Murdoch
UNIVERSITY

IT Project Management

Topic 6

Quality Management

READING

Schwalbe Chapter 8

LEARNING OBJECTIVES

At the end of this topic you should be able to:

- ✓ ***Discuss*** the **importance** of project quality management (Quality Assurance & Quality Control) for IT products and services
- ✓ ***Define*** project quality management and ***explain*** the relationship of quality planning to project scope management
- ✓ ***Describe*** what factors relate to improving quality in IT projects and how they do so
- ✓ ***Apply*** some of the tools and techniques for quality control

TODAY'S SESSION IS IN 3 PARTS

INTRODUCTION
(WHAT IS QUALITY MANAGEMENT & WHY IS IT IMPORTANT?)

KEY CONCEPTS & PRINCIPLES

THE QUALITY MANAGEMENT PROCESS

AN INTRODUCTION TO QUALITY MANAGEMENT

INTRODUCTION
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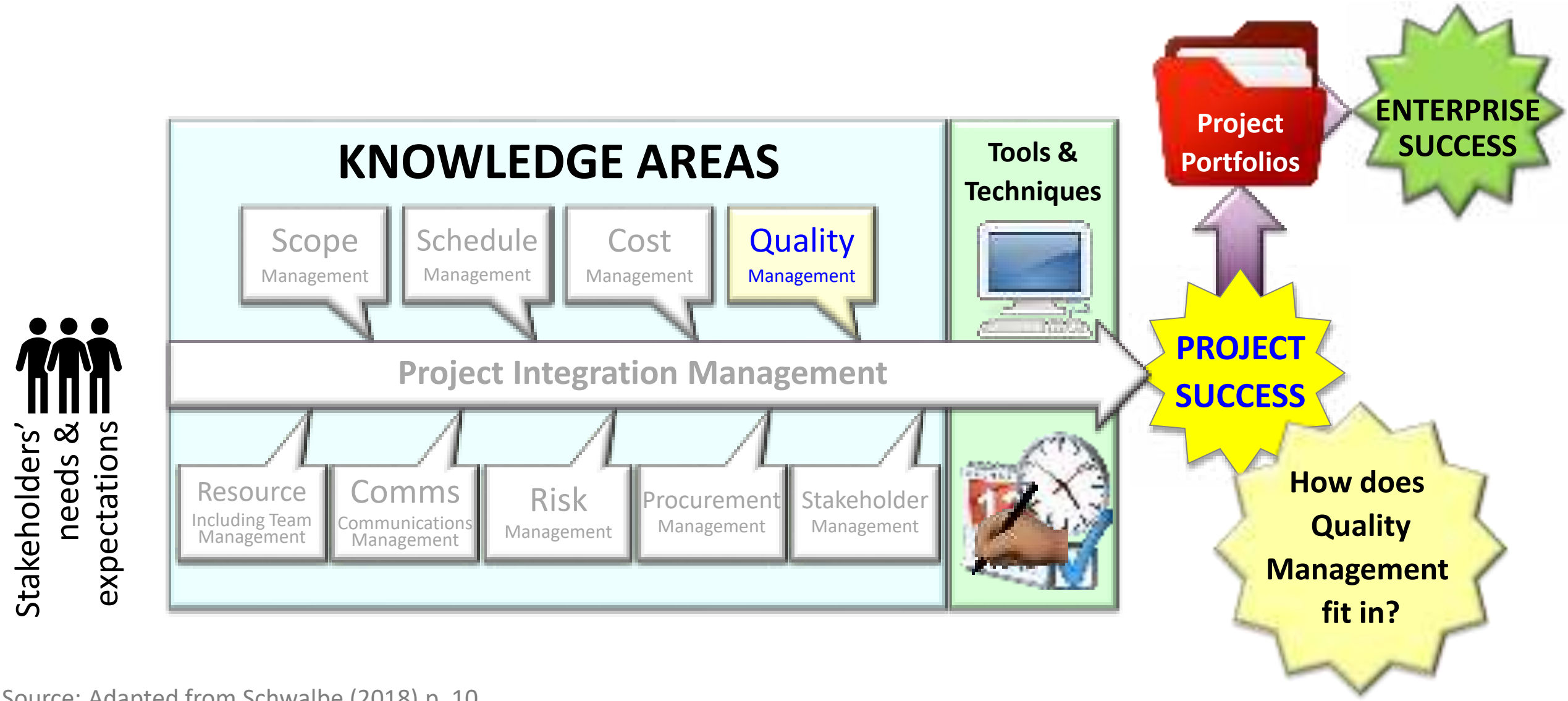
KEY CONCEPTS & PRINCIPLES

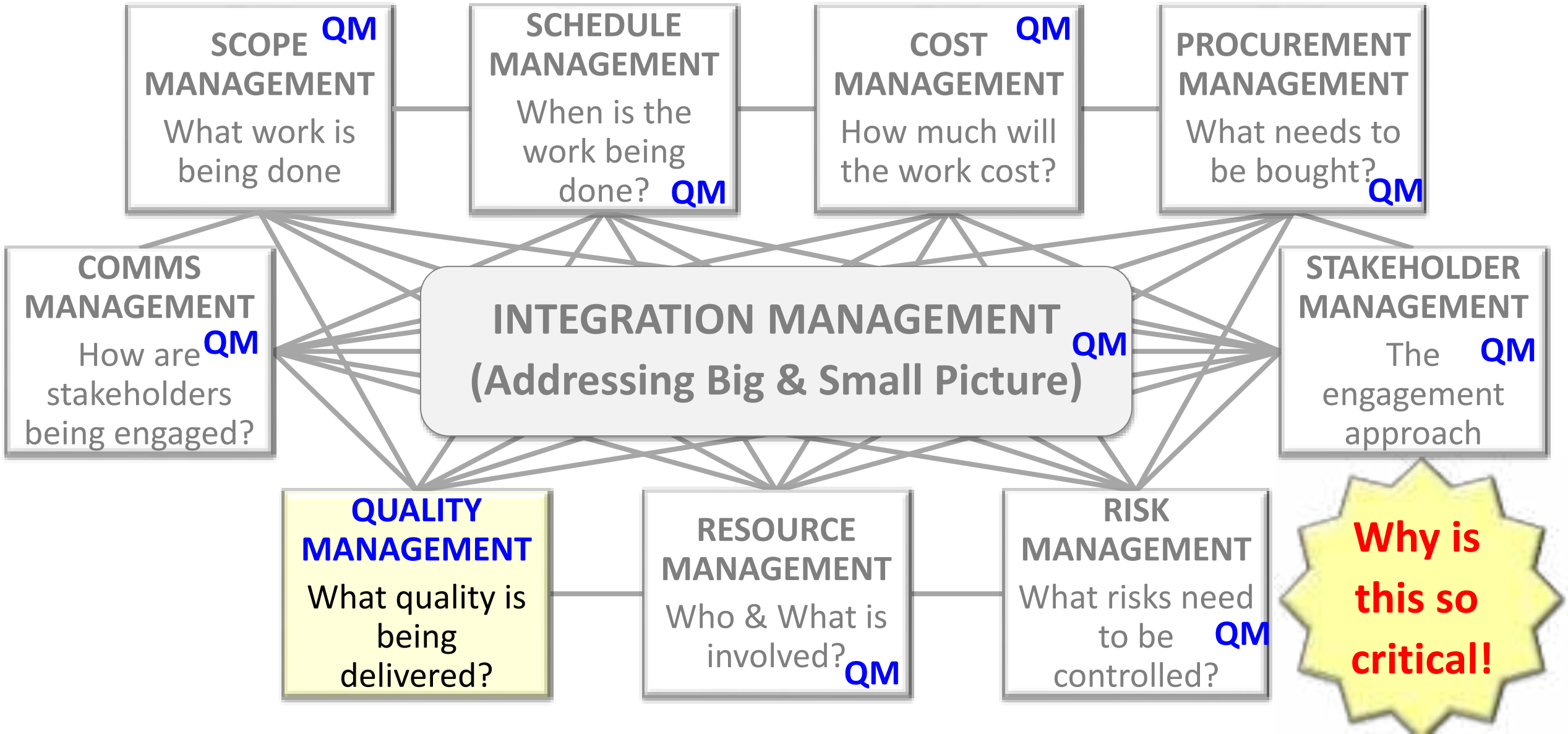
THE QUALITY MANAGEMENT PROCESS

OVERVIEW - PMBOK APPROACH



Source: Adapted from Schwalbe (2018) p. 10

THE KNOWLEDGE AREAS



WHAT IS QUALITY?

Achieved through Project Quality Management (PQM)

According to the ISO **(International Organisation for Standardisation)** it is...

...the degree to which a set of inherent characteristics fulfils requirements (ISO9000)

✓ It can be defined in terms of:

- Conformance to requirements **(does it actually do what it is supposed to do)**
- Fitness for use **(can it be used as it was intended in all required situations)**

WHAT IS PQM?

Why is it so important?

It is a series of integral processes designed to ensure that 'all project activities necessary to design, plan and implement a project are effective and efficient' and…

… ensures that deliverables will:

- ✓ conform to requirements, and
- ✓ be fit for use

Source: PMBoK 6th Edition

OUTCOMES FROM POOR PQM

1. Rework/Repair **(fix deliverables)** – **Huge costs**
2. Bad decisions **(poor information leads to blow outs)**
3. Troubleshooting **(time consuming/costly to respond to problems and identify/resolve issues)**
4. Poor morale **(leads to poor work & costs)**
5. Client dissatisfaction **(Product/service mistrust = business goes broke)**

Source: https://www.theicpm.com/blog/item/5595-costs-of-poor-quality

WHAT DOES THIS COST?

For the US in 2018 for software projects alone:

$2,260,000,000,000 in losses

Source: https://it-cisq.org/wp-content/uploads/2018/10/The-Cost-of-Poor-Quality-Software-in-the-US-2018-Report.pdf

KEY CONCEPTS & PRINCIPLES

INTRODUCTION
(WHAT IS QUALITY MANAGEMENT & WHY IS IT IMPORTANT?)

