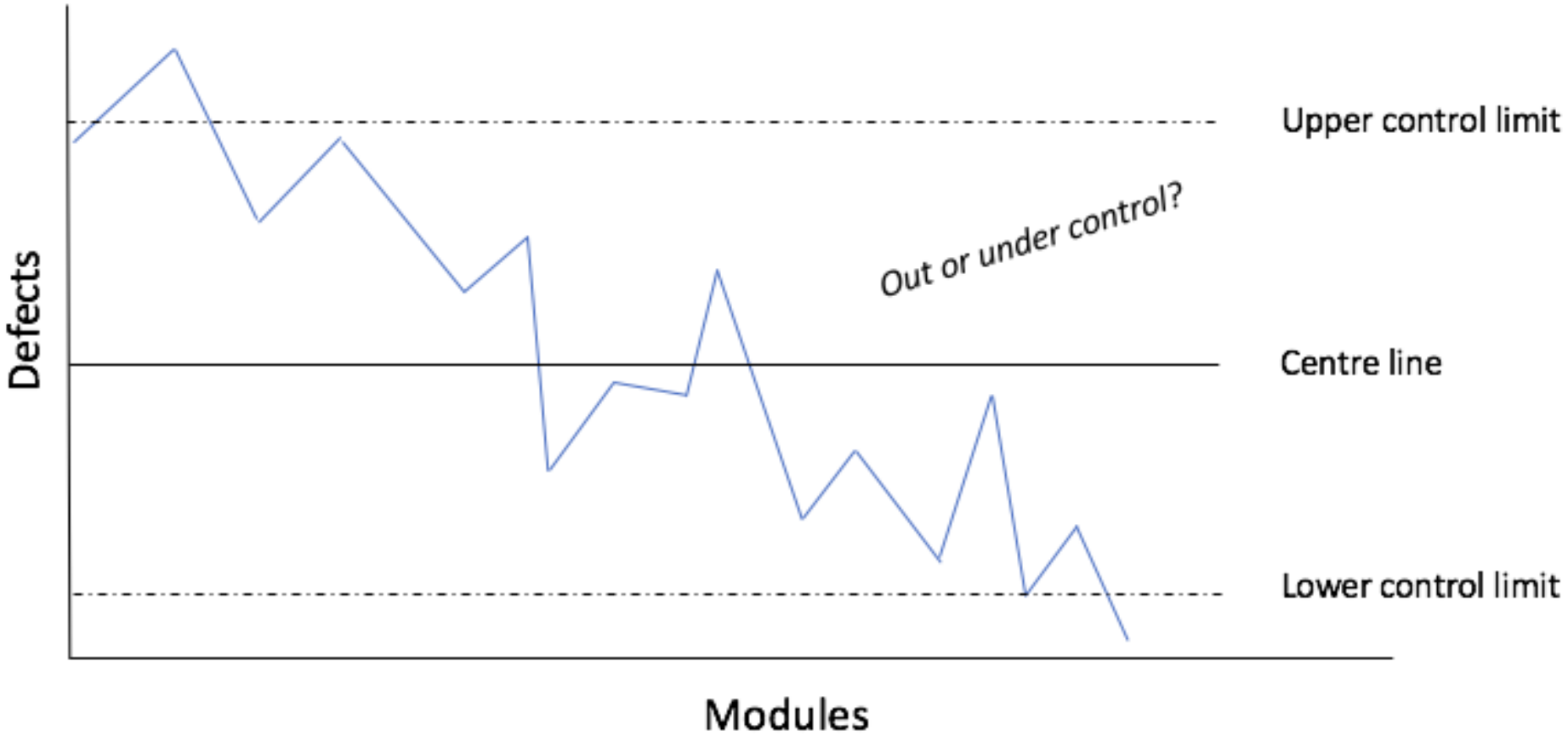
Ishikawa's seven basic tools

Control chart

- If all values of the parameter are within the control limits and show no particular tendency, the process is regarded as being in a controlled state.
- If they fall outside or indicate a trend . . . the process is considered out of control.
- Process capability is the inherit variation of the process in relation to the specific limits. **The smaller the process variations, the better the quality will be**.

Ishikawa's seven basic tools

Control chart



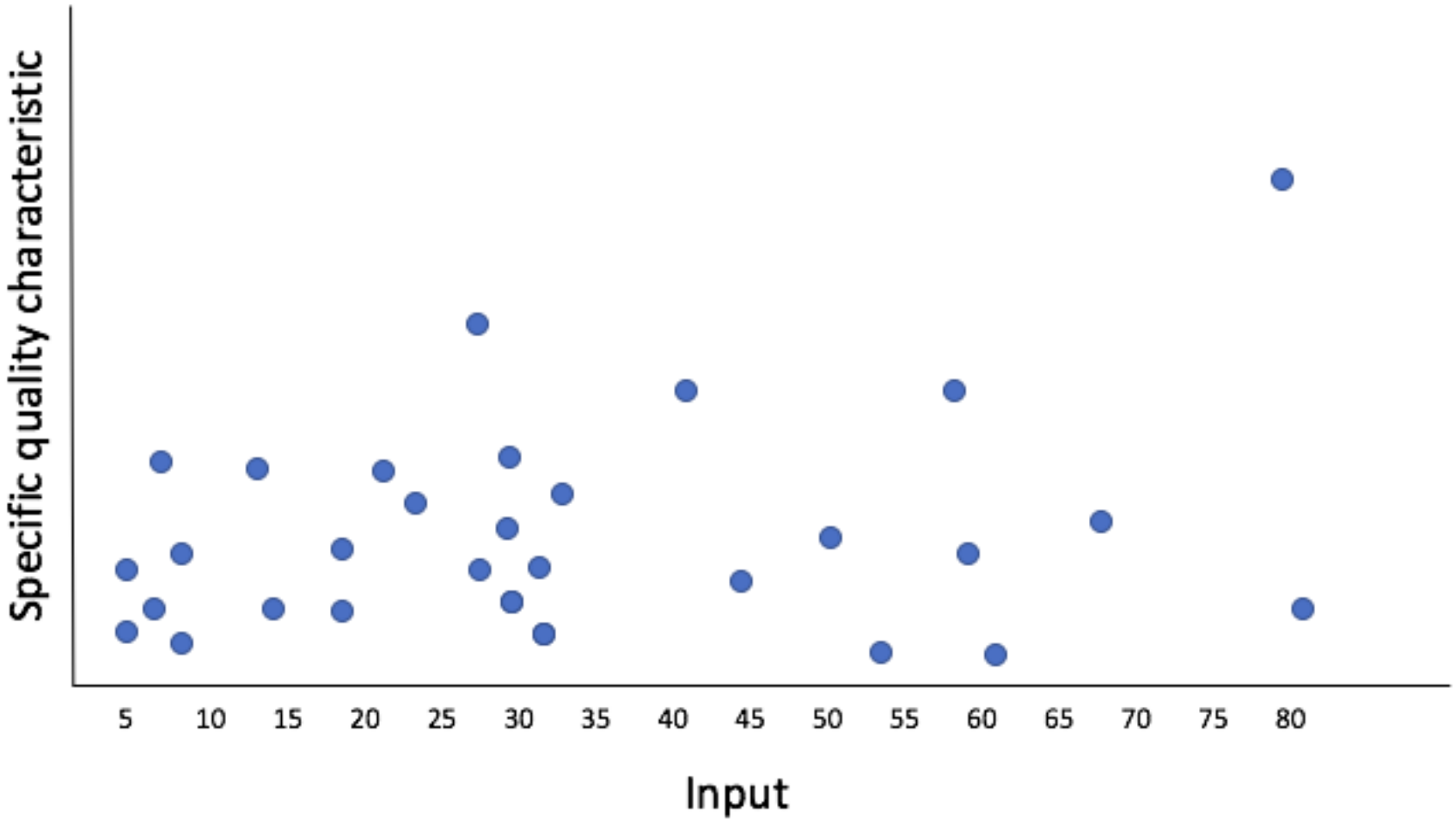
Ishikawa's seven basic tools

Scatter diagram

- A scatter diagram vividly **portrays the relationship of two interval variables**.
- In a cause-effect relationship, the X-axis is for the independent variable and the Y-axis for the dependent variable.
- Each point represents an observation of both the dependent and independent variables.

