Contents

1 Project Quality Management

1.1 Introduction

Project Quality Management

Project Quality Management Processes include all activities of the performing organisation that determine quality policy, objectives, and responsibilities so that the project will satisfy the needs for which it was undertaken. Processes are:

- Plan Quality
- Perform Quality Assurance
- Perform Quality Control

Project Quality Management

PMBOK processes are intended to be compatible with International Organisation for Standardisation (ISO) standards. Other Standards include:

- Total Quality Management (TQM)
- Six Sigma
- Failure Mode & Effect Analysis
- Etc.

Project Quality Management

- Project Quality Management must address the management of projects and the product of the project.
- Project Quality Management applies to all projects regardless of the nature of the product.
- Project Quality Techniques are specific to the particular type of product produced by the project.

Project Quality Management

Quality is:

- the degree to which a set of inherent characteristics fulfill requirements, American Society for Quality, 2000

The critical element is to turn stakeholder needs, wants and expectations into requirements through Stakeholder Analysis, performed during Project Scope Management

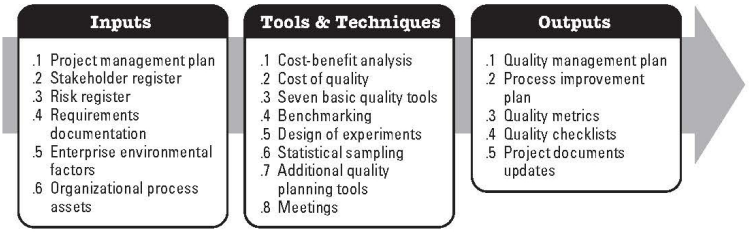


Figure 8-3. Plan Quality Management Inputs, Tools & Techniques, and Outputs

Quality and Grade

Quality and **Grade** are not the same. Grade is a category assigned to products or services having the same functional use but different technical characteristics. 5★ Hotel 2★ Hotel Both serve the same function (provide a bed) but differ greatly technically.

- Low Quality is always a problem
- Low Grade may not be a problem

Ryan Air: low grade (no frills), high quality.

Precision and Accuracy

Precision and **Accuracy** are not the same. Precision is consistency that the value of repeated measurements are clustered and have little scatter

- Multiple Unit similarity

Accuracy is how 'close' the measured value is to the real value

- Measurement Error

Inaccurate measurement can yield false precision

QM and PM

Quality Management and Project Management both recognize the importance of:

- Customer Satisfaction
- Prevention over Inspection
- Management Responsibility
- Continuous Improvement

1.2 Plan Quality

Plan Quality

Part of the Planning Process Group

Plan Quality

'Quality is Planned, Designed, and Built in - Not Inspected in.' Quality Planning involves identifying which quality standards are relevant to the project and determining how to satisfy them. Quality Planning should be performed in parallel with all other planning processes

- If high grade finished are required, then high grade resources (employees and/or subcontractors) need to be used in order to achieve the quality objective of 'high grade finish'

Plan Quality **Inputs**

Enterprise Environmental Factors

- Government Rules, Standards, Regulations,
- Industry Best Practice etc.

Organisational Process Assets

- Performing Organisations Quality Policies, Procedures, Guidelines etc.
- If they do not exist, the PM team needs to generate them

Plan Quality **Inputs**

Scope Baseline

- Details Major Deliverables, Project Objectives, Thresholds, and Acceptance Criteria
- Thresholds: limits of cost, time, resources
- Acceptance Criteria: performance requirements and essential conditions that must be met before project deliverables are accepted
- Etc.

Refer to Book

Plan Quality **Tools and Techniques**

Cost - Benefit Analysis (CBA)

- Remember Ford Pinto? Cost of improved quality must be less than the potential savings or benefit
- Benefits can be realised by less Rework, Higher Productivity, increased stakeholder satisfaction (clients and employees)

Benchmarking

- Comparing actual or planned projects practices to those of other projects to generate ideas for improvement and to provide a basis by which to measure performance: Dominos Pizza

Domino's Pizza, and other similar organisations are a model for efficiency. They can take an order, assemble and cook the product, and deliver it to your home within an hour. Most organisations can only dream of this level of efficient production and logistics. Recently, they have also been highly successful in implementing on-line order processing. The Australian business unit is currently taking 50% of their orders on-line, and expect this to grow to 80% over the next 3 years.