KEY CONCEPTS & PRINCIPLES

THE QUALITY MANAGEMENT PROCESS

WHAT ARE WE GOING TO COVER

Key Terms ***Key Standards*** ***Key Principles***

Let’s look at each of these in more detail

KEY TERMS

UNDERSTANDING SOME KEY TERMS

- ✓ **Quality** = The degree to which a set of inherent characteristics fulfil user requirements (e.g. number of defects)
- ✓ **Grade** = A categorisation of deliverables based on the provision of functionality or features (e.g. lots or few features)

You can have:

Low grade **(few high end features)** and high quality **(no defects)**; or

High grade **(lots of features)** with low quality **(lots of defects) – This latter is most unacceptable (hence focus on Quality)**

Sources: PMBoK 6th Edition, ISO9000

UNDERSTANDING SOME KEY TERMS

- ✓ **Quality Assurance (QA).** QA aims to optimise processes and methods. In other words, the goal is to make sure that the team is doing the right things the right way *(Process Focus/Measures)*
- ✓ **Quality Control (QC).** QC is focussed on ensuring that what is provided as deliverables will meet the required standards *(Outputs Focus/Measures)*

Sources: PMBoK 6th Edition, ISO9000

UNDERSTANDING SOME KEY TERMS

- ✓ **Continuous Improvement.** A proactive and ongoing effort to improve products, services & processes *(typically incremental)*
- ✓ **Quality Audit.** A (formal) review used to identify issues and lessons learnt for use in current and future projects *(supports Continuous Improvement & QA)*
- ✓ **Key Performance Indicators (KPIs).** These are quantifiable measures used to evaluate the success in meeting objectives for performance

Sources: PMBoK 6th Edition, ISO9000

UNDERSTANDING SOME KEY TERMS

- ✓ ***Benchmarking.*** Identifying options for optimising QA/QC by drawing on available standards and previous experience *(e.g. earlier projects or what has been done before by other organisations)*
- ✓ **Best Practice.** Processes and methods that are identified as being correct and most effective **(sometimes Worlds Best Practice)**

Be careful not to apply solutions and systems that are not applicable to your situation

Sources: PMBoK 6th Edition, ISO9000

KEY STANDARDS

- ✓ System Quality Measures
- ✓ Quality Standards

3 KEY SYSTEM QUALITY (QC) MEASURES

- ✓ **Reliability.** Continuous operation measures (% of uptime)

RELIABILITY - MINIMUM UPTIMES PER ANNUM		
This Standard is Called	**What it means for uptime**	**Maximum downtime PA**
Two nines	99%	87.6 hours
Five nines	99.999%	5 mins 15 sec
Nine nines	99.9999999%	0.03 seconds

- ✓ **Compliance.** Compliance to standards & mandated requirements

Satisfaction – This is a prime issue

KEY STANDARDS

- ✓ Overarching QM Standards (ISO9000) **(Family of Standards)**
  - ➢ ISO9000:2015 - Explains the framework and vocabulary for QM
  - ➢ ISO9001: 2015 – QM system requirements (mandated standards)
  - ➢ ISO9004: 2018 – QM systems (Continuous Improvement)
  - ➢ ISO19011: 2018 – Guidelines for Auditing QM systems
- ✓ ISO 33001:2015 (**Information Technology Process Assessments**) – Technical Standards

KEY STANDARDS

- ✓ There are lots of other ISO standards

The repository is maintained by the International Organisation for Standardisation (ISO)

You can find it at this web address

https://www.iso.org/standards-catalogue/browse-by-ics.html

In particular look at the 33 & 35 groups

KEY STANDARDS

- ✓ There are also country specific standards

For example Standards Australia manages AS/NZ standards

You can find it at this web address

https://www.standards.org.au/standards-catalogue

Search for the standards appropriate for your project

KEY STANDARDS

- ✓ There are also technical procedures/systems

PERSONAL QUALIFICATION

Microsoft CERTIFIED Professional

COVERS MOST KEY ASPECTS OF DESIGN

ORGANISATIONAL QUALIFICATION

Microsoft Partner

ORACLE Certified Associate

PERSONAL QUALIFICATION

CISCO CERTIFIED SPECIALIST

Java ORACLE

ORGANISATIONAL QUALIFICATION

CISCO PARTNER Registered

PHP

They require compliance with their procedures/standards

KEY STANDARDS

- ✓ And there are key Project Management Standards, which include:
  - ➢ Project Management Body of Knowledge
  - ➢ Provides standard terminologies, frameworks, processes & methods (5 Process Groups/10 Knowledge Areas)
  - ➢ Used by about 41% of ICT companies globally

KEY STANDARDS

- ✓ And there are key Project Management Standards, which include:

- ➢ **PR**ojects **IN** **C**ontrolled **E**nvironments PRINCE2®
- ➢ Many similarities to PMBoK but different approach
  (Splits into principles/themes: Business Case/Organisation/ **Quality**/Plan/Risks/Change/Progress)
- ➢ Used widely in Australia/UK/Europe **(mandated by many Government Departments)**

KEY STANDARDS

- ✓ And there are key Project Management Standards, which include:

- ➢ **I**nformation **T**echnology **I**nfrastructure **L**ibrary
- ➢ IT Service Management (ITSM) framework **(full lifecycle coverage)**
- ➢ Used widely in Australia/UK/Europe **(mandated by many Governments)**

OTHER KEY STANDARDS

And there are many other standards around the globe, mandated by:

- ✓ Different governments
- ✓ Different organisations **(particularly large ICT organisations)**

You need to capture these in your QM Plan

KEY PRINCIPLES

- ✓ The focus of Quality
- ✓ A key process (Plan, Do, Check, Act: (PDCA))
- ✓ Understanding the Cost of Quality

- ✓ Responsibility for Quality
- ✓ A key approach to achieving Quality (Testing)

THE FOCUS OF QUALITY PRINCIPLES

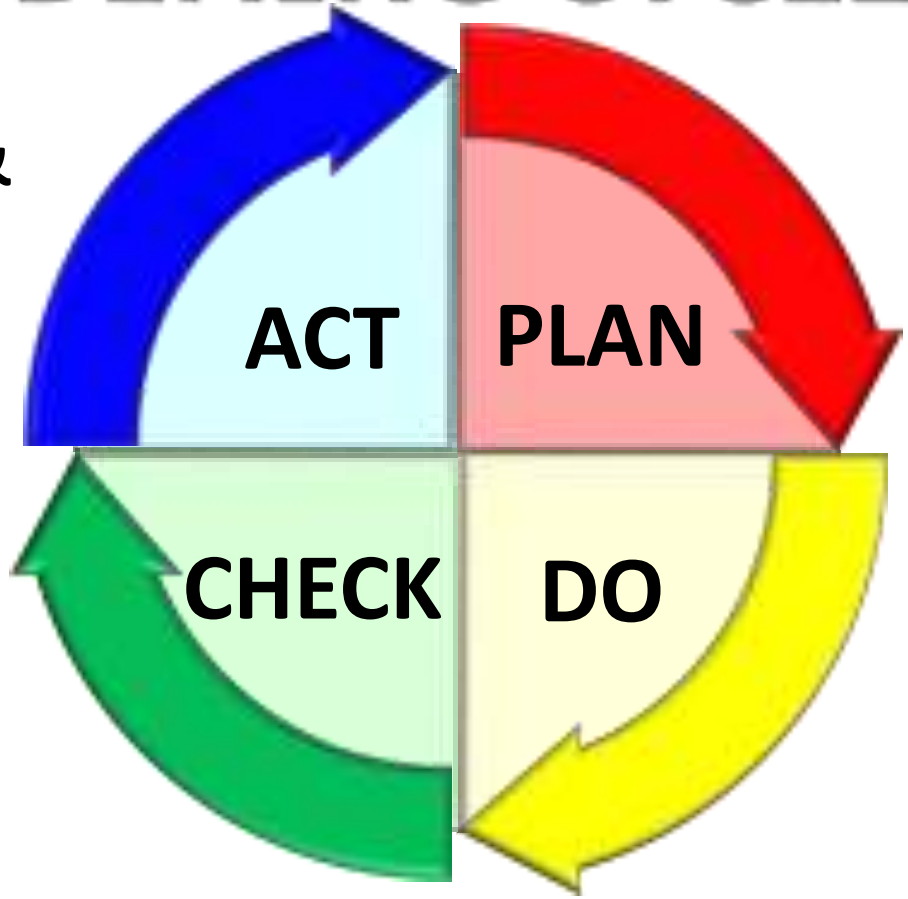
- ✓ Define and satisfy user needs
- ✓ Prevent rather than inspect
- ✓ Proactive rather than reactive
- ✓ Validate project processes
- ✓ Measure against approved standards
- ✓ Continually improve
- ✓ Be accountable

This is normally managed through the PDCA cycle

(Often called the Deming Cycle)

A KEY PROCESS (PDCA) – DEMING CYCLE

- ✓ **Plan:** Establish the objectives & processes needed to deliver quality
- ✓ **Do:** Implement the processes
- ✓ **Check:** Monitor & measure the process & report
- ✓ **Act:** Take actions to continually improve



The level of effort is driven by a key balance

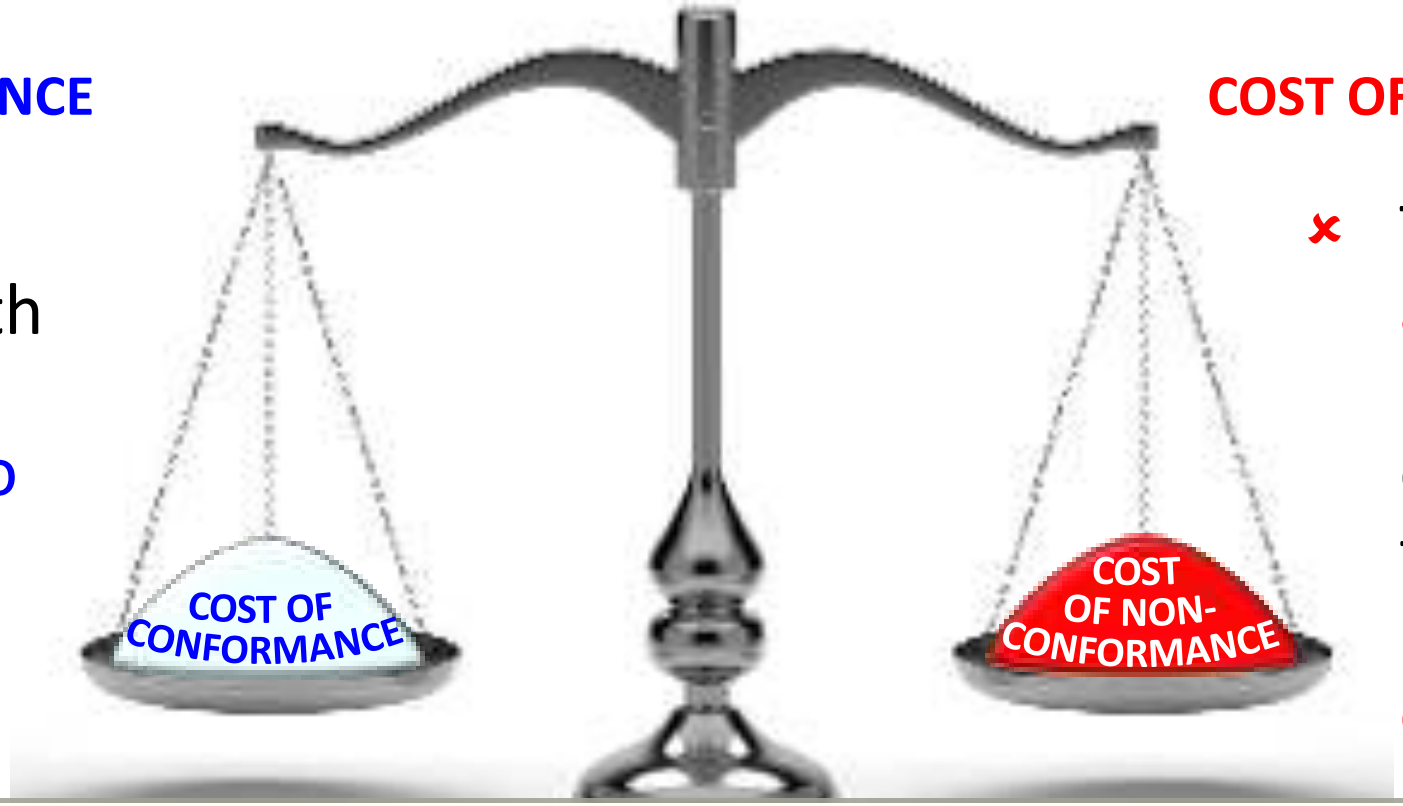
(based on the Cost of Quality)

COST OF QUALITY

- ✓ This encapsulates the need to find the right balance between…

COST OF CONFORMANCE

- ✓ The costs associated with providing the deliverables to the required standards



COST OF NON-CONFORMANCE

- ✗ The costs associated with providing deliverables that do not meet the quality expectations

IMPLEMENT THE QA/QC TASKS THAT REFLECT THE REQUIRED BALANCE

WHOSE RESPONSIBILITY IS QA/QC?