Ishikawa's seven basic tools

Scatter diagram



Ishikawa's seven basic tools

Cause-and-effect diagram

- Cause-and-effect diagram (or fishbone diagram) **shows the relationship between a quality characteristic and factors that affect that characteristic**.
- It layout *resembles a fishbone*, with the *quality characteristic* of interest labelled at the *fish head*, and *factors affecting* the characteristics placed where the bones are located.
- While scatter diagram describes a specific bivariate relationship in detail, the cause-and-effect diagram identifies all causal factors of a quality characteristic in one chart.

Cause-and-effect diagram

Steps

1. To identify the effect. What do we investigate?

Ishikawa's seven basic tools

Cause-and-effect diagram

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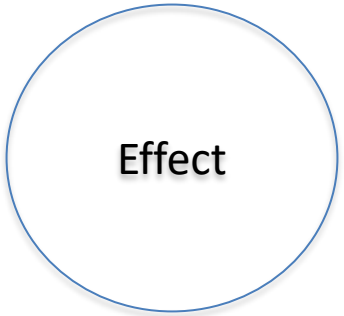
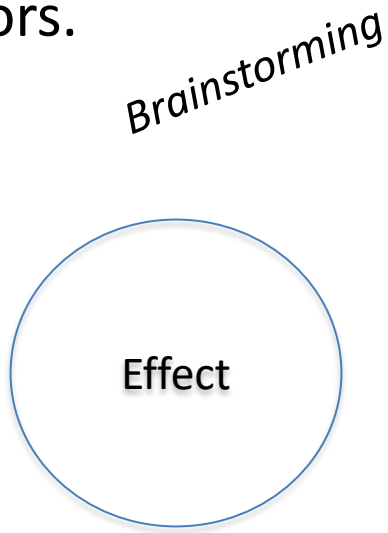


Steps

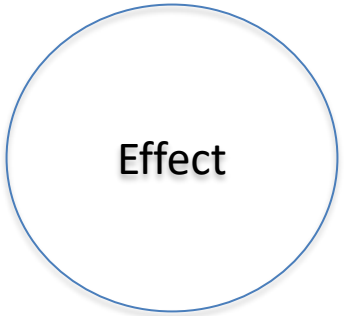
2. To analyse the effect looking for causes/factors.



Cause-and-effect diagram

Steps

3. To determine the groups in which the causes/factors can be categorized. (Major factors or main causes)



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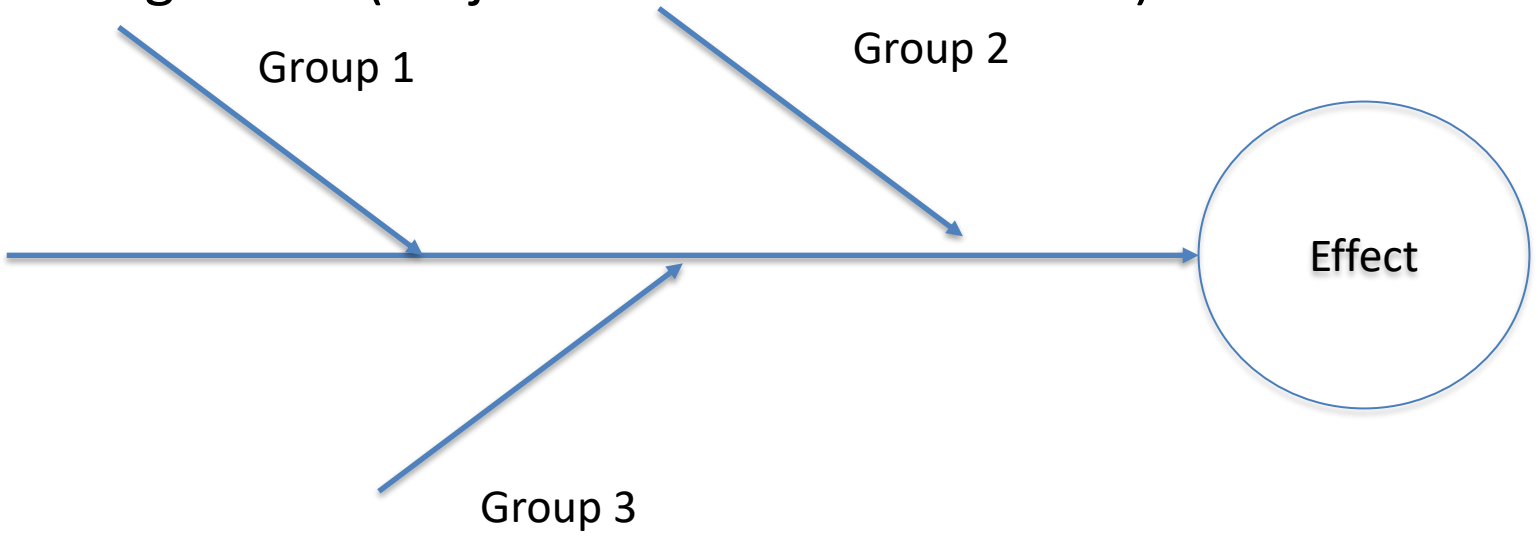
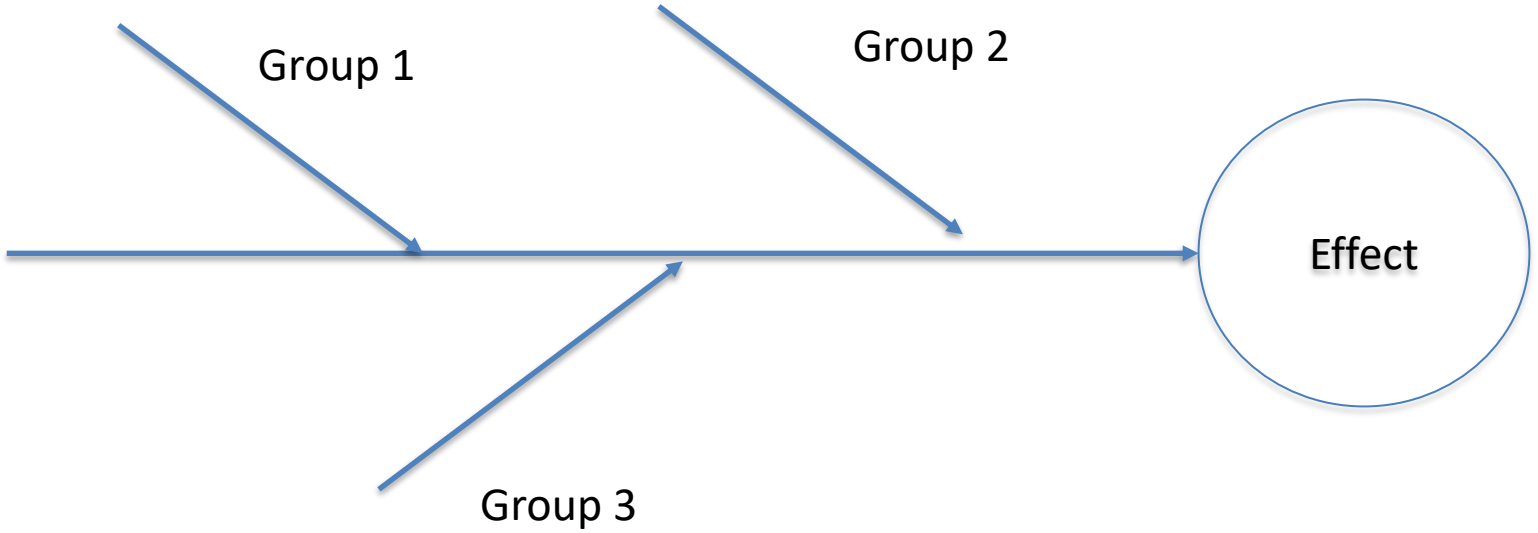