Plan Quality **Tools and Techniques**

Design of Experiments (DOE)

- Statistical Method that helps identify which factors may influence specific variables of a product or process under development.
- Also used for optimisation of processes
- Provides a framework that can be used to modify several important factors in parallel

Cost of Quality (COQ)

- Total Costs incurred by investment in preventing non-conformance to requirements, appraising the product or service, etc.
- Failure Costs are often split into Internal Costs and External Costs

Plan Quality **Tools and Techniques**

Quality Planning Tools:

- Brainstorming
- Affinity Diagrams
- Matrix Diagrams
- Etc.

Control Charts:

- See next slide and refer to book

Control Charts

Plan Quality **Outputs**

Quality Management Plan:

- Describes how the PM team will implement the Quality Policy
- QM Plan is an input to the overall PM Plan

Quality Metrics:

- An Operational Definition that describes, in very specific terms, what something is and how the quality control process measures it.

Quality Checklists:

- A structured tool used to verity that a set of required steps has been performed, very common in H&S

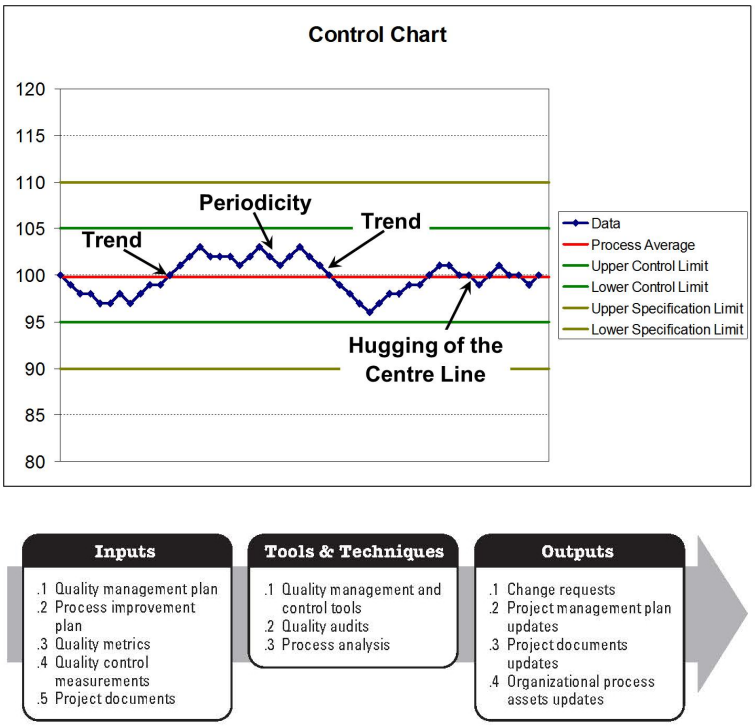


Figure 8-8. Perform Quality Assurance: Inputs, Tools & Techniques, and Outputs

Plan Quality **Outputs**

Process Improvement Plan:

- Subsidiary of the PM Plan
- Details Steps for Analysing Processes that will facilitate the identification of waste and non-value added activity.

Project Document Updates

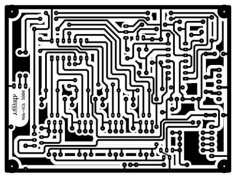
- As per book

Perform Quality Assurance

Part of the Executing Process Group

Perform Quality Assurance

- Quality Assurance is the application of planned, systematic quality activities to ensure that the project will employ all processes needed to meet requirements.
- Quality Assurance is about implementing systems and procedures that will lead to fulfilment of project objectives and deliverables.



Perform Quality Assurance **Inputs**

Project Management Plan

- Quality Plan, etc. refer to book
- Process Improvement Plan

Quality Metrics

- Already covered, refer to book

Work Performance Information

- Work Performance Information including technical performance measures, project deliverable status, required corrective actions, performance reports, etc. EVMS yields performance information in relation to costs and schedules

Perform Quality Assurance **Inputs**

Quality Control Measurements

- Results of the Quality Control Activities.
- Results are fed back into fed back into the QA process to determine the success of Corrective Actions, and to determine if changes to the QA process are successful

Perform Quality Assurance **Tools and Techniques**

The tools and techniques for quality planning can be applied to quality assurance **Quality Audits:**

- Structured, independent review to determine whether project activities comply with organisational and project policies, processes and procedures. for instance Reuters PCB Quality policy required that tracks on PCB's should could only change direction in two 45° steps.