RESPONSIBILITY FOR QUALITY

- ✓ Key responsibilities for quality must be supported as follows:
  - **Project Manager.** *Holds ultimate responsibility and must oversee the implementation of the processes*
  - **Quality Team.** *Depends on the size of the project (often a key part of the Project Office)*
  - **Test Team.** *Responsible for developing and implementing testing regimes (particularly Integration, System & Acceptance)*
  - **Everyone.** *Responsible for implementing the Quality Assurance & Quality Control systems pertinent to them*

TYPES OF QC TESTING

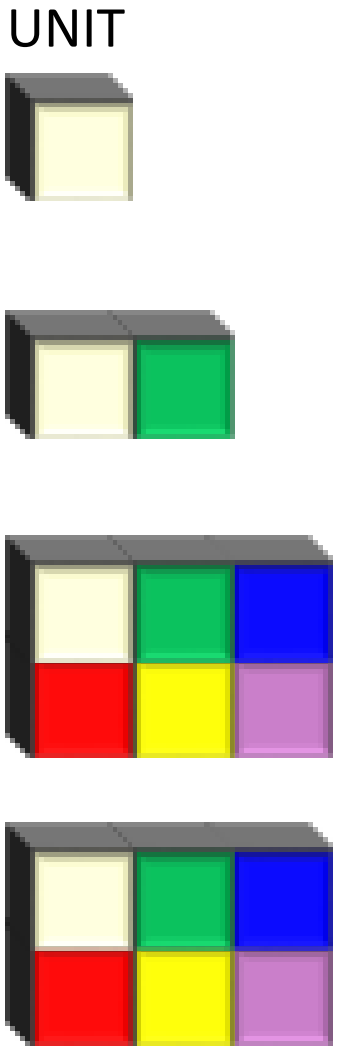
There are two broad categories of Testing, which are:

THESE ARE INTEGRAL & OFTEN INTEGRATED

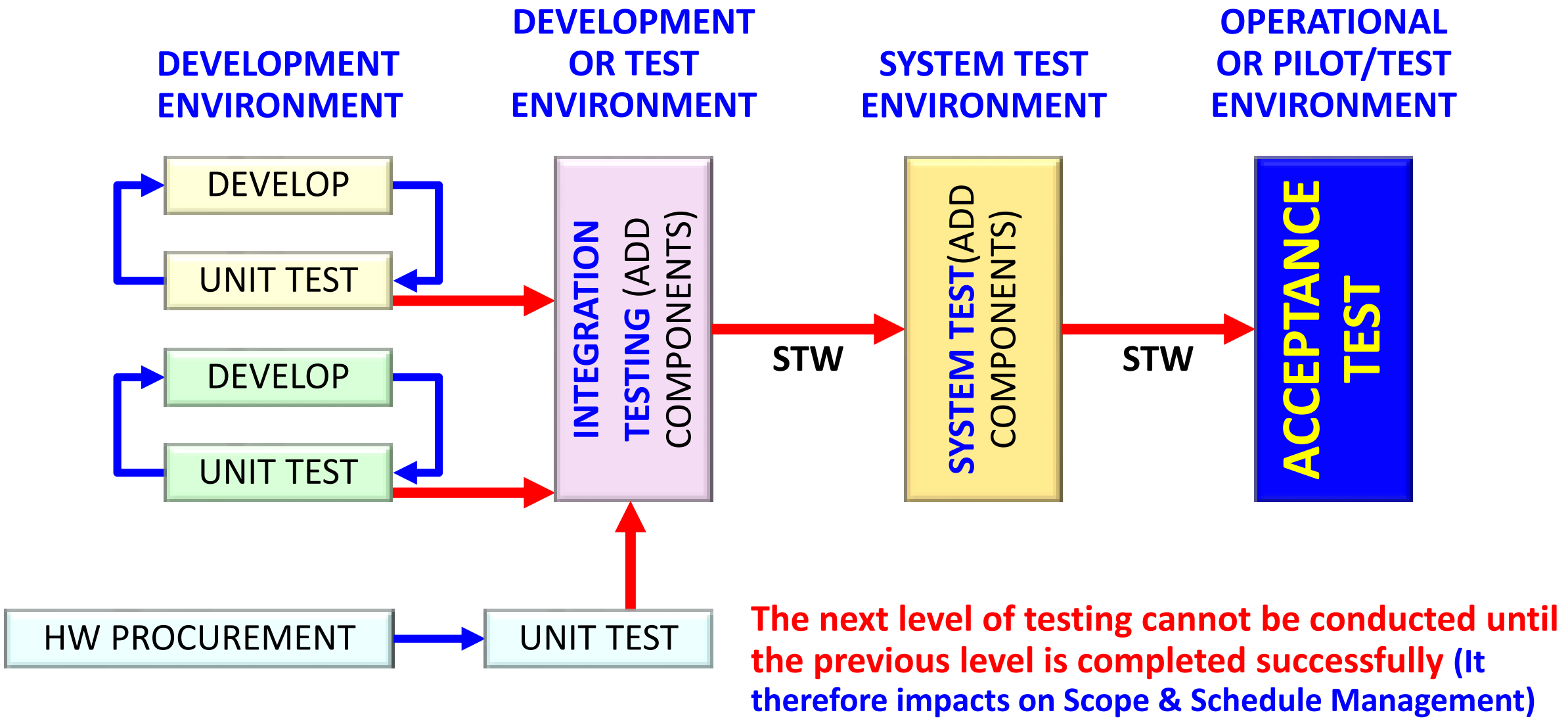
- ✓ **Functional Testing.** **Testing behaviour/execution – what it does – e.g.**
  - **Functionality** is the degree to which a system performs its intended function
  - **Features** are the system's special characteristics
- ✓ **Non-Functional Testing.** **Tests how well it does it – for example:**
  - **Performance** addresses how well a product or service performs the users' requirements (e.g. how well does it perform in their real-world)
  - **Reliability** is the ability of a product or service to perform as expected under normal conditions
  - **Maintainability** addresses the ease of performing maintenance on a product

STAGES IN A QC FRAMEWORK

- ✓ Linked to key **Functional Tests**, which are:
  - **Unit Testing.** *This involves the testing of individual units (e.g. software, hardware, etc.)*
  - **Integration Testing.** *This is where individual units are integrated and tested together to make sure they work as designed/required*
  - **System Testing.** *This is a full system test that includes all of the required elements*
  - **Acceptance Testing.** *This is a full systems test against acceptance criteria (handover-UAT)*



AN EXAMPLE TEST REGIME



The next level of testing cannot be conducted until the previous level is completed successfully (It therefore impacts on Scope & Schedule Management)

APPLYING VARIOUS NON-FUNCTIONAL TESTS

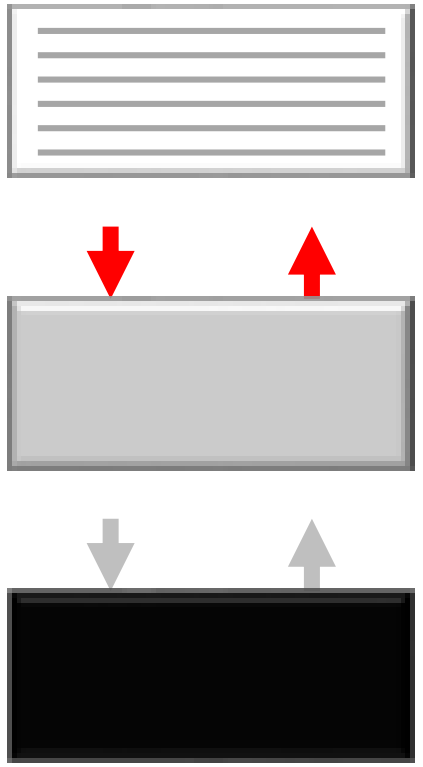
- ✓ These include:
  - **Availability** is the degree to which a system is actually available through its operating cycle (probability that it will run when required)
  - **Compatibility Testing.** Forward/Backward system element compatibility
  - **Compliance Testing.** Tests against standards & requirements
  - **Configuration Testing.** Validates that system elements are compliant with configuration requirements
  - **Interoperability Testing.** Checks that the system components can interoperate
  - **Recoverability Testing.** How well system elements can recover after a crash

APPLYING VARIOUS NON-FUNCTIONAL TESTS

- ✓ These include:
  - **Security Testing.** Test for security flaws **(break-in, etc.)**
  - **Performance** addresses how well a product or service performs the users' requirements (e.g. how well does it perform in real conditions)
    - **Load Testing.** Performance testing under real-world situations
    - **Stress Testing.** Performance testing to max capacity **(breakpoint)**
    - **Endurance Testing.** How long it can sustain continuous expected load
    - **Spike Testing.** Testing to extreme load/demand fluctuations
  - **Regression Testing.** Check that recent changes have not affected other aspects of the system **(mostly used for software)**
  - **Usability Testing.** Tests usability/intuitiveness of a system

A KEY LIMITATION TO KEEP IN MIND

- ✓ Testing approaches are directly affected by the project team's access to systems
- ✓ These are broadly classified as:
  - **White Box.** You have access to all code and system elements
  - **Grey Box.** You only have limited access to understand/manipulate the code/system
  - **Black Box.** You do not have access to allow understanding of what is happening inside the code/system



THE QUALITY MANAGEMENT PROCESS

INTRODUCTION
(WHAT IS QUALITY MANAGEMENT & WHY IS IT IMPORTANT?)

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THE QUALITY MANAGEMENT PROCESS

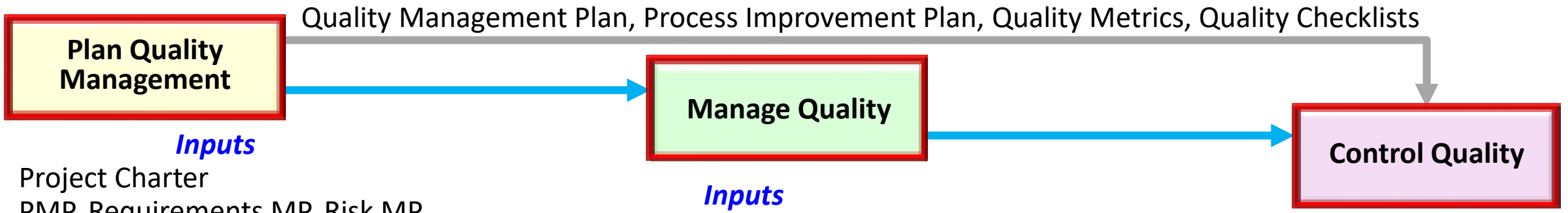
QUALITY MANAGEMENT PROCESSES

1. **Plan Quality Management.** Identifying and documenting relevant quality standards and how to achieve them

2. **Manage Quality.** Translating the plan into executable quality activities that align with the organisation's policies

3. **Control Quality.** Monitoring & evaluating processes & system deliverables to ensure that they meet standards & requirements

RELATIONSHIP BETWEEN THE STEPS?