Cause-and-effect diagram

Steps

4. To determine sub-causes inside the groups. (More detailed)



Cause-and-effect diagram

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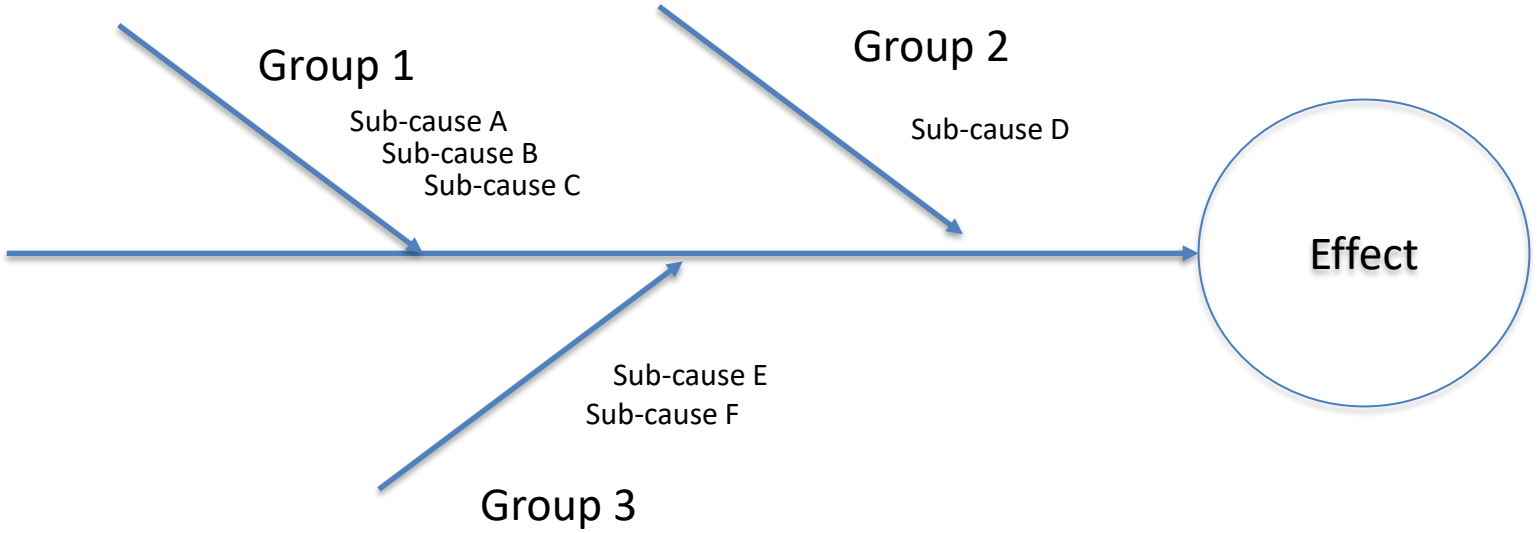

Ishikawa's seven basic tools

Cause-and-effect diagram

Ishikawa's seven basic tools

Cause-and-effect diagram

CLASS WORK

Design Reviews and Program Inspections

- QA activities that check the quality of project deliverables.
- This involves examining software, its documentations and records . . . to discover errors and/or omissions … and ... to see if quality standars are followed.

Design Reviews and Program Inspections

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- **OBJECTIVE**: to improve software quality, not to assess the performance of people in development team.

Design Reviews and Program Inspections

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- This involves examining software, its documentations and records . . . to discover errors and/or omissions … and ... to see if quality standars are followed.

- **OBJECTIVE**: to improve software quality, not to assess the performance of people in development team.
  - Inevitably -> mistakes made by developers are revealed.
  - Project managers have to be sensitive to individual concerns.
  - Project managers must develop a working culture that provides support without blame when errors are discovered.

Design Reviews and Program Inspections

REVIEWS

- During a review, a group of people **examine** the **software** and its **documentation** . . . looking for:
  - Potential problems
  - Non-conformance with standards

Design Reviews and Program Inspections

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Design Reviews and Program Inspections

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- With this information . . .

Design Reviews and Program Inspections

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- As a result, the team **generates informed judgements** about the level of quality of a system or project deliverable.
- With this information . . . project managers are **able to** make planning decisions and allocate resources to the development process.

Design Reviews and Program Inspections

REVIEWS

- **Quality reviews** are based on:

  - Documents that have been produced during the software development process.
  - Software specifications.
  - Designs.
  - Code.
  - Process models.
  - Test plans.
  - Configuration management procedures.
  - Process standards.
  - User manuals.

Design Reviews and Program Inspections

REVIEWS

- **Quality reviews**:

  - To help discover problems and omissions.
  - The conclusions of the review should be formally recorded as part of the quality management process.
  - Problems -> discovered? -> Reviewers' comments -> person in charge of corrections.

Design Reviews and Program Inspections

REVIEWS

- ***DIRECT* OBJECTIVES**:

Design Reviews and Program Inspections

REVIEWS

- ***DIRECT* OBJECTIVES**:

Current project

Design Reviews and Program Inspections

REVIEWS

- ***DIRECT* OBJECTIVES**:

Current project

To **detect analysis and design errors** as well as subjects where corrections, changes and completions are required with respect to the original specification and approved changes.

To **identify new risks** likely to affect completion of the project.

To **locate deviations** from templates and style procedures and conventions. Correction of these deviations is expected to contribute to improved communication and coordination resulting from greater uniformity.

To **approve the analysis or design product**. Approval allows the team to continue to the next development phase.

- ***INDIRECT* OBJECTIVES**:

Design Reviews and Program Inspections

REVIEWS

- ***INDIRECT* OBJECTIVES**:

. . . more general . . .