Perform Quality Assurance **Tools and Techniques**

Process Analysis

- Process Analysis follows the steps outlined in the process improvement plan to identify needed improvements from an organisational and technical standpoint

Most Business Processes could be improved by analysis

- Purchase Order Processing; value under €1000.00
- Technical Processes can be more difficult to analyse
- Includes Root Cause Analysis etc.

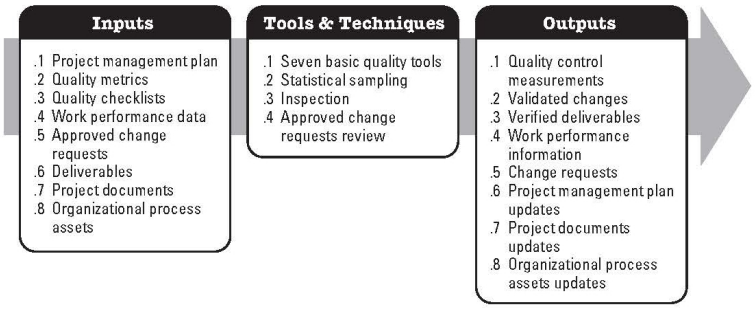


Figure 8-11. Control Quality: Inputs, Tools & Techniques, and Outputs

Perform Quality Assurance **Outputs**

- Organisational Process Assets Updates
- Change Requests
- Recommended Corrective Actions
  - Corrective Actions is an action that is recommended immediately as a result of QA audits and processes
- Project Management Plan Updates
- Project Document Updates

Control Quality

Part of the Monitoring and Controlling Process Group

Perform Quality Control

- Quality Control involves monitoring specific project results to determine whether they comply with relevant quality standards.
- Also involves identifying ways to eliminate causes of unsatisfactory results.

Perform Quality Control

PM Team should be know the following terms: **Prevention**

- Keeping errors out of the process

Inspection

- Keeping errors out of the hands of the customer.

Attribute Sampling

- The result conforms or does not (Binary)

Variables Sampling

- Result is measured on a continuous scale that measures the degree of conformity (Continuous)

Perform Quality Control

PM Team should be know the following terms: **Special Causes**

- Unusual Events

Common Causes

- Normal Process variation

Tolerance

- The result is acceptable if it falls within the range specified

Control Limit

- The process is in control if the result falls within the control limits

Perform Quality Control **Inputs**

- Project Management Plan - Already Covered, refer to Book
- Quality Metrics - Already Covered, refer to Book
- Quality Checklists - Already Covered, refer to Book
- Work Performance Information
  - Technical Performance measures, Schedule performance measures, project deliverable status, etc.
- Planned versus Actuals

Perform Quality Control **Inputs**

Approved Change Requests:

- Change Control System
  - Applies to processes and product
  - Deliverables
- Organisational Process Assets - Already Covered, refer to Book

Perform Quality Control **Tools and Techniques**

- Cause and effect diagram
- Control Charts
- Flowcharting
- Histogram
- Pareto Chart
- Run Chart
- Scatter Diagram
- Statistical Sampling
- Inspection
- Approved Change Request Review

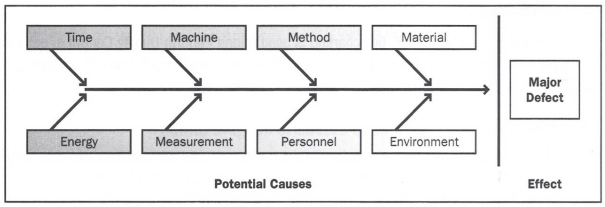


Figure 8-12. Classic Sources of Problems to Consider

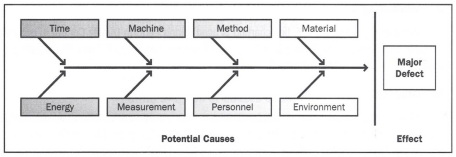


Figure 8-12. Classic Sources of Problems to Consider

Cause and Effect Diagram

AKA Ishikawa Diagrams or Fishbone Diagrams

Cause and Effect Diagram

Diagramming method used to identify the relationship between an effect and its causes.

- Defect is an effect
- Potential Causes can be grouped under Time, Machine, Method, Material etc.