Inputs

- Project Charter
- PMP, Requirements MP, Risk MP, Stakeholder Engagement Plan, Scope Baseline, etc.
- Other Project Documents (Risk Register, Assumptions Log, etc.)
- EEF & OPA

Tools & Techniques

- Expert Judgement
- Data Analysis (Cost benefit)
- Decision making
- Test & Inspection planning
- Meetings

Outputs

- Quality Management Plan (QMP)
- Quality metrics
- Project documentation updates

Inputs

- PMP & QMP
- Project documents (e.g. Lessons learnt, Risk reports, Quality metrics)
- OPA

T&T

- Checklists
- Data analysis (Range of methods)
- Decision making (Data representation, Design for X, Problem solving)
- QA/QC Methods (including Audits)

Outputs

- Quality reports & test/evaluation documents
- Change requests
- Document updates

Inputs

- PMP, QMP & Other project documents
- Approved Change Requests
- Deliverables & work performance data
- EEF & OPA

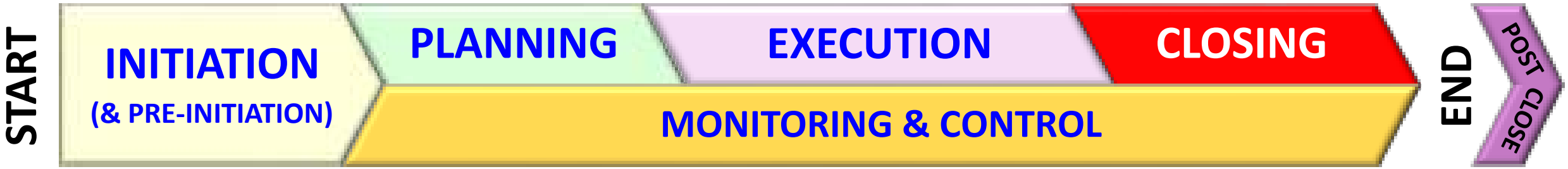
T&T

- Data gathering (various methods)
- Data representation & analysis
- Testing, Inspection and Evaluation
- Meetings

Outputs

- QC measures & Work performance info
- Verifiable deliverables
- Change Requests
- Document updates

WHEN DO THESE STEPS GET DONE?



Plan Quality Management

Set the plans in place early (including test planning)

Manage Quality

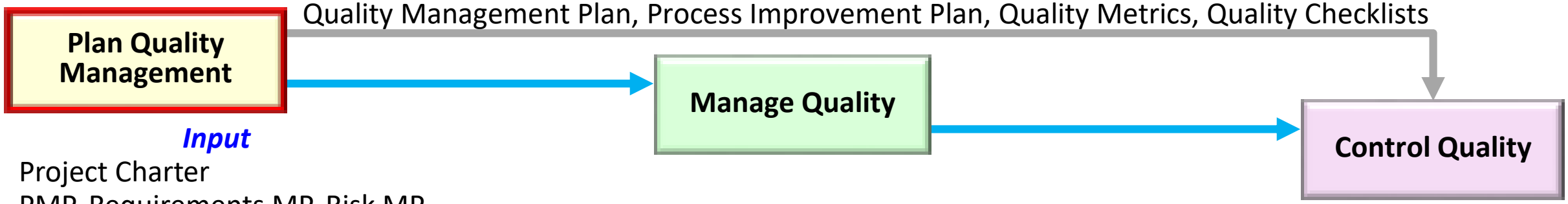
Coordinate the implementation of the plan

Control Quality

Implement the various iterative processes to achieve the required quality

Let’s look at the steps in more detail

PLAN QUALITY MANAGEMENT



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PLAN QUALITY MANAGEMENT

- ✓ Proactively plan and document how Quality objectives will be achieved throughout the life of the project
- ✓ This involves:
  - ➢ Identifying internal & external standards to be met (ISO, legal/legislative, internal, technical, external/client)
  - ➢ Working out how the standards will be tested/measured
  - ➢ Defining procedures for Quality Assurance and Quality Control
  - ➢ Documenting the framework so it can be used effectively

IT LINKS MANY ASPECTS

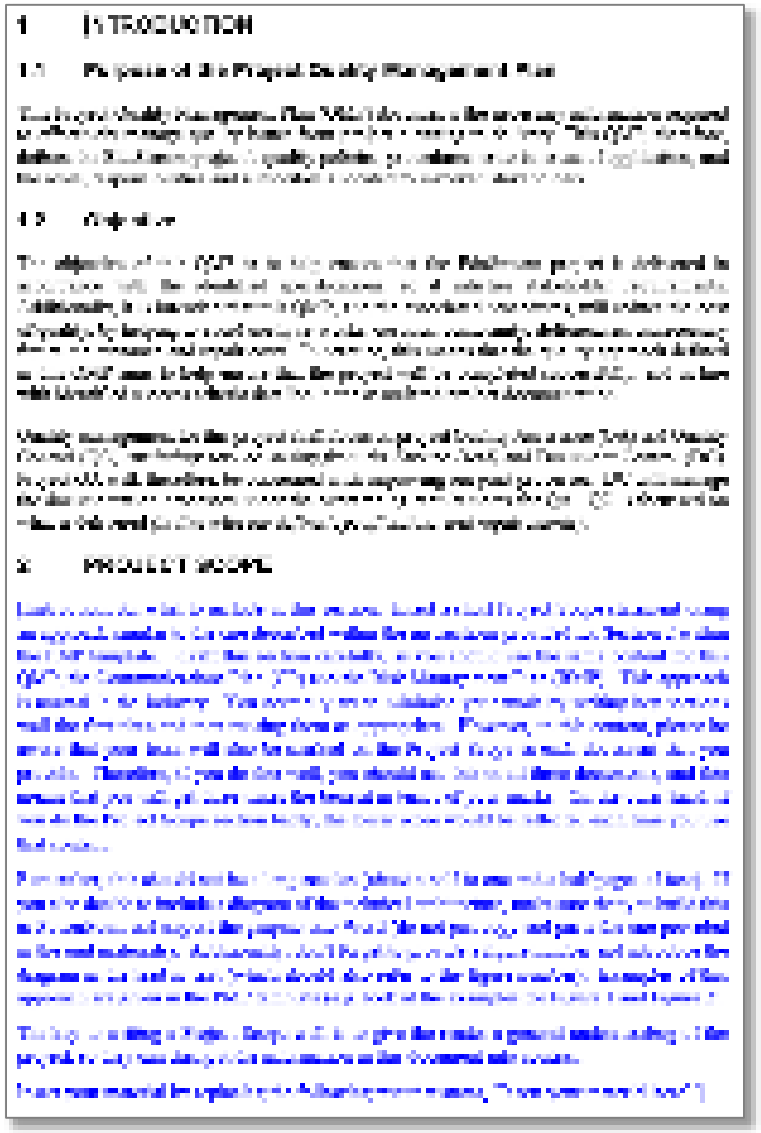
QUALITY MANAGEMENT PLAN

- ✓ A good Quality Management Plan includes:
  - ➢ Clear objectives and guidance on why it should be applied
  - ➢ Information on QA/QC team responsibilities
  - ➢ Detailed information on how QA/QC will be managed **(including auditing, reporting, monitoring and testing regimes)**
  - ➢ Clear definitions regarding the quality standards and Key Performance Indicators that are to be met **(for ICT systems and Team members)**

Team Members need to read, understand, and sign-off that they will comply with these standards

AN EXAMPLE QMP TEMPLATE

This is the one you will be using for Assignment 2



1 INTRODUCTION

1.1 Purpose of this Project Quality Management Plan

1.2 Objectives

2 PROJECT SCOPE

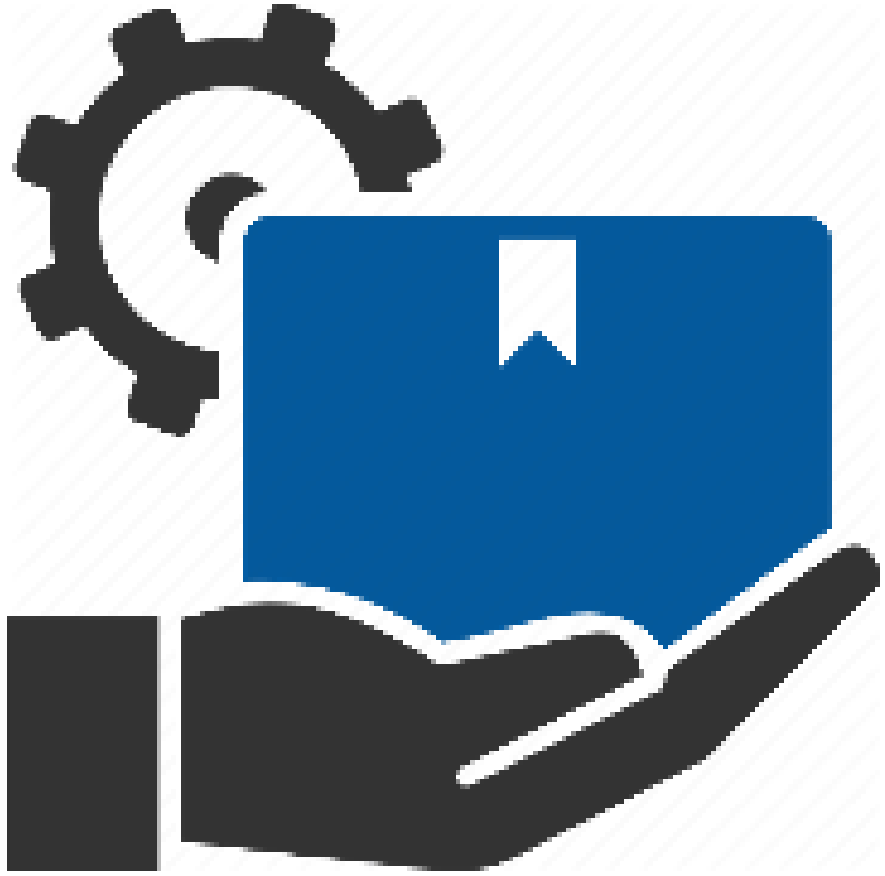
We will work through this during the Topic 6 Workshops

HOW TO DEVELOP THE CONTENT

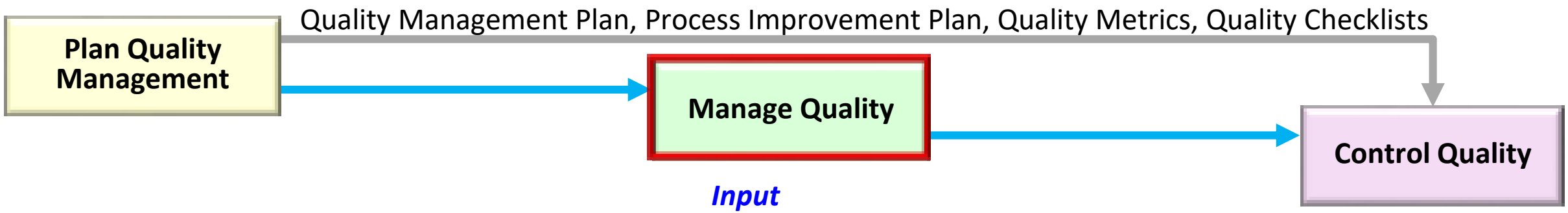
- ✓ Expert judgement **(Meetings, Brainstorming, Interviews)**
- ✓ Benchmarking
- ✓ Data Analysis **(Cost benefit analysis & Cost of Quality Analysis)**
- ✓ Data representations **(flowcharts, logic models, matrix diagrams, mind mapping, etc.)**
- ✓ Decision making

OTHER OUTPUTS

- ✓ Process Improvement Plan
- ✓ Quality Metrics
- ✓ PMP, RMP, Scope, Cost, Schedule updates
- ✓ Other project document updates
  (Lessons learnt, Requirements Tracability, Risk Register, etc.)