Design Reviews and Program Inspections

REVIEWS

- ***INDIRECT* OBJECTIVES**:

To improve knowledge (team) and developments methodologies

- ***INDIRECT* OBJECTIVES**:

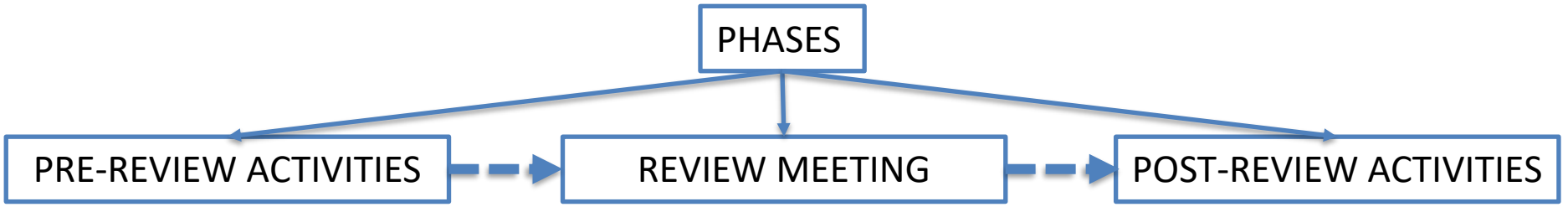
To **provide an informal meeting** place for exchange of professional knowledge about development methods, tools and techniques.

To **record analysis and design errors** that will serve as a basis for **future** corrective actions. The corrective actions are expected to improve development methods by increasing effectiveness and quality, among other future products.