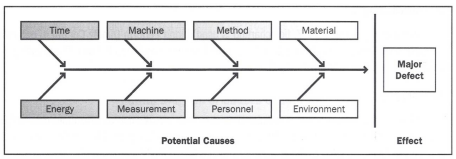
Cause and Effect Diagram

Material Grouping

- Material can be of the wrong specification
- Wrong size
- Damaged

Environment Grouping

- Insufficient Light
- Temp too low or high
- Inclement weather



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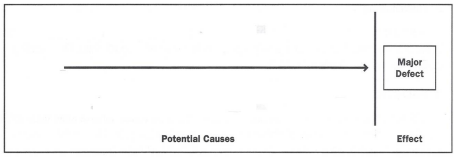

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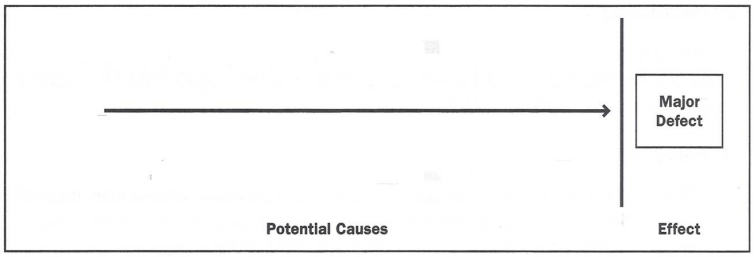


Figure 8-12. Classic Sources of Problems to Consider

Cause and Effect Diagram

How to construct

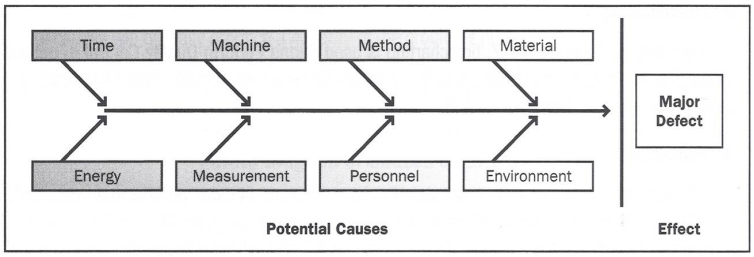
1. Identify the problem
2. Draw prime box and prime arrow
3. Identify major categories
4. Identify defect causes (worn machine parts, poorly trained staff, etc.)
5. Identify corrective actions

Cause and Effect Diagram

1. Identify the problem
2. Draw prime box and prime arrow

Cause and Effect Diagram

3. Identify major categories



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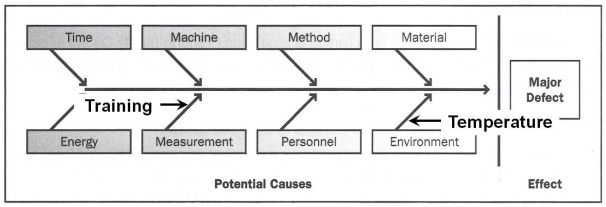

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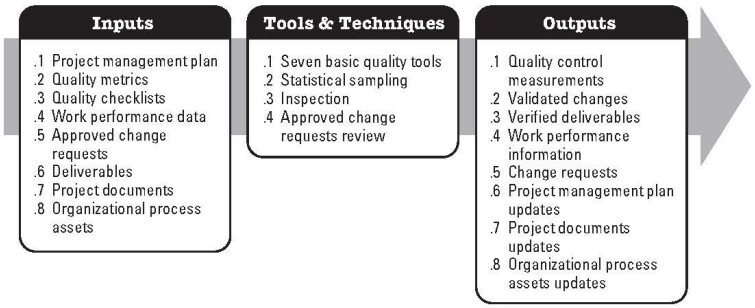