MANAGE QUALITY



Input

- PMP & QMP
- Project documents (e.g. Lessons learnt, Risk reports, Quality metrics)
- OPA

T&T

- Checklists
- Data analysis (Range of methods)
- Decision making (Data representation, Design for X, Problem solving)
- QA/QC Methods (including Audits)

Outputs

- Quality reports & test/evaluation documents
- Change requests
- Document updates

MANAGE QUALITY

- ✓ Focussed on coordinating QM processes :
  - Checklists
  - Audits
  - Data Representation & Analysis
  - Problem solving through QM methodologies
  - Applying frameworks for Continuous Improvement and development/application of Best Practices

There are a range of different approaches utilised, which include…

Design for X

Design for Excellence (DFX)

- ✓ It provides a placeholder for designing different aspects **(each is an X)**
- ✓ Focus singly and jointly on each X **(sometimes its a trade-off)**
- ✓ Identify resources, activities, processes, methods, developments, etc. required to achieve Excellence for X

DFX is becoming more popular in ICT

(But there are lots of different variations)

SIX SIGMA

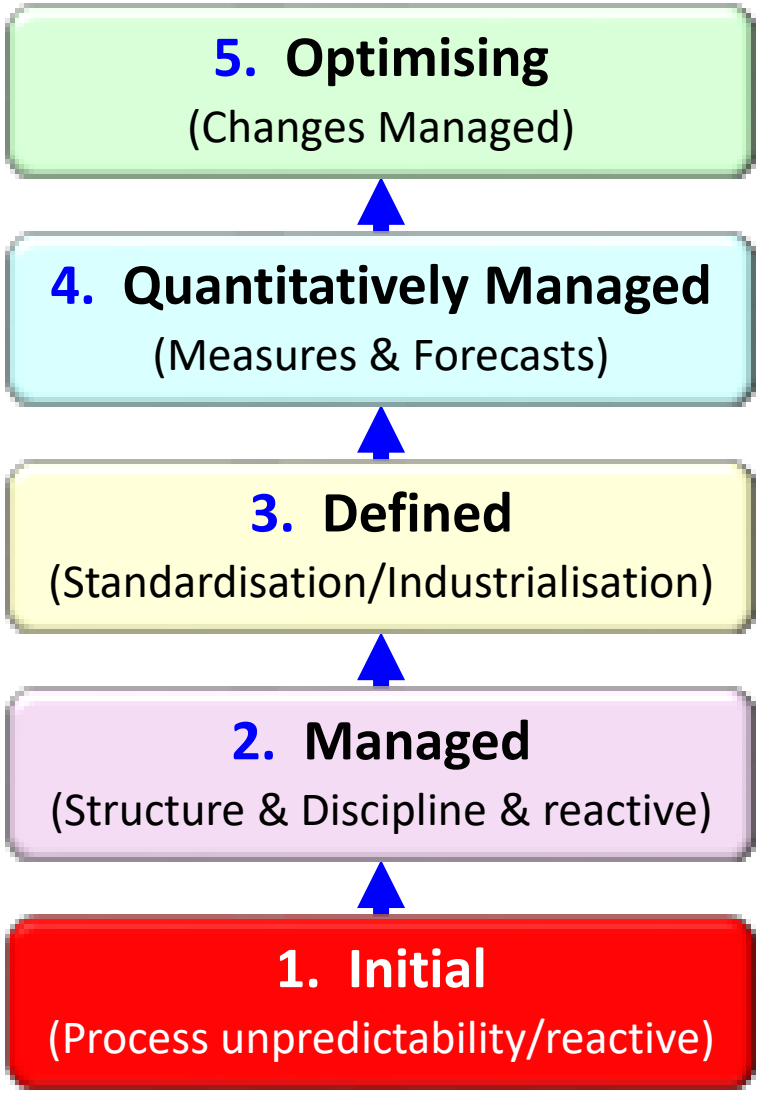
6σ provides tools & techniques

- ✓ Aims for 99.99966% defect free
- ✓ Aims to identify causes of defects by minimising variability in processes
- ✓ Utilises statistical modelling based on Standard Deviation
- ✓ Applies defined steps to: reduce cycle time, reduce unwanted outcomes, etc.

CMMI

Capability Maturity Model Integration

- ✓ Process level improvement program
- ✓ Has a clear Ensuring Quality (ENQ) focus **(Requirement development & Management (RDM), Process Quality Assurance (PQA), Validation & Verification (VV) & Peer Reviews (PR))**
- ✓ Also addresses other aspects **(Engineering & Developing Products (EDP), Selecting & Managing Suppliers (SMS), Planning & Managing Work (PMW), Managing Workforce (MWF), etc.)**



LEAN

Based on 5 LEAN Principles

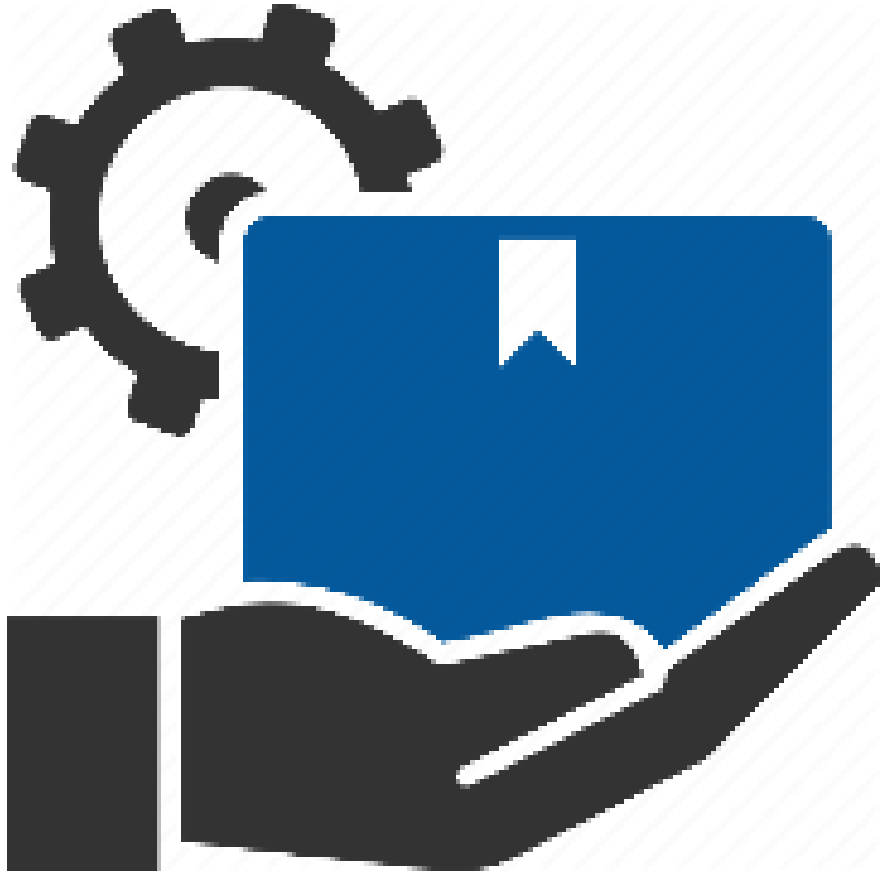
1. Define value **(from client/user perspective – what will they pay for)**
2. Map what creates client value **(what steps add value & what don't)**
3. Create flow-looks at streamlining **(after wasteful activities are removed)**
4. Establish pull is used to provide resources Just-in-Time **(create savings)**
5. Pursue Perfection = focus on Continuous Improvement

A range of statistical analysis techniques support these approaches

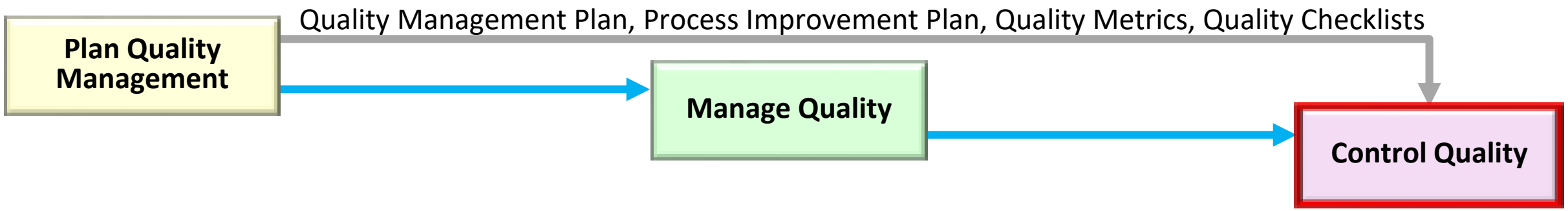
We'll discuss some of these as a part of Control Quality

OUTPUTS

- ✓ Quality Reports
- ✓ Test & Evaluation documents
- ✓ Change requests
- ✓ PMP, RMP, Scope, Cost, Schedule updates
- ✓ Other project document updates **(Issue log, Lessons Learnt, Risk Register, etc.)**



CONTROL QUALITY



Input

- PMP, QMP & Other project documents
- Approved Change Requests
- Deliverables & work performance data
- EEF & OPA

T&T

- Data gathering (various methods)
- Data representation & analysis
- Testing, Inspection and Evaluation
- Meetings

Outputs

- QA/QC measures & Work performance info
- Verifiable deliverables
- Change Requests
- Document updates