To improve knowledge (team) and developments methodologies

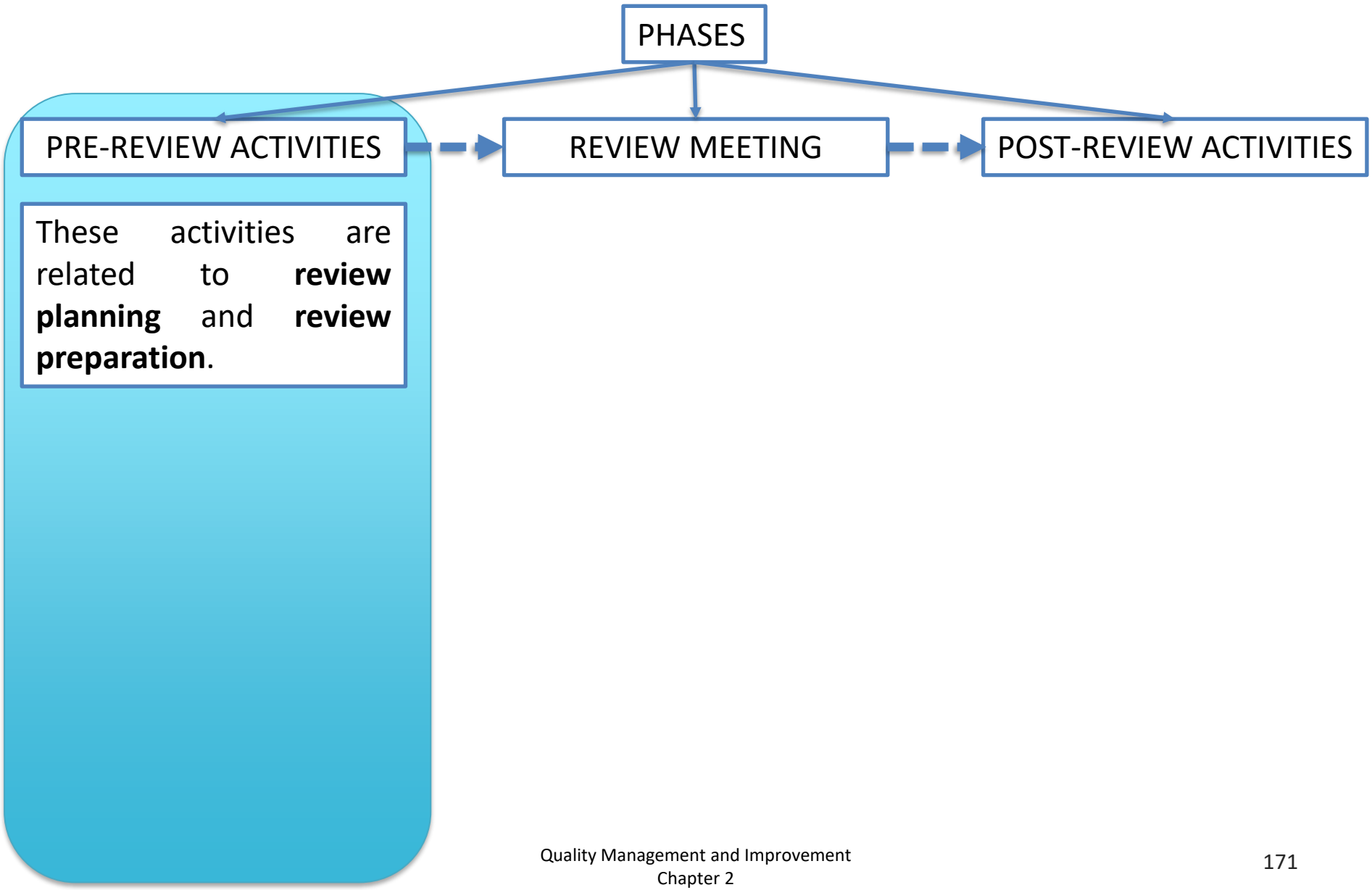
Design Reviews and Program Inspections

REVIEWS



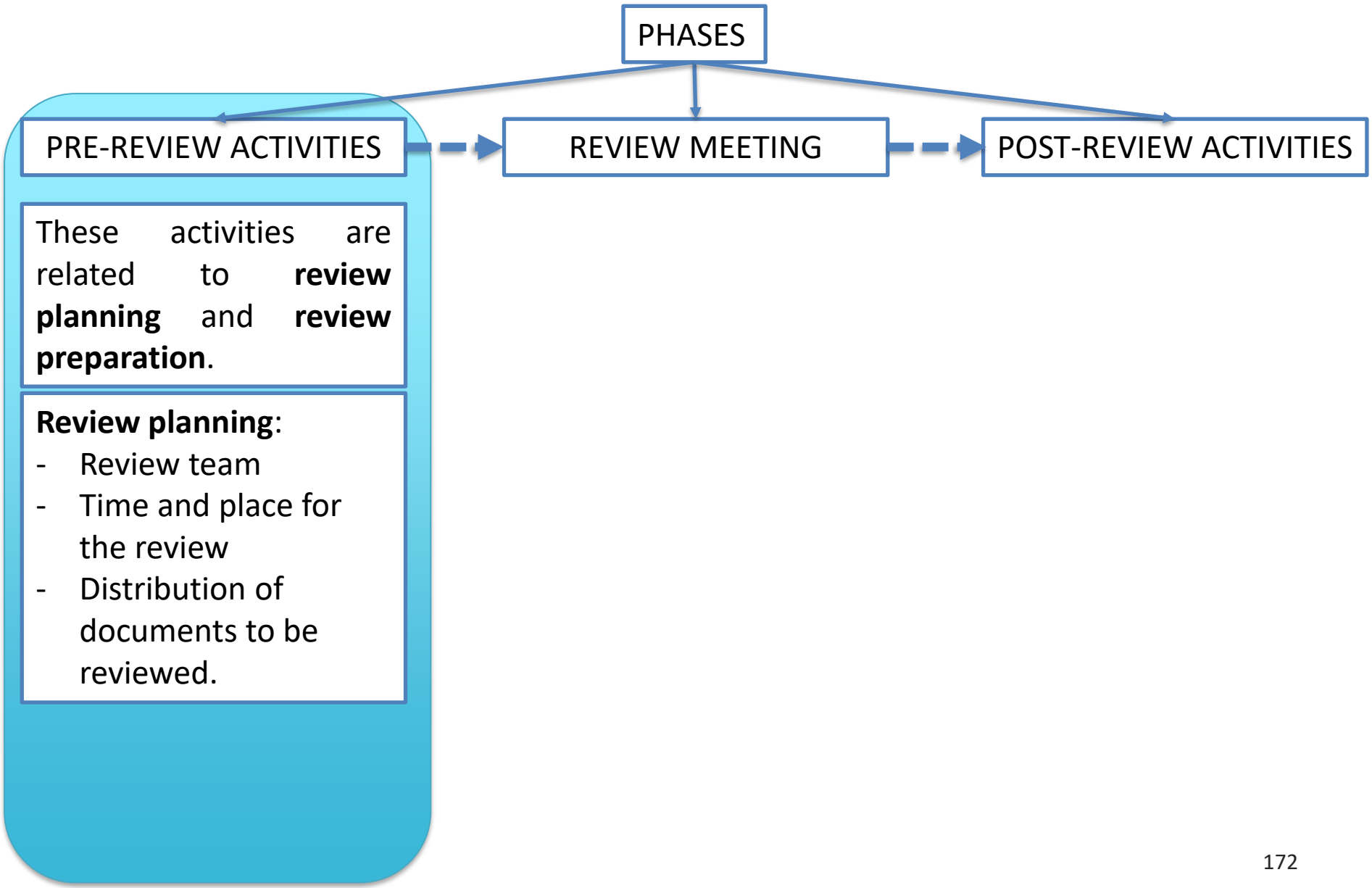
Design Reviews and Program Inspections

REVIEWS



Design Reviews and Program Inspections

REVIEWS



Design Reviews and Program Inspections

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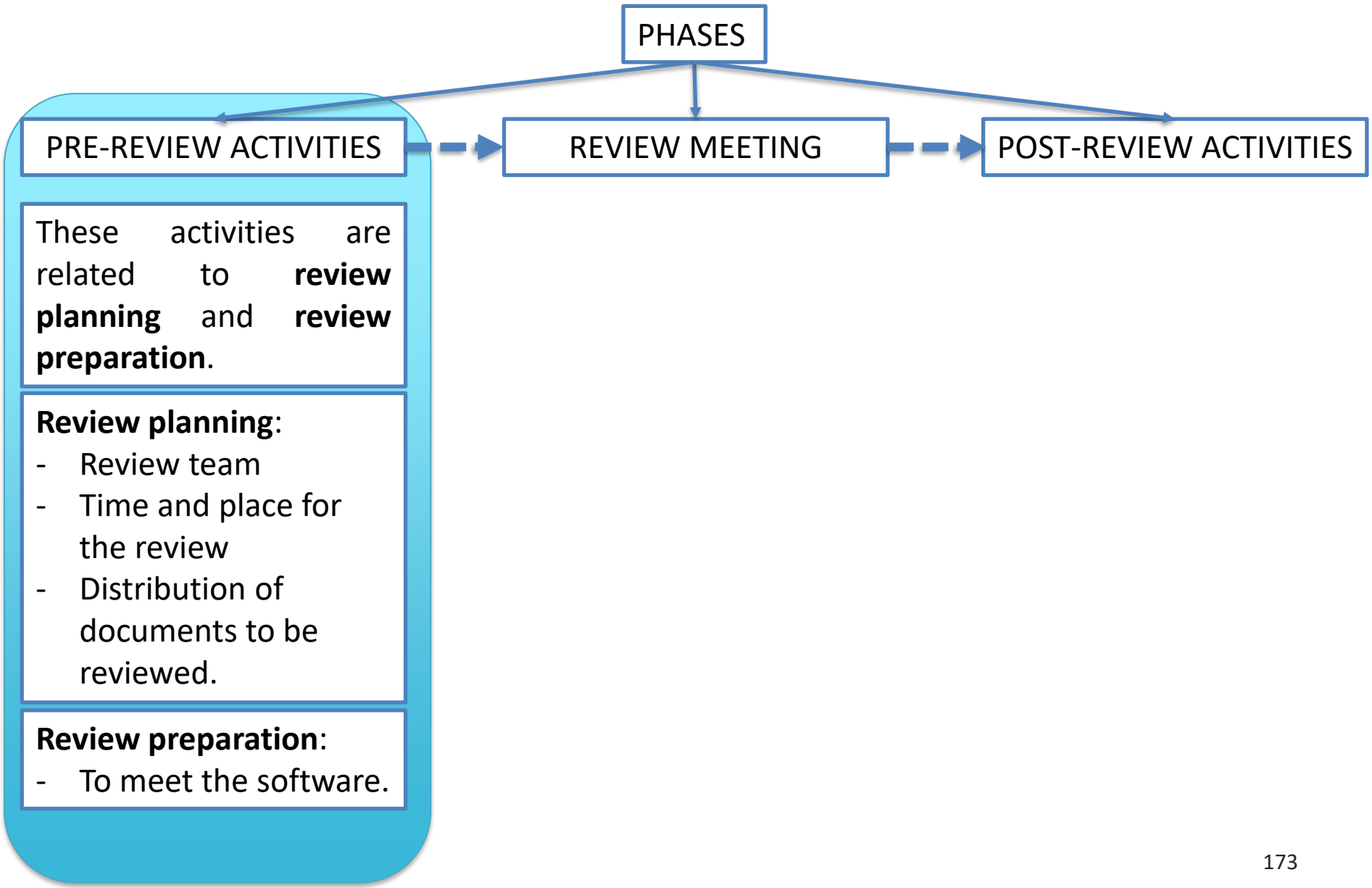
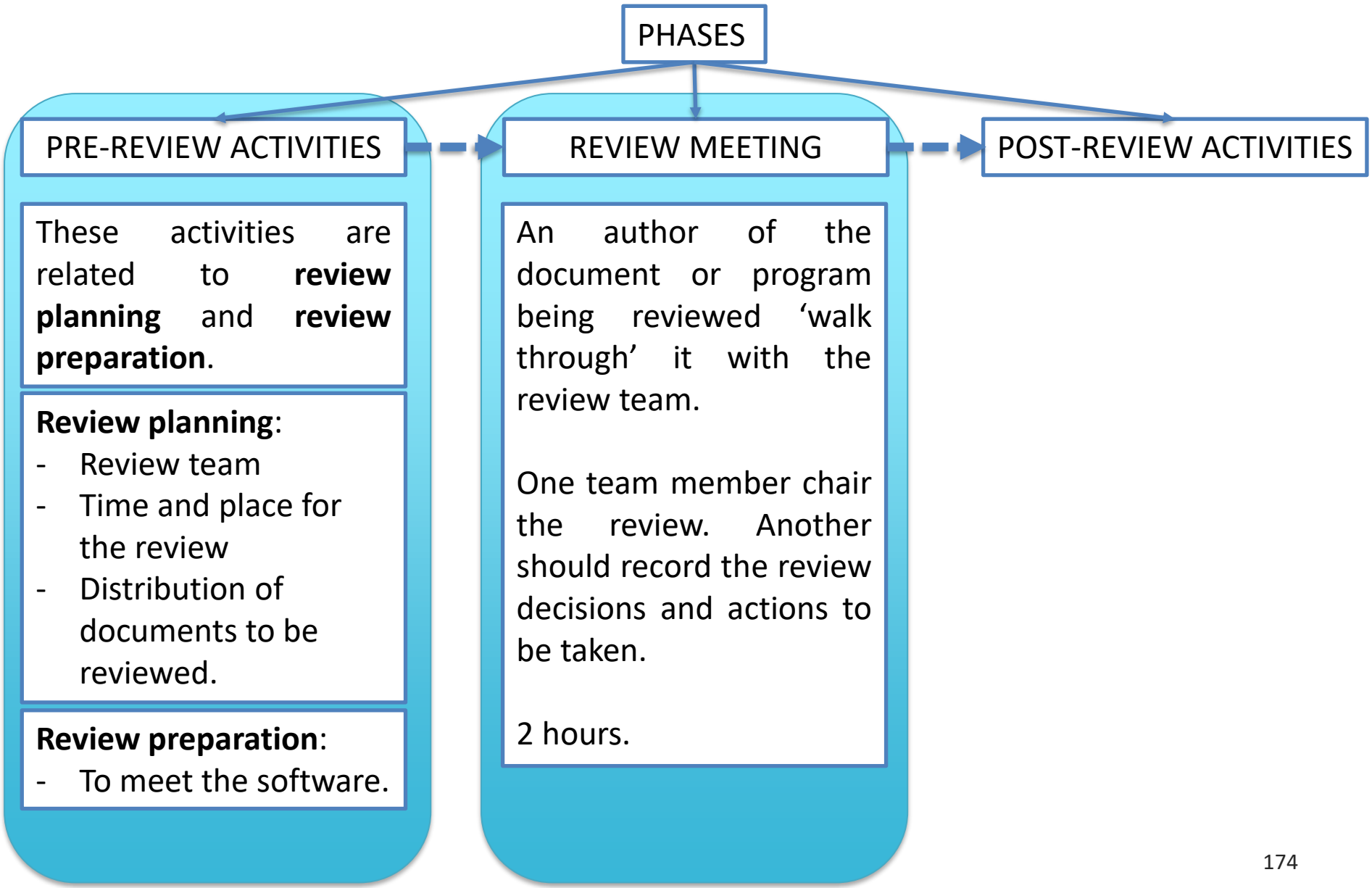