Figure 8-11. Control Quality: Inputs, Tools & Techniques, and Outputs

Cause and Effect Diagram

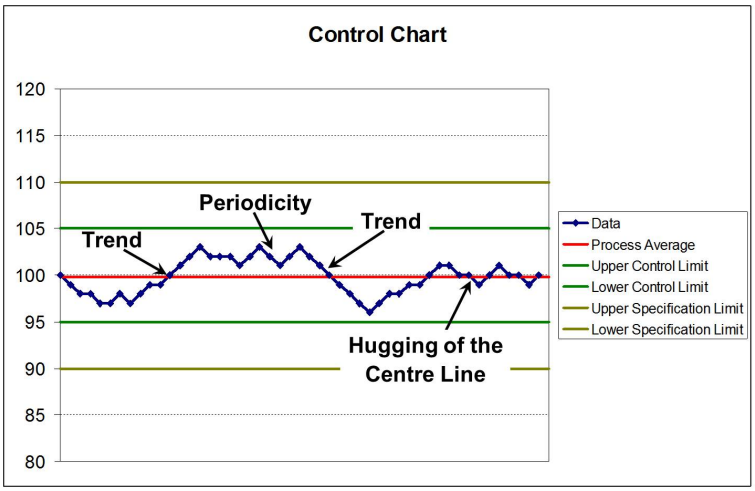
4. Identify defect causes (worn machine parts, poorly trained staff, etc.)
5. Identify corrective actions

1.3 Control Quality

Control Quality
Part of the Monitoring and Controlling Process Group

Perform Quality Control **Tools and Techniques**

- Cause and effect diagram ✓
- Control Charts
- Flowcharting
- Histogram
- Pareto Chart
- Run Chart / Trend Analysis
- Scatter Diagram
- Statistical Sampling
- Inspection
- Defect Repair Review



Control Charts

Trends

Trend

- If there is a continued rise or fall in a series of points, this pattern is called a trend.
- In general, if 7 consecutive points rise or fall, there is an abnormality.

Periodicity

- Points that show the same pattern of change (rise or fall) over equal intervals

Hugging of the Centre Line

- Points that are close to the central line, or to a control limit, are said to hug the line
- Can be indicative of a process abnormality if there is a bias.

Flowchart

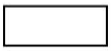
Flow Chart Symbols (ISO5807:1985)

Flow Chart Symbols (ISO5807:1985)

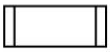
Attempts at standardisation of flowcharts have largely failed. When developing complex flowcharts, it is now common to include a kyeto the symbols used

Software developers use a set of diagramming rules referred to as 'The UML', or simply 'UML'. This is in widespread use due to automatic code generation tools that have been developed to create code based on the diagrams.

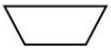
Flowchart Process Symbols



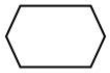
Basic Process - any kind of processing function (e.g., defined operation or group of operations)



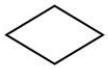
Predefined Process - One or more operations or steps that are specified elsewhere (e.g., SOP, subroutine, a module).



Manual Operation - A process performed by a human.



Preparation - (e.g., setting a switch, initializing a routine, etc.)



Decision - A minimum of two outputs is required (e.g., Yes / No, OK / Rejected)

Flowchart Data Symbols

Data - the medium being unspecified.

Stored Data - the medium being unspecified.

Internal Storage

Sequential Storage - tape, cassette, etc.

Direct Access Storage - Disk, Drum, etc.

Document - Human readable data (e.g., paper, microfilm, etc.)

Manual Input - keyboard, switch settings, push buttons, light pen, bar-code wand, etc.

Card - punched cards, magnetic cards, etc.

Punched Tape (i.e., paper tape)

Display - Information displayed for human use (e.g., video, indicators)

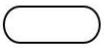
Flowchart Line Symbols

Basic Line - Represents the flow of data or control.

Dashed Line - Alternative relationship between two or more symbols (e.g., used to surround annotated area).

Flowchart Special Symbols

Connector - A circle represents an exit to, or entry from, another part of the same flowchart (the connector MUST contain some form of unique identification).



Terminator - Represents an exit to, or entry from, the outside environment (e.g., start or end of a program flow).

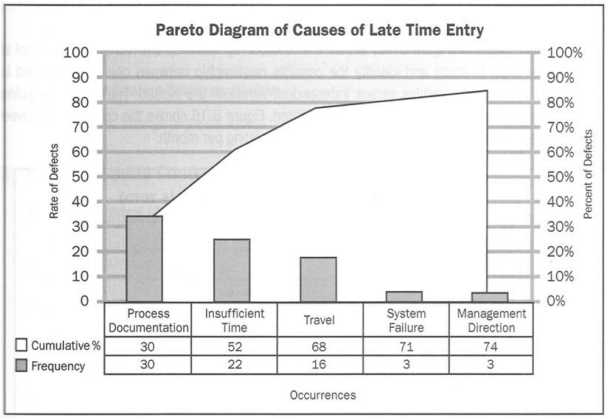


Figure 8-15. Pareto Diagram

Pareto Diagram

A Pareto Diagram is a specific type of histogram that is ordered by frequency of occurrence. Organising the data in this way prioritizes the actions required to reduce non-conformance.