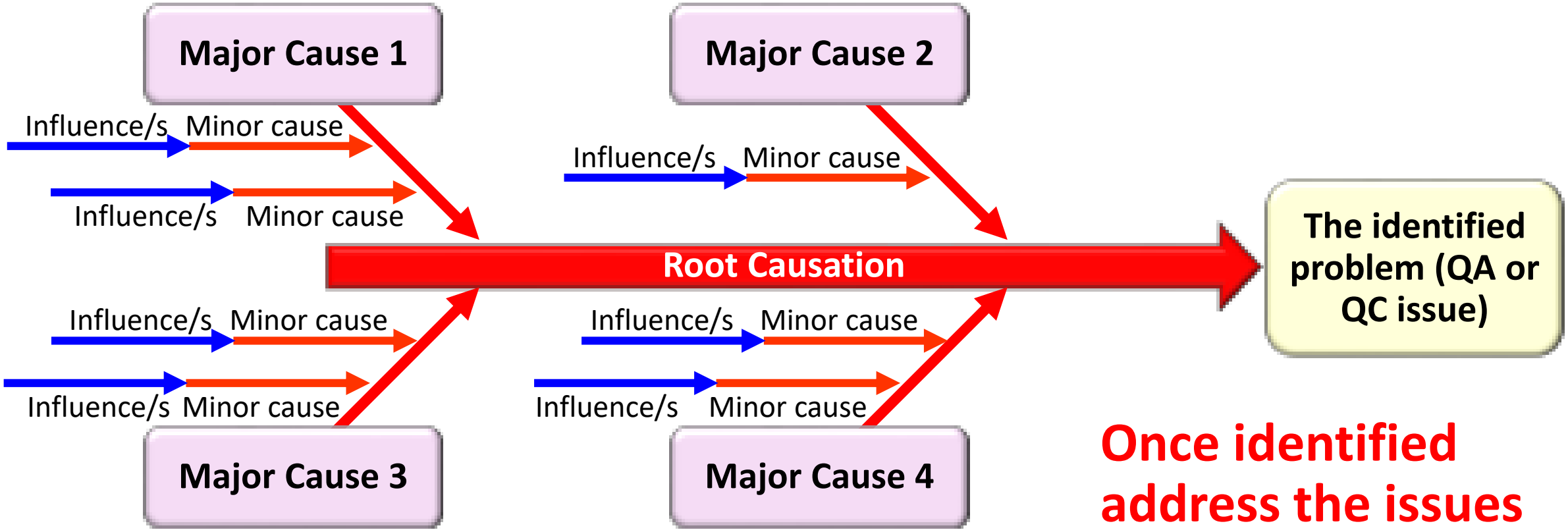
CONTROL QUALITY

- ✓ These processes are used to monitor, measure and control QA and QC methods
- ✓ Requires effective monitoring **(inputs, processes & outputs – deliverables)**
- ✓ Effective data gathering and inspections are essential
- ✓ Proactive analytics & analysis is essential

Here are some of the commonly used techniques

1. CAUSE-AND-EFFECT DIAGRAMS

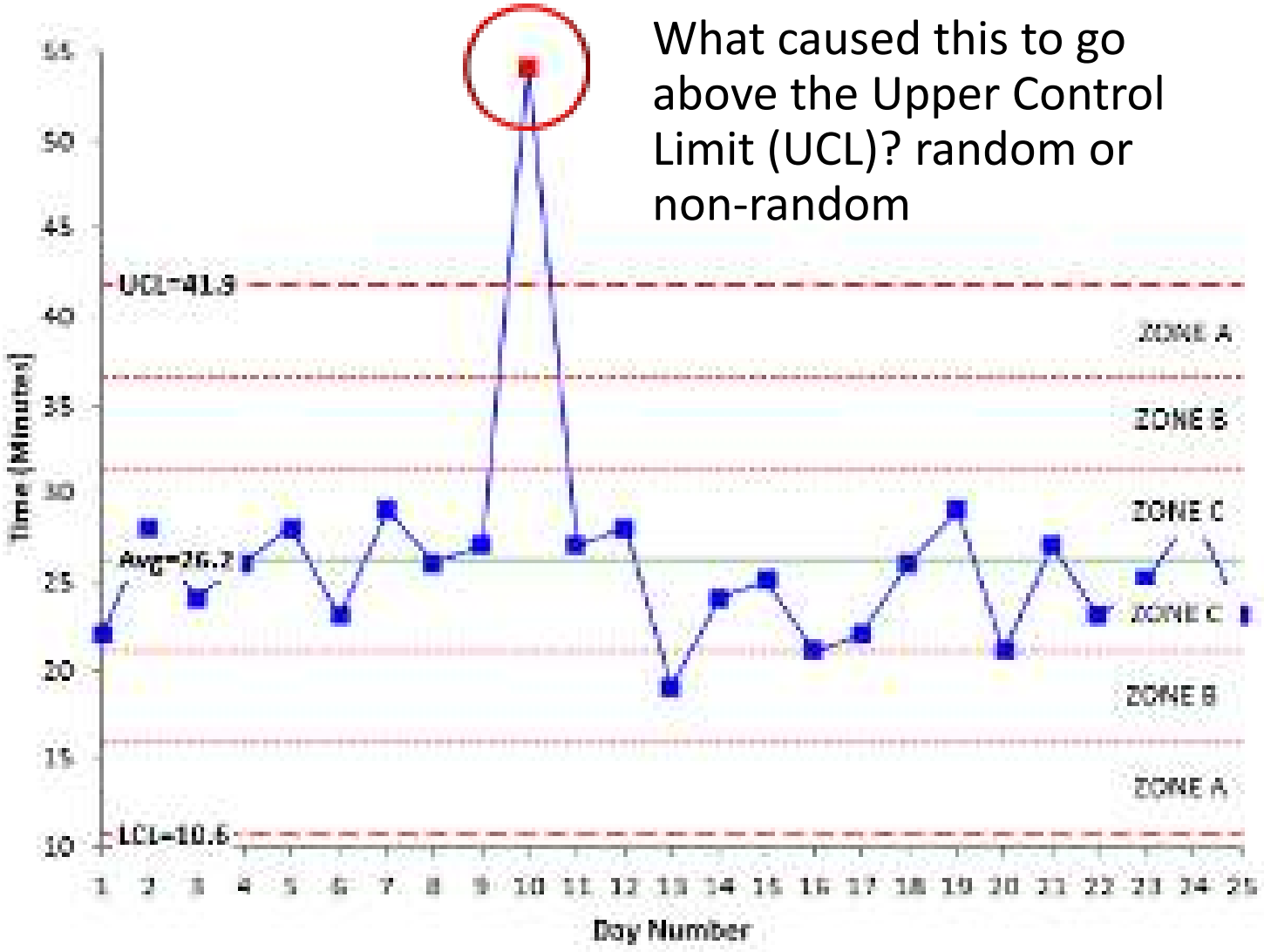
- ✓ Trace issues about quality problems to identify **root cause** *(asking the 'Why' question consistently – multiple levels is normal)*
- ✓ Also known as **Fishbone** or **Ishikawa diagrams**



Once identified address the issues

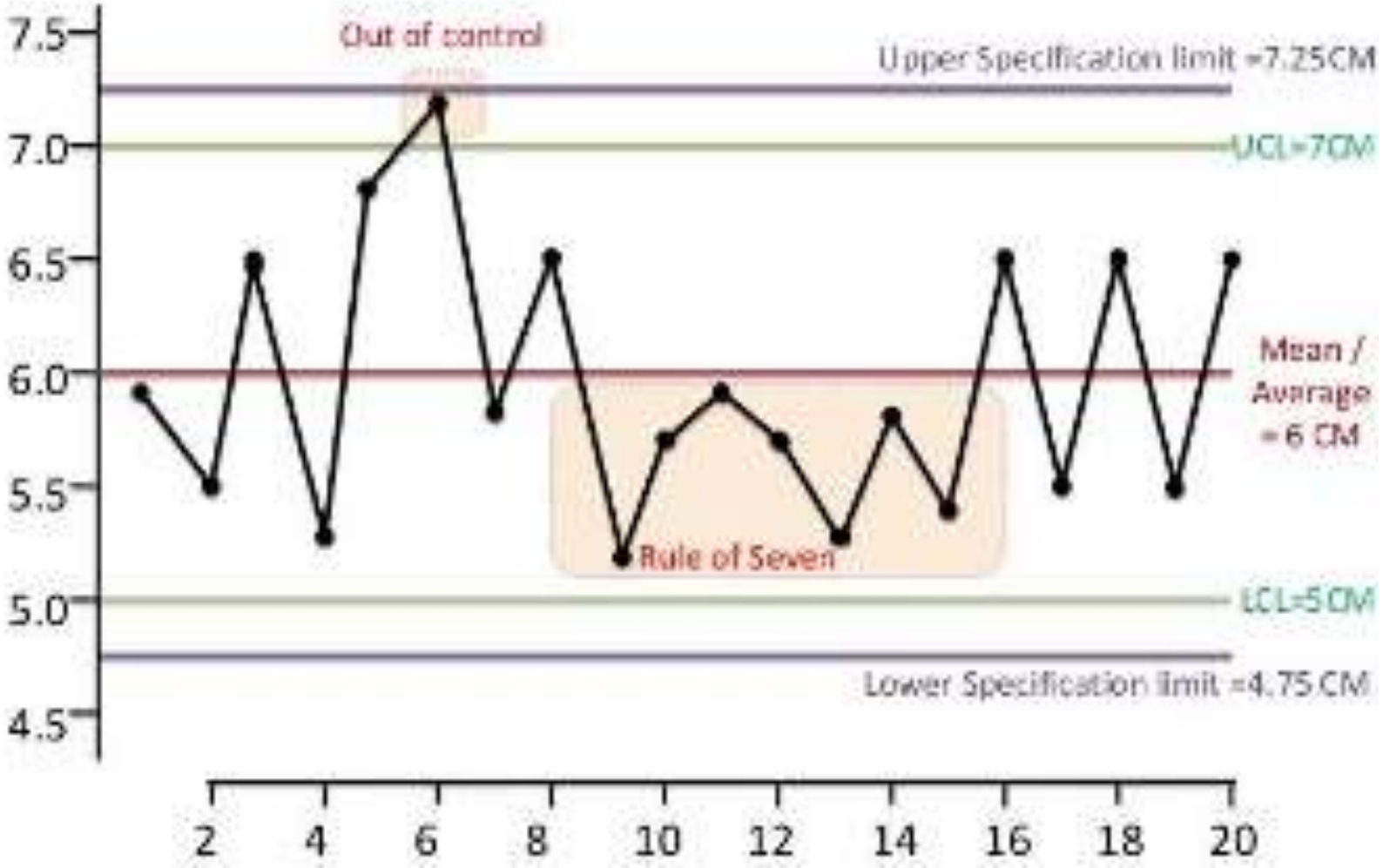
2. QUALITY CONTROL CHARTS

- ✓ Graphic representation of data that illustrate the results of a process over time
- ✓ Determine whether a process is in control or out of control:
  - ➢ **when in control** - process variations are random (okay?)
  - ➢ **when out of control** - variations caused by non-random events (fix!)