Design Reviews and Program Inspections

REVIEWS



Design Reviews and Program Inspections

REVIEWS

PHASES

PRE-REVIEW ACTIVITIES

These activities are related to **review planning** and **review preparation**.

Review planning:
- Review team
- Time and place for the review
- Distribution of documents to be reviewed.

Review preparation:
- To meet the software.

REVIEW MEETING

An author of the document or program being reviewed 'walk through' it with the review team.

One team member chair the review. Another should record the review decisions and actions to be taken.

2 hours.

POST-REVIEW ACTIVITIES

The issues and problems raised during the review must be addressed.

After changes have been made, the review chair may check that the review comments have all been taken into account.

Design Reviews and Program Inspections

DESIGN REVIEWS

- The only reviews that are necessary for the approval of the design product.

Design Reviews and Program Inspections

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Design Reviews and Program Inspections

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- Focused on documents of the software development process.

Design Reviews and Program Inspections

DESIGN REVIEWS

- The only reviews that are necessary for the approval of the design product.
- Without this approval, the development team cannot continue to the next phase of the sw development project.
- Focused on documents of the software development process.
- Some common formal design reviews:

Development Plan Review (DPR)	Software Requirement Specification Review (SRSR)
Preliminary Design Review (PDR)	Detailed Design Review (DDR)
Data Base Design Review (DBDR)	Test Plan Review (TPR)
Software Test Procedure Review (STPR)	Version Description Review (VDR)
Operator Manual Review (OMR)	Support Manual Review (SMR)
Test Readiness Review (TRR)	Product Release Review (PRR)
Installation Plan Review (IPR)	

GOLDEN GUIDELINES FOR A SUCCESSFUL DESIGN REVIEW

- Checklist for each type of design document. Common ones.
- Schedule the DRs as part of the project activity plan.
- Discuss professional issues in a constructive way (free of tension).
- Focus on detection of defects by verifying and validating the participants' comments.
- Properly document the discussions.
- Review team should be limited in size.
- Duration of a review -> 2 hours.

Based on:

Pressman, R.S. (2000): "Software Engineering – A Practitioner's Approach". European adaptation by D. Ince, 5th edn, McGraw-Hill International, London.

Design Reviews and Program Inspections

DESIGN REVIEWS (DRs) – Design Review Report

Appendix 8A DR report form

Design Review Report

DR date: _____ The report was prepared by: _____

Project name: _____

The review document: _____ Version: _____

The review team: _____

1 Summary of the discussions

#	Discussion subject	Number of action items

2 The action items

#	Action items to be performed	Responsible employee	Completion date	Approval of completion	
				Date	Signature

3 Decision regarding the design product

☐ Full approval

☐ Partial approval. Approval granted for continuation to the next phase of the following parts:

☐ Denial of approval

Comments:

The report was approved by:

Name of participant	Date	Signature	Name of participant	Date	Signature

Approval of sucessful completion of all action items

Comments:

Name: Signature: Date:

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

- Program inspections are ‘peer reviews’ where team members collaborate to find bugs in the program that is being developed.

Design Reviews and Program Inspections

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- PIs involve team members from **different backgrounds** who make a careful, **line-by-line** review of the program source code.

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

- Program inspections are ‘peer reviews’ where team members collaborate to find bugs in the program that is being developed.

- PIs involve team members from **different backgrounds** who make a careful, **line-by-line** review of the program source code.

- Detecting . . .
  - Defects -> logical errors, anomalies in the code.
  - Problems.

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

- A checklist of common programming errors is used.
- Each organization should develop its own checklist.
  - Updated
  - Items vary based on programming language.

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

Fault class	Inspection check
Data faults	• Are all program variables initialized before their values are used? • Have all constants been named? • Should the upper bound of arrays be equal to the size of the array or size-1? • If character strings are used, is a delimiter explicitly assigned? • Is there any possibility of buffer overflow?
Control faults	• For each conditional statement, is the condition correct? • Is each loop certain to terminate? • Are compound statements correctly bracketed? • In case statements, are all possible cases accounted for? • If a break is required after each case in case statements, has it been included?
Input / Output faults	• Are all input variables used? • Are all output variables assigned a value before they are output? • Can unexpected inputs cause corruption?

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

Fault class	Inspection check
Interface faults	• Do all function and method calls have the correct number of parameters? • Do formal and actual parameter types match? • Are the parameters in the right order? • If components access shared memory, do they have the same model of the shared memory structure?
Storage management faults	• If a linked structured is modified, have all links been correctly reassigned? • If dynamic storage is used, has space been allocate correctly? • Is space explicitly deallocated after it is no longer required?
Exception management faults	• Have all possible error conditions been taken into account?

Design Reviews and Program Inspections

PROGRAM INSPECTIONS (PIs)

Appendix 8B Inspection session findings report form

Inspection Session Findings Report

Session dates: _____ The report was prepared by: _____

Project name: _____

The inspected document: _____ Version: _____

The inspected document sections: _____

The inspection team: _____

1 The error list

#	Error type	Error nature (W/M/E)*	Error description	Error location	Error severity
			La		

2 Follow-up decisions

a	Follow-up will be carried out by:
b	Re-inspection is recommended: Yes/No
c	

3 Comments

*W = Wrong M = Missing E = Extra

Procedures

- **Procedures**, as transmitted in documents, are detailed activities or processes to be performed according to a given method for the purpose of accomplishing a task.