Pareto Analysis

There are 3 types of Pareto Analysis:

- Basic
- Comparative
- Weighted

Basic Pareto Analysis

- Identifies the vital few contributors that account for most non-conformances

Comparative Pareto Analysis

- Combines two or more Pareto Charts for the same process variable for comparison

Weighted Pareto Analysis

- Applies a level of significance to other factors such as time, cost, and criticality.

Run Chart

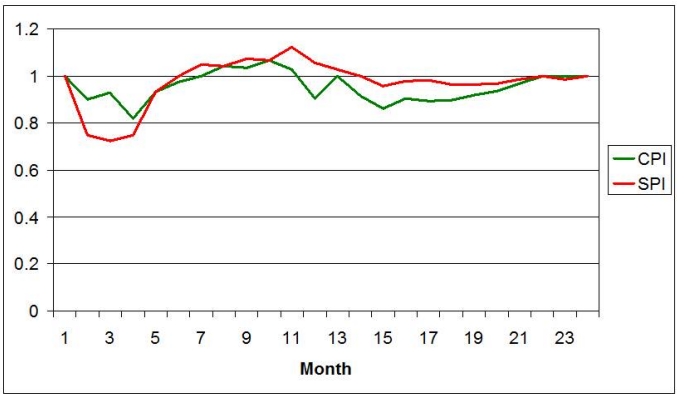
Trend Analysis is performed using Run Charts

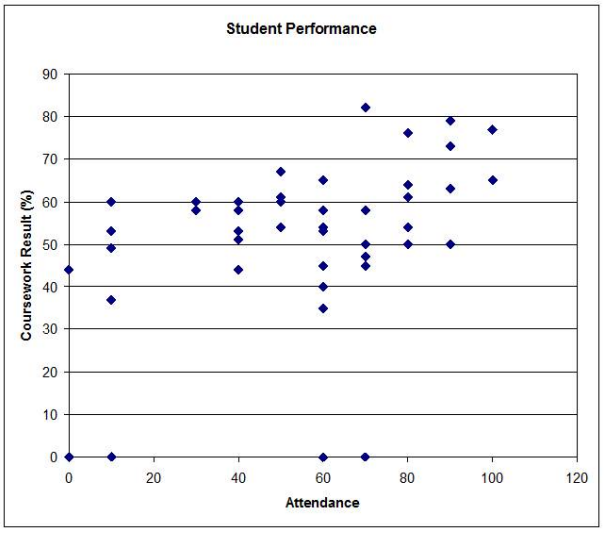
Run Chart & Trend Analysis

Run Chart shows:

- History
- Pattern of Variation

Run Charts show trends in processes over time. Trend Analysis involves using mathematical techniques to forecast future outcomes based on historical results.