2. QUALITY CONTROL CHARTS

- ✓ You can apply the Seven Run Rule to look for patterns



Source: http://www.slideshare.net/anandbobade/pmp-chap-8-project-quality-management-38392489

3. CHECKSHEET

- ✓ A Checksheet *(sometimes called a tally or checklist)* is used to collect and analyse data

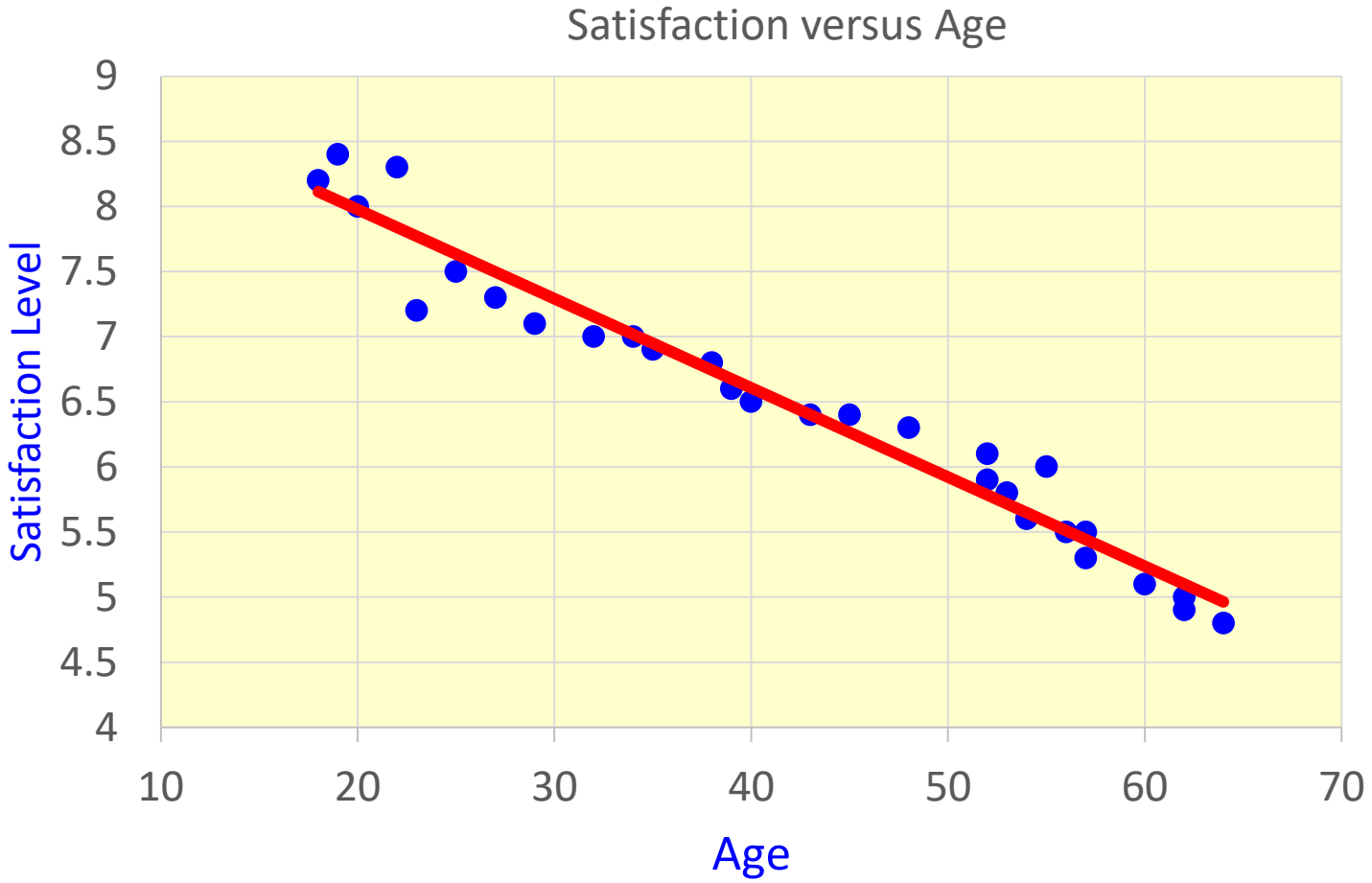
Service Request Tickets Frequency and Source								
Source	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Total
Email	7	4	1	1	2	3	3	21
Text	8	6	4	3	5	2	1	29
Phone	5	2	1	2	1	1	0	12
Total	20	12	6	6	8	6	4	62

- ✓ When do we get most complaints? Why?
- ✓ How do we get most complaints? What are the implications?
- ✓ Why are we getting more emails & less phone calls on the weekends?

4. SCATTER DIAGRAM

- ✓ A **scatter diagram** helps to show if there is a relationship between two variables (understand correlation visually)

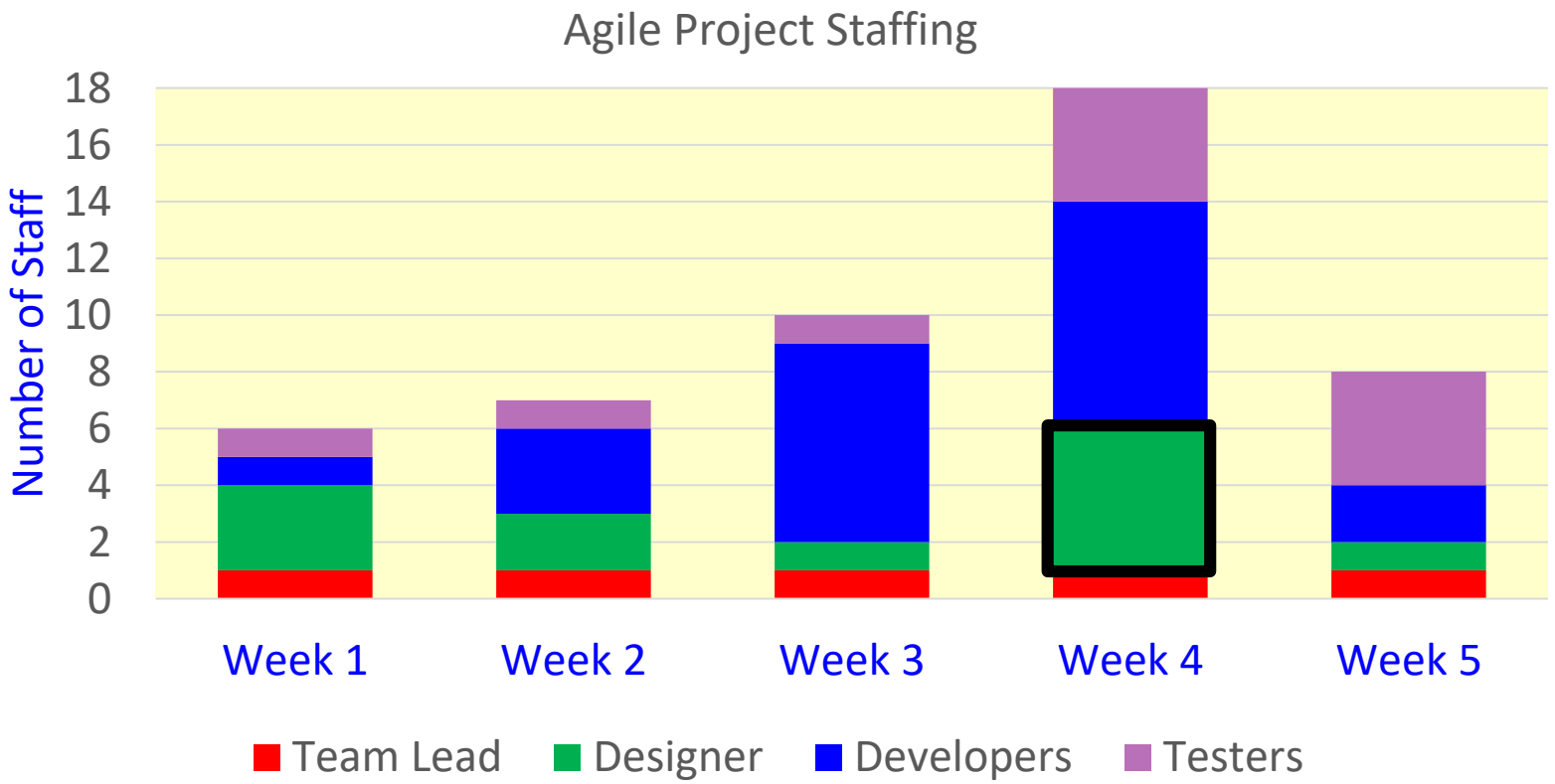
In this case – there is an apparent link between age and satisfaction



5. HISTOGRAMS

✓ A **histogram** is a bar graph of a distribution of variables

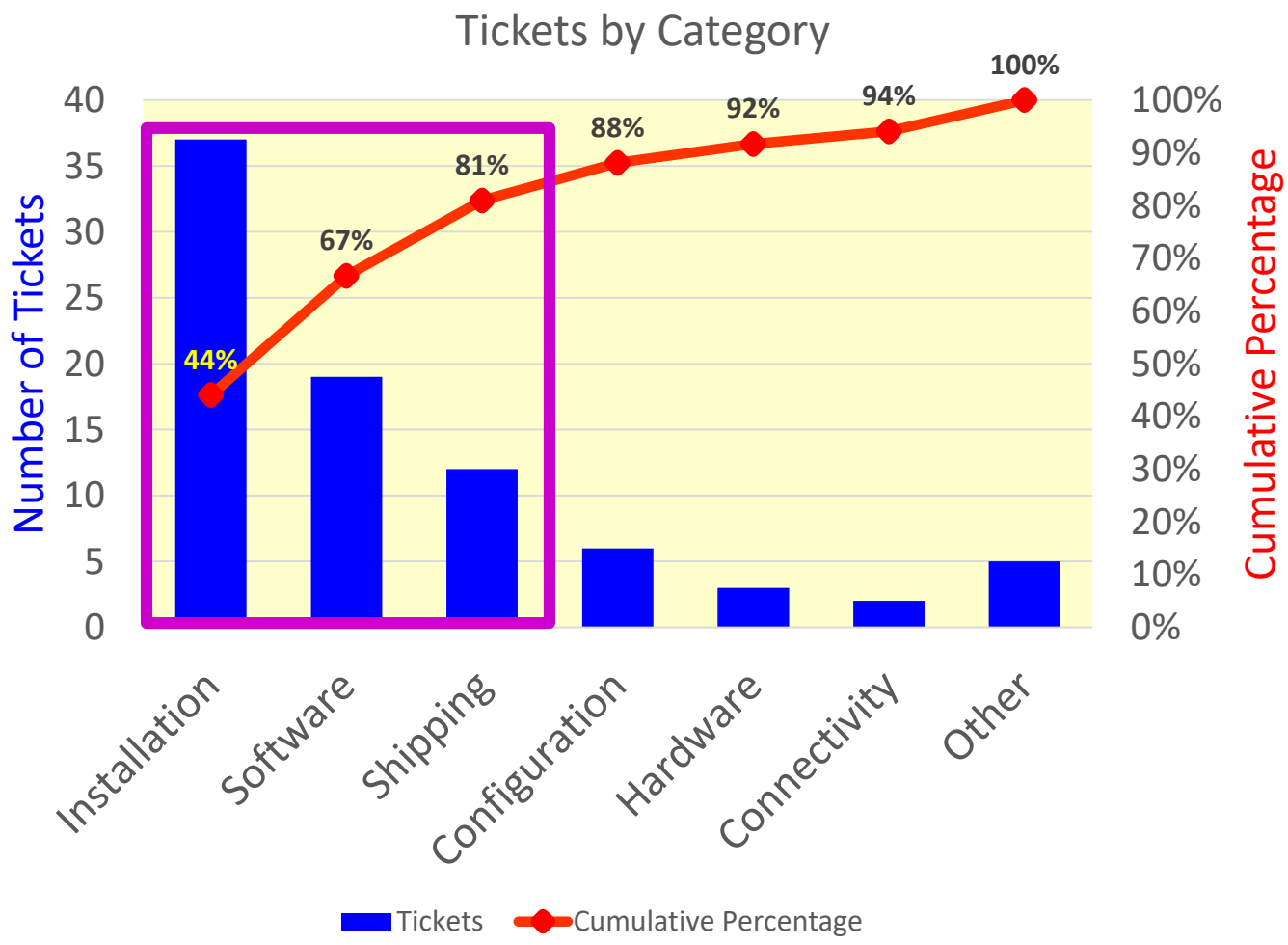
For instance this histogram shows staff utilisation over 5 weeks



Can you see a possible problem here?