Procedures

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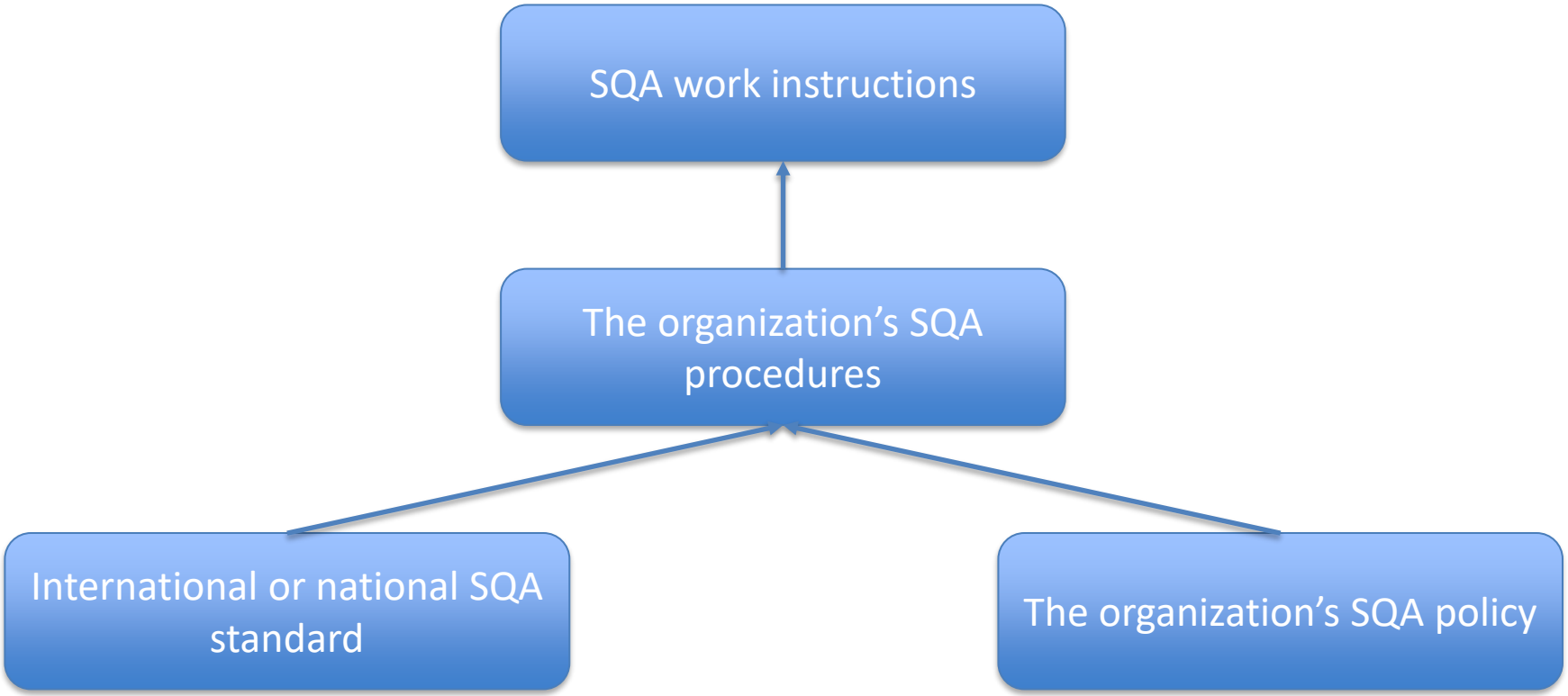
- SQA procedures are required to conform to the organization's quality policy but also tend to conform to international or national SQA standards.

Procedures


SQA work instructions
The organization's SQA procedures
International or national SQA standard
The organization's SQA policy

Procedures

OBJECTIVES

. . . by staff

Procedures

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Why should we use SQA procedures?

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The answers uncover the challenge: *application of the organization's accumulated know-how, experience and expertise.*

Procedures

OBJECTIVES

SQA procedures aim at:

- Performance of tasks, processes or activities in the most effective and efficient way without deviating from quality requirements.
- Effective and efficient communication between the separate staffs involved in the development and maintenance of sw systems.
- Uniformity in performance, achieved by conformity with procedures and work instructions, reduces the misunderstandings that lead to software errors.
- Simplified coordination between tasks and activities performed by the various bodies of the organization. Better coordination means fewer errors.

Procedures

PROCEDURES AND PROCEDURES MANUAL

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  - *Five W's.*

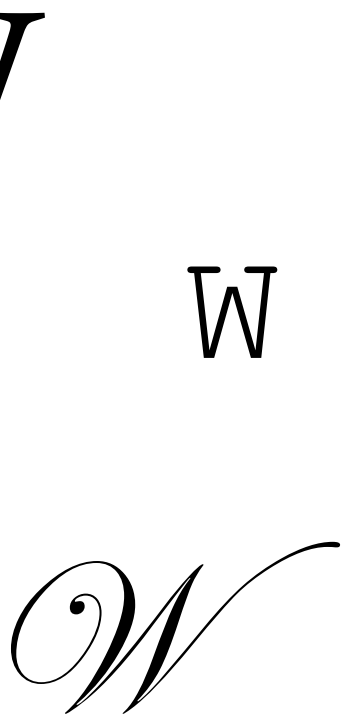
What activities have to be performed?

Ho**W** should each activity be performed?

When should the activity be performed?

Where should the activity be performed?

Who should perform the activity?



Example

DESIGN REVIEW PROCEDURE

1. INTRODUCTION

   A design review is carried out throughout the *Software development projects.*

2. PURPOSE

   The purpose is to define the method for doing a design review.

3. SCOPE

   All software development projects. We could exclude minor projects.

4. APPLICABLE DOCUMENTS

   Project quality plan for sw development projects.

Example

DESIGN REVIEW PROCEDURE

5. METHOD

Step	Activity	Responsibility (performer/approval)	Documentation
A) Preparation of design documents	Preparation of complete draft of design documents	Project leader (PL) / not required (NR)	Draft of design documents
B) Coordination of meeting	- Define list of participants - Coordination of meeting - Delivery of documents to participants	- PL / manager - DR team leader / NR - DR team leader / NR	List of participants and DR invitation letters
C) DR meeting	Agenda	PL / NR	DR minutes
D) DR report	- Preparation - Distribution to participants	- DR team leader / DR team members - DR team leader / NR	DR report
E) Implementation of DR decision	- Implementation - Examination	- Project team / PL - DR team member / NR	- Approval of each correction - Approval of completion of all correction

Procedures

PROCEDURES AND **PROCEDURES MANUAL**

- The *SQA procedures manual* is the collection of all SQA procedures.

- The content for an organization varies according to:
  - Types of software development and maintenance activities.
  - Range of activities.
  - Range of customers and suppliers.
  - Method applied to achieve desired SQA objectives.

Templates and Checklists

- In many cases, we refer to documents prepared in the past to **save time** . . . repetitive tasks are a main objective.

Templates and Checklists

- In many cases, we refer to documents prepared in the past to **save time** . . . repetitive tasks are a main objective.

- **Templates** and **checklists** are simple tools to save time but also, these contribute to SQA.

Templates

- In software engineering: *a format (specially tables of contents) created by units or organizations, to be applied when compiling a report or some other type of document.*

- Its applications may be obligatory for some documents and elective for others.