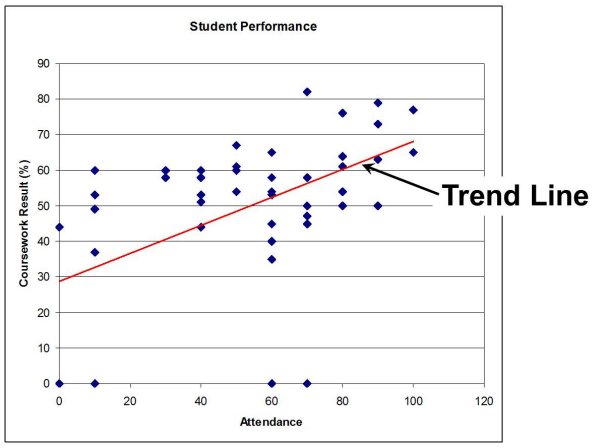
Trend Analysis

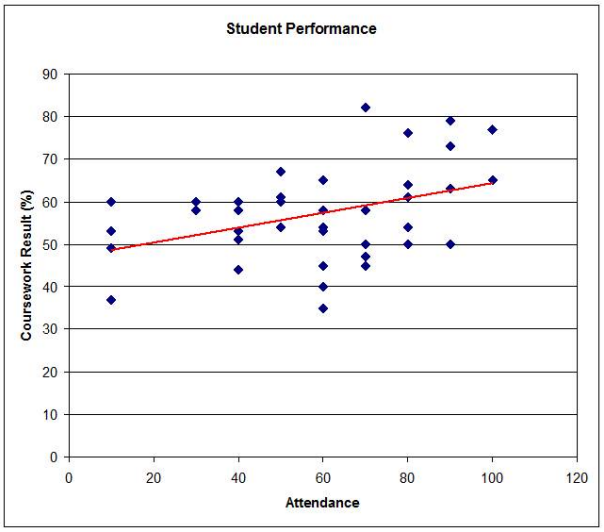
- Trend Analysis is a statistical method for determining the equation that best fits the data in a scatter plot or scatter diagram.
- Trend Analysis quantifies the relationships of the data, determines the equation and measures the fit of the equation to the data, e.g. Curve Fitting.
- One of the most important aspects of trend analysis is that it can be used for forecasting

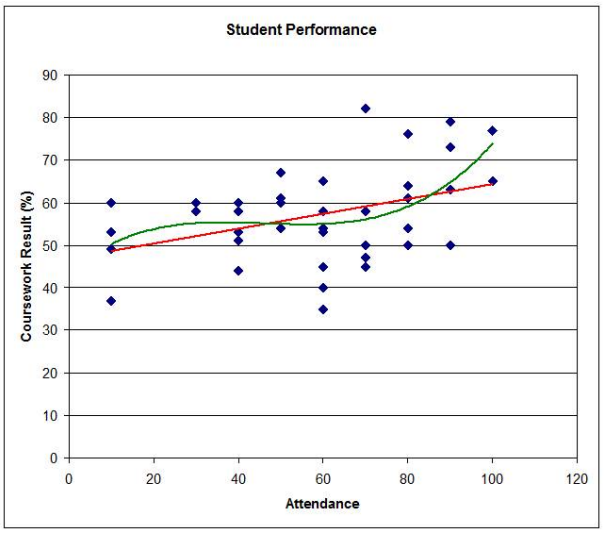
Scatter Diagram - Student Performance

Student Performance - Trend Line

Scatter Diagram - Outliers Removed


Student Performance
Coursework Result (%)
Attendance
Trend Line


Student Performance
Coursework Result (%)
Attendance



Scatter Diagram - Polynomial

Scatter Diagram

Scatter diagrams organise data using two variables

- An input (or independent) variable
- An output (or dependant) variable

The relationship between variables fall into several categories:

- Positive correlation (Student Performance.)
- Negative correlation
- Curvilinear correlation
- No correlation

Statistical Sampling

- Often it is impractical or impossible to inspect all incoming or outgoing materials or products.
- In these instances it is more practical to randomly select a smaller number of items and test for conformance. This is known as **acceptance sampling**
  - If the sample set passes, then the lot is accepted
  - If the sample set fails, the entire lot is rejected

Statistical Sampling

Common Sampling plans:

- Single Sampling - Lot is accepted or rejected based on one sampling run
- Double Sampling - A small sample size is tested. If the results are not conclusive, a second sample is tested
- Multiple Sampling - Several small lots are sampled

Sampling errors can occur:

1. An acceptable lot can be rejected
2. An unacceptable lot can be accepted

Inspection

- Inspection is the examination of a work product to determine whether it conforms to standards.
- Typically involves the selection and measurement of specific characteristics.
- For instance timber:
  - Type
  - Size
  - Warp
  - Finish

Defect Repair Review

Action taken to ensure that product defects are repaired and brought into compliance with requirements or specifications

Perform Quality Control **Outputs**

Quality Control Measurements

- Measurements that are fed back into the Quality Assurance Process

Validated Changes

- Re-inspection after repair; results in either acceptance or rejection

Validated Deliverables

- Validation that project deliverables conform to requirements.

Organisational Process Assets Updates

- Completed Checklists
- Lessons Learned Documentation

Perform Quality Control **Outputs**

Change Requests

- Recommended Corrective and Preventative Actions must be sent through the Integrated Change Control Process
- May be actions taken as a result of QC measurements

Recommended Defect Repair

- Repair required to address a non-conformance

Project Management Plan Updates

- Quality Management Plan
- Process Improvement Plan

Project Document Updates

- Quality Standards, Procedures, Test Specs, etc.