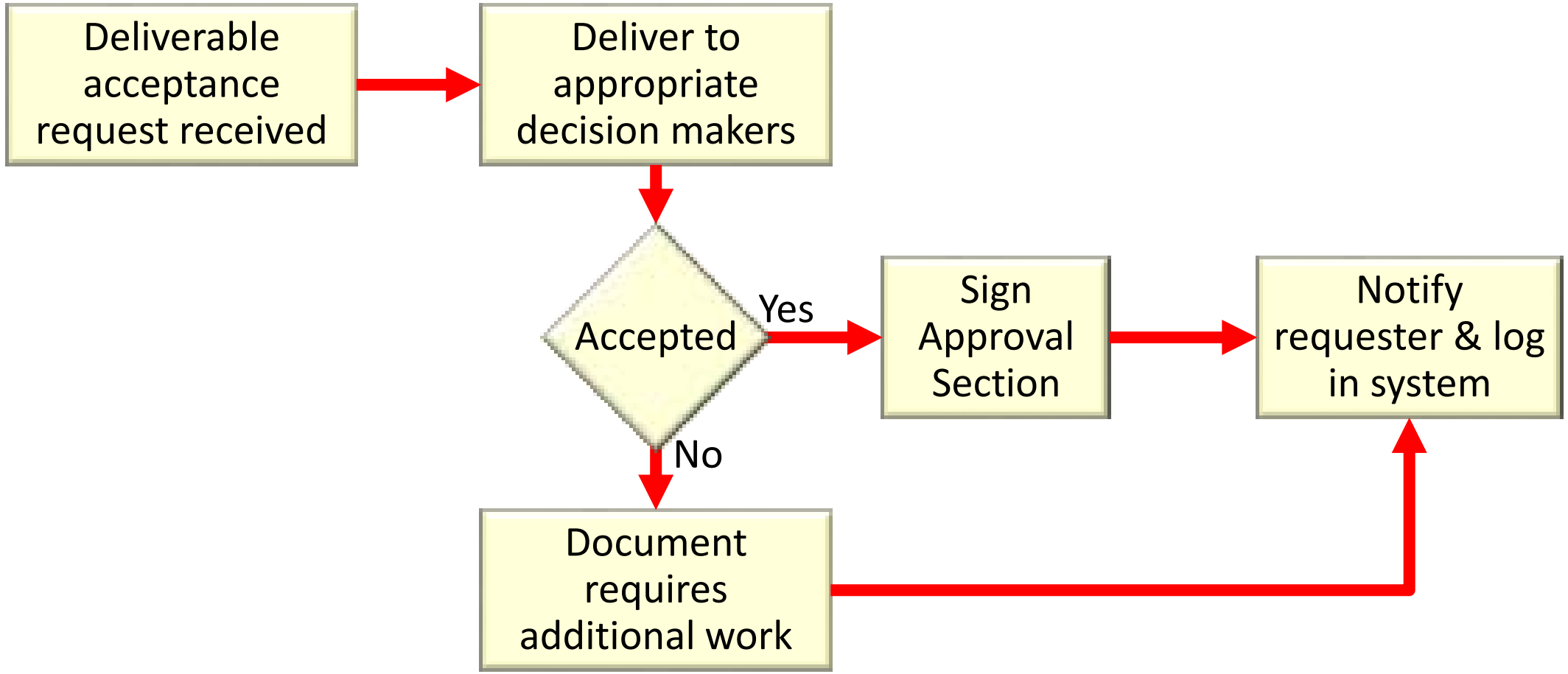
6. PARETO CHARTS

- ✓ A **Pareto Chart** is a histogram that can help you identify and prioritise problem areas
- ✓ What is causing us the most number of problems (Tickets)?
- ✓ How would we address this?



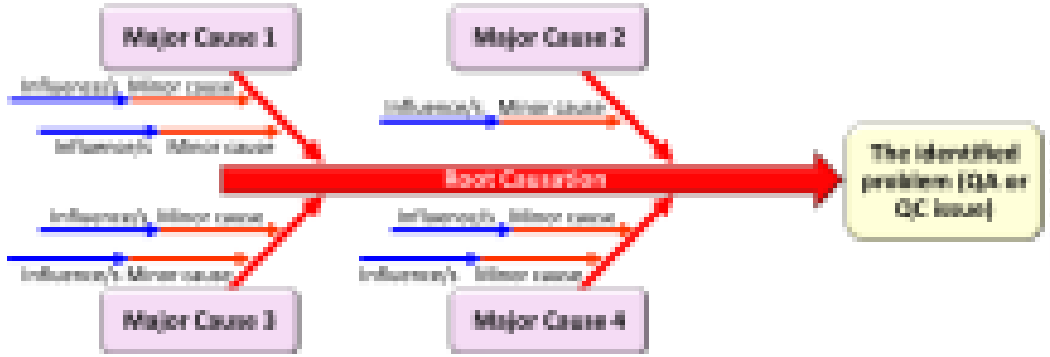
7. FLOWCHARTS

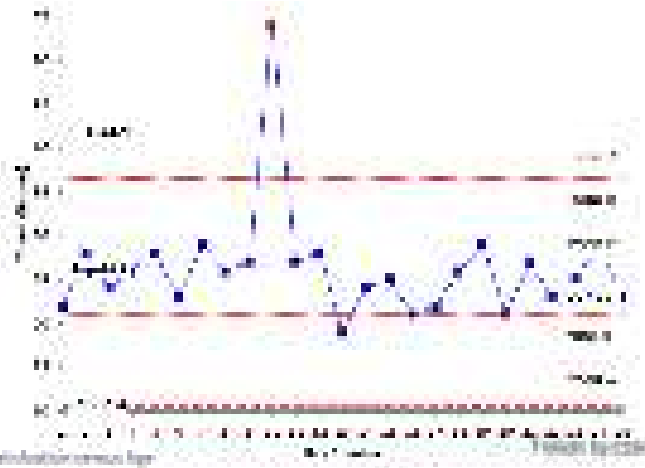
- ✓ Flowcharts illustrate logic and flow of processes
  (helps to analyse how problems may be occurring)

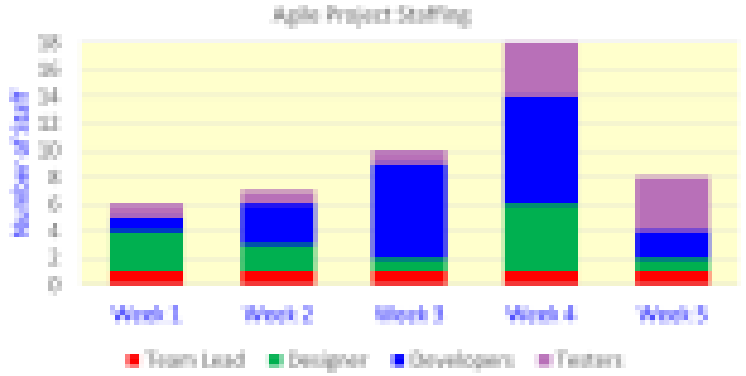


THE 7 TOOLS & TECHNIQUES

- ✓ Can assist in QC & QA **(get used to using them)**







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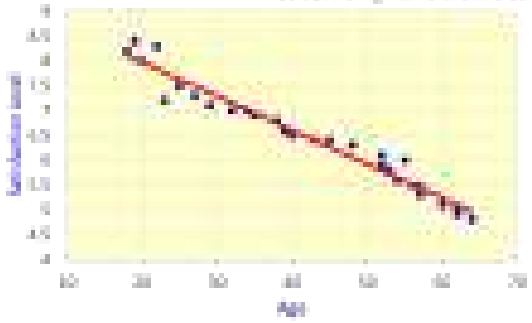
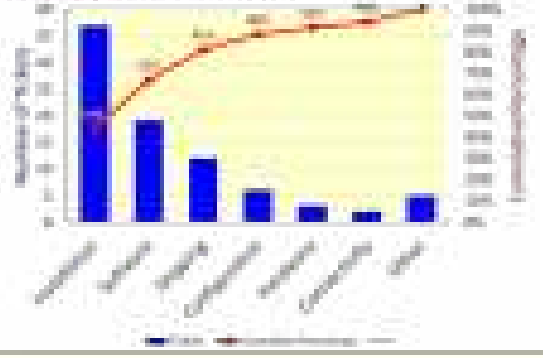
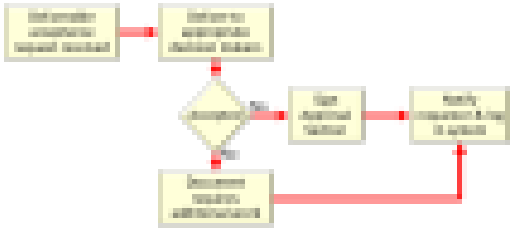






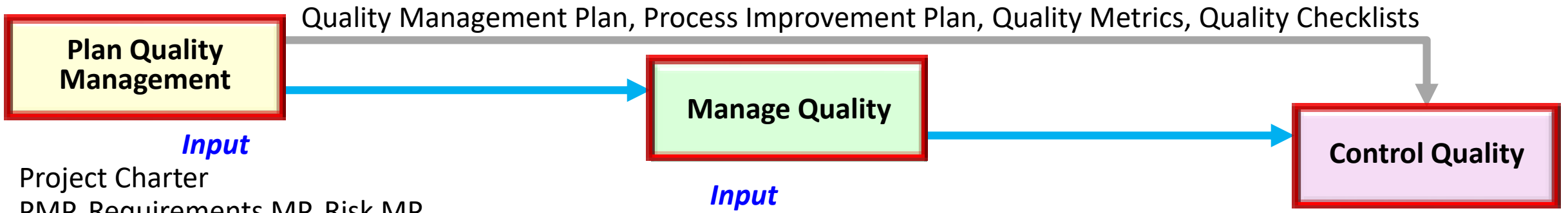
To optimise your projects

TOPIC SUMMARY

TOPIC SUMMARY

- ✓ Project Quality Management is important **(and can be costly if you don't get this right)**
- ✓ It is based on integral processes that:
  - ➢ Aim to optimise processes (QA) & deliverables (QC)
  - ➢ By meeting appropriate standards (QA & QC)
  - ➢ Should focus on a balance **(based on an analysis of the cost of quality – what is worth doing?)**
- ✓ Should be built into scope, cost & schedule management to support testing **(unit, integration, system & acceptance)**

IT IS MANAGED THROUGH



Input

- Project Charter
- PMP, Requirements MP, Risk MP, Stakeholder Engagement Plan, Scope Baseline, etc.
- Other Project Documents (Risk Register, Assumptions Log, etc.)
- EEF & OPA

Tools & Techniques

- Expert Judgement
- Data Analysis (Cost benefit)
- Decision making
- Test & Inspection planning
- Meetings

Outputs

- Quality Management Plan (QMP)
- Quality metrics
- Project documentation updates

Input

- PMP & QMP
- Project documents (e.g. Lessons learnt, Risk reports, Quality metrics)
- OPA

T&T

- Checklists
- Data analysis (Range of methods)
- Decision making (Data representation, Design for X, Problem solving)
- QA/QC Methods (including Audits)

Outputs

- Quality reports & test/evaluation documents
- Change requests
- Document updates

Input

- PMP, QMP & Other project documents
- Approved Change Requests
- Deliverables & work performance data
- EEF & OPA

T&T

- Data gathering (various methods)
- Data representation & analysis
- Testing, Inspection and Evaluation
- Meetings

Outputs

- QC measures & Work performance info
- Verifiable deliverables
- Change Requests
- Document updates


ANY
QUESTIONS