Example

SOFTWARE TEST REPORT (STR) – Template

1. Test identification, site, schedule and participation
   a) The tested sw identification (name, version and revision)
   b) The documents providing the basis for the tests
   c) Test site
   d) Initiation and concluding times for each session
   e) Team
   f) Other participants
   g) Hours
2. Test environment
   a) HW and firmware configurations
   b) Preparations and training prior to testing
3. Test results
   a) Test identification
   b) Test case results
4. Summary tables for total number of errors
   a) Summary
   b) Comparison with previous results

Templates

CONTRIBUTION TO SW QUALITY

- **Facilitates the process of preparing documents**
  - Saving time and effort while elaborating the report's structure
  - Downloaded
- **Ensures the documents prepared by the developer are more complete**
  - All the subjects to be included in the document have already been defined and repeatedly reviewed by numerous professionals
- **Provides for easier integration of new team members**
  - Documents' standard structure … easier
- **Facilitates review of documents**
  - Eliminate the need to study the structure of the document.

Checklists

- A checklist refers to the *list of items, specially constructed for each type of document, or a menu of preparations to be completed prior to performing an activity*.

Example

CONTRACT DRAFT REVIEW – SUBJECTS CHECKLIST

1. No unclarified issues remain in the contract drat
   a) Supplier's obligations as defined in the contract draft and its appendices.
   b) Customer's obligations as defined in the contract draft ad appendices.

2. All understandings reached subsequently to the proposal are correctly documented
   a) Understandings about the project's functional requirements.
   b) Understandings about financial issues, including payment schedule, bonuses, penalties, etc.
   c) Understandings about the customer's obligations.
   d) Understandings about partner and subcontractor obligations, including the supplier's agreements with external parties.

3. No "new" changes, additions or omissions have entered the contract draft
   a) The contract draft is completed; no contract section or appendix is missing.
   b) No changes, omissions and additions have been entered into the agreed document, regarding the financial issue, the project schedule, or the customer and partners' obligations.

Checklists

CONTRIBUTION TO SW QUALITY

To development teams

- Helps developers carrying out self-checks of documents or software code.
- Assists developers in their preparations for tasks.

To review teams

- Assures completeness of document reviews by review team members as all the relevant review items appear on the list.
- Facilitates improves efficiency of review sessions as the subjects and order of discussion are defined and well known in advance.

Documentation Control

- SW development and maintenance processes **involve** many **documents**.
  - Some are vital immediately for SQA.
  - Others become vital for SQA over the time.

- Where is the documentation?

- Related …
  - Controlled documents
  - Quality record

Documentation Control

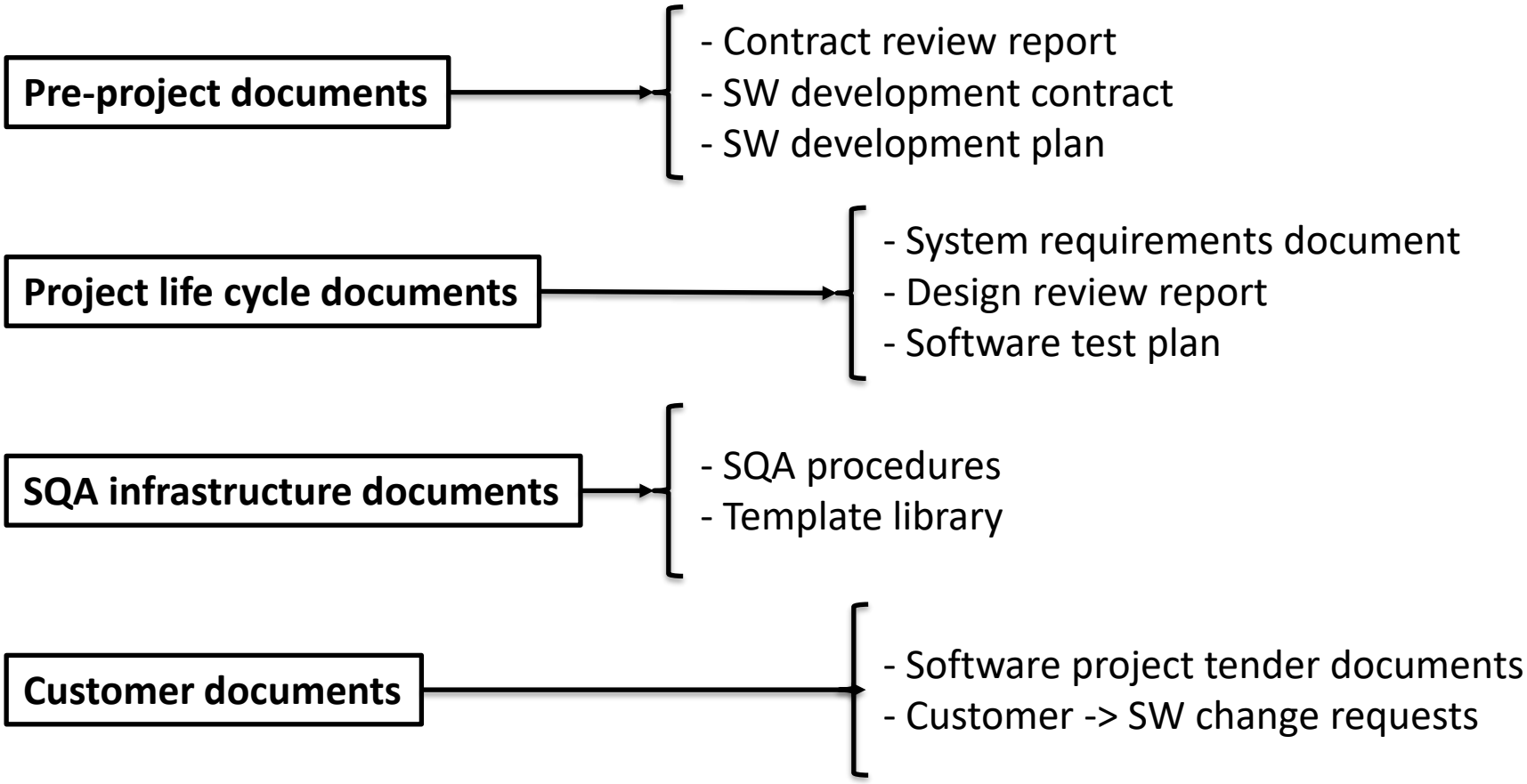
CONTROLLED DOCUMENT

- *A document that is currently vital or may become vital for the development and maintenance of SW systems as well as for the management of current and future relationships with the customer.*

- Objectives
  - To assure the quality of the document.
  - To assure its technical completeness and compliance with document structure procedures and instructions (use of templates, proper signing, etc.)
  - To assure the future availability of documents that may be required for maintenance, development or responses to the customer's complaints.
  - To support investigation of software failure causes.

Documentation Control

CONTROLLED DOCUMENT - Typical



Documentation Control

CONTROLLED DOCUMENT

- The SQA tools that **regulate** the handling of a controlled document are called ***documentation control procedures***.

- Typical components
  - Definition of the list of the documents to be controlled.
  - Document preparation.
    - Structure
    - Identification method (e.g. version)
    - Orientation and reference information
  - Document approval.
    - Who?
    - Approval process
  - Document storage and retrieval requirements.

Documentation Control

QUALITY RECORDS

- *Special type of controlled document. It is a customer-targeted document that may be required to demonstrate full compliance with customer requirements and effective operation of the SQA system throughout the development and maintenance processes.*

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Quality Management and Improvement

Chapter 2
Quality Management

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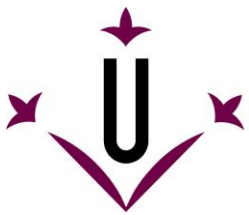

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