Project Quality Management

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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

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

Plan Quality

Part of the Planning Process Group

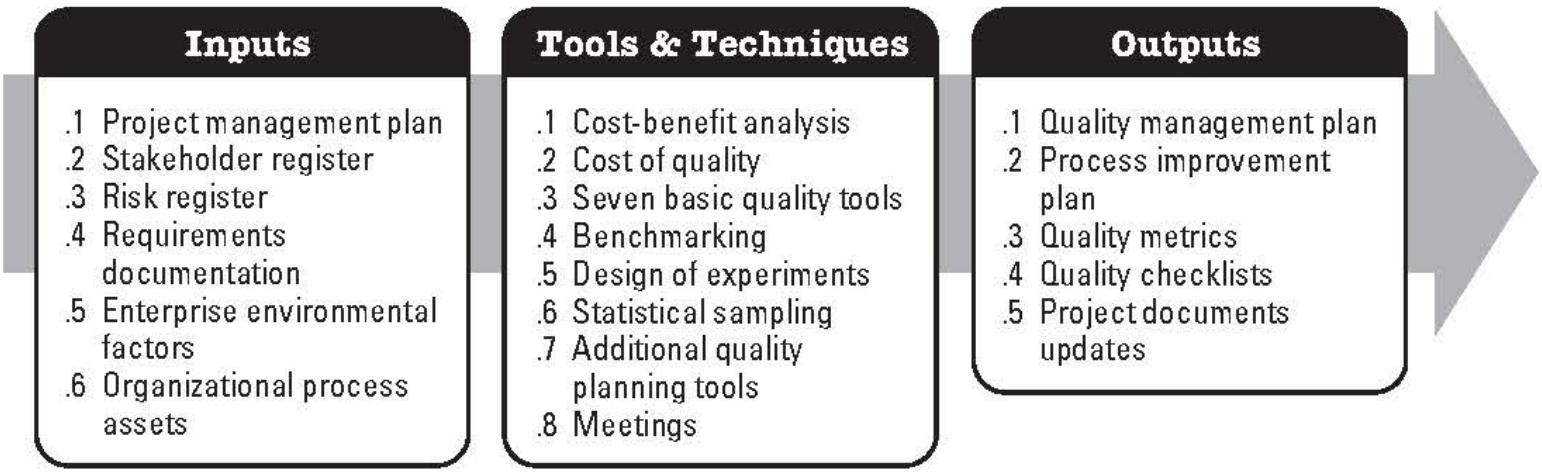


Figure 8-3. Plan Quality Management Inputs, Tools & Techniques, and Outputs

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

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

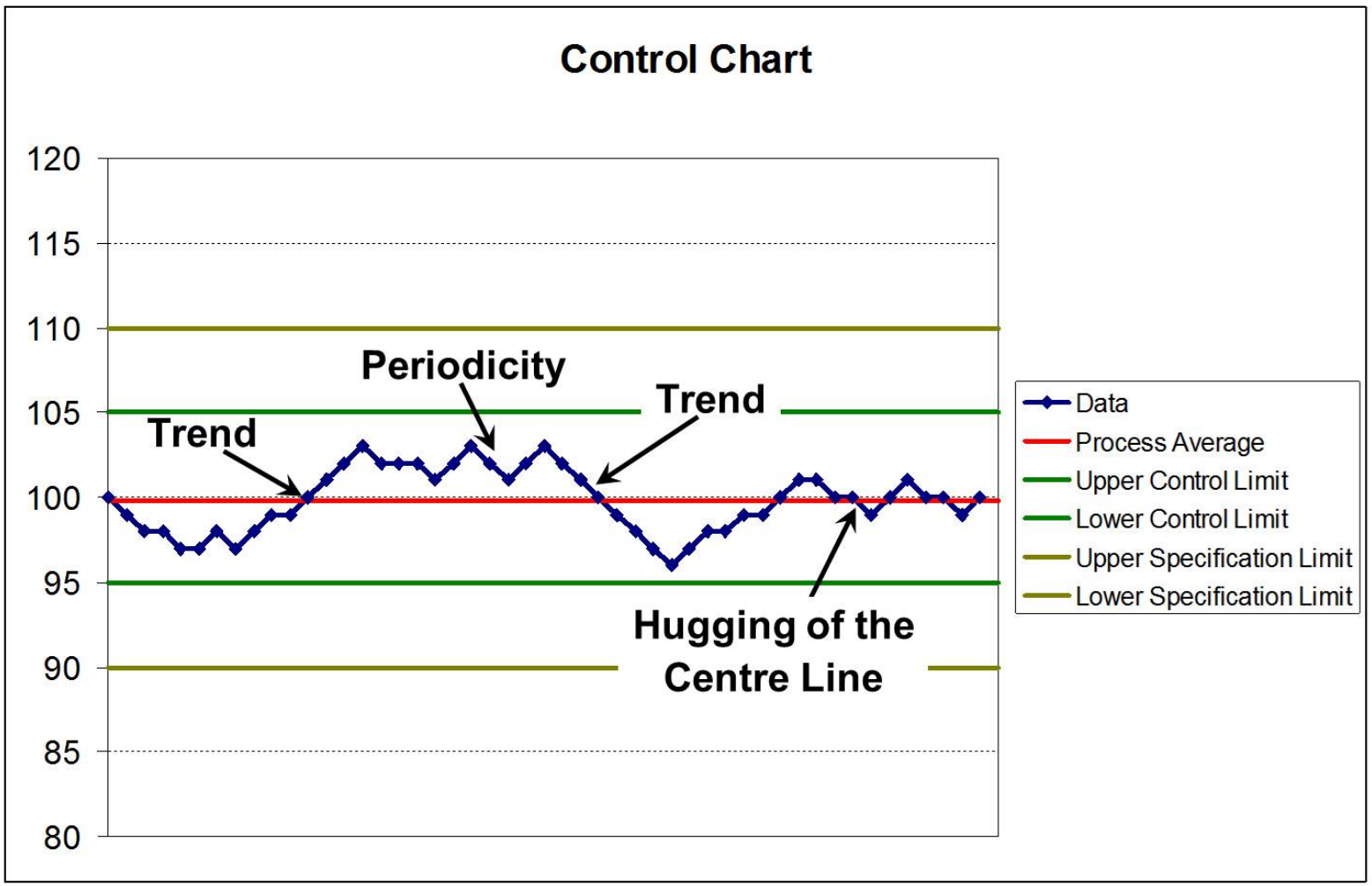
Quality Planning Tools:

- 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

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

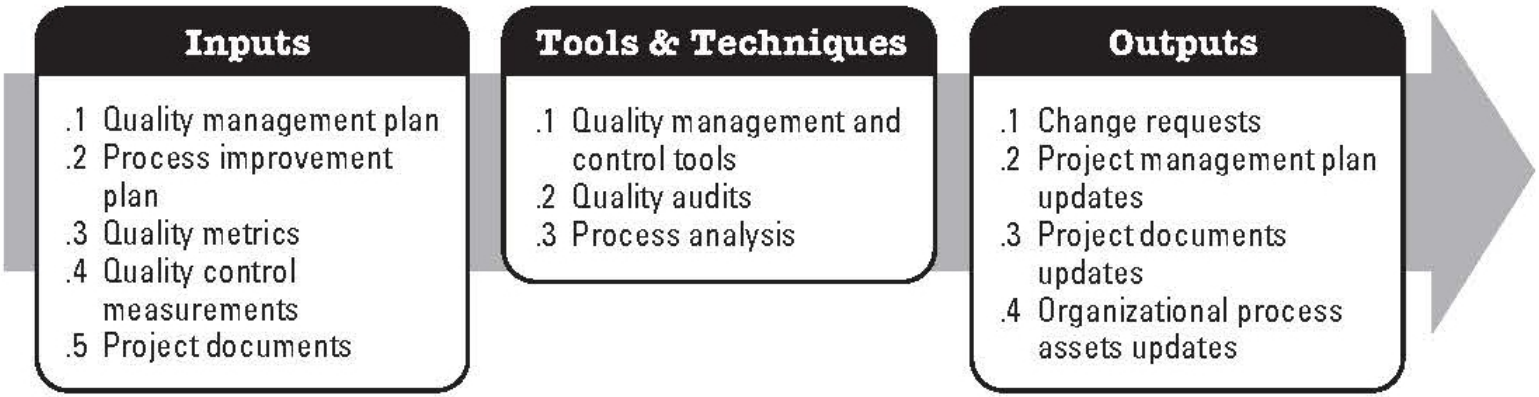


Figure 8-8. Perform Quality Assurance: Inputs, Tools & Techniques, and Outputs

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

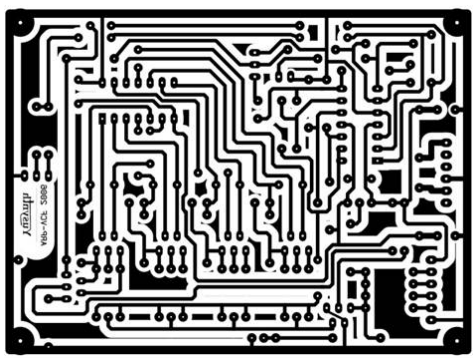
- Results of the Quality Control Activities.
- Results are fed back into fed back into the QA process to determine the success of Corrective Actions, and to determine if changes to the QA process are successful

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.

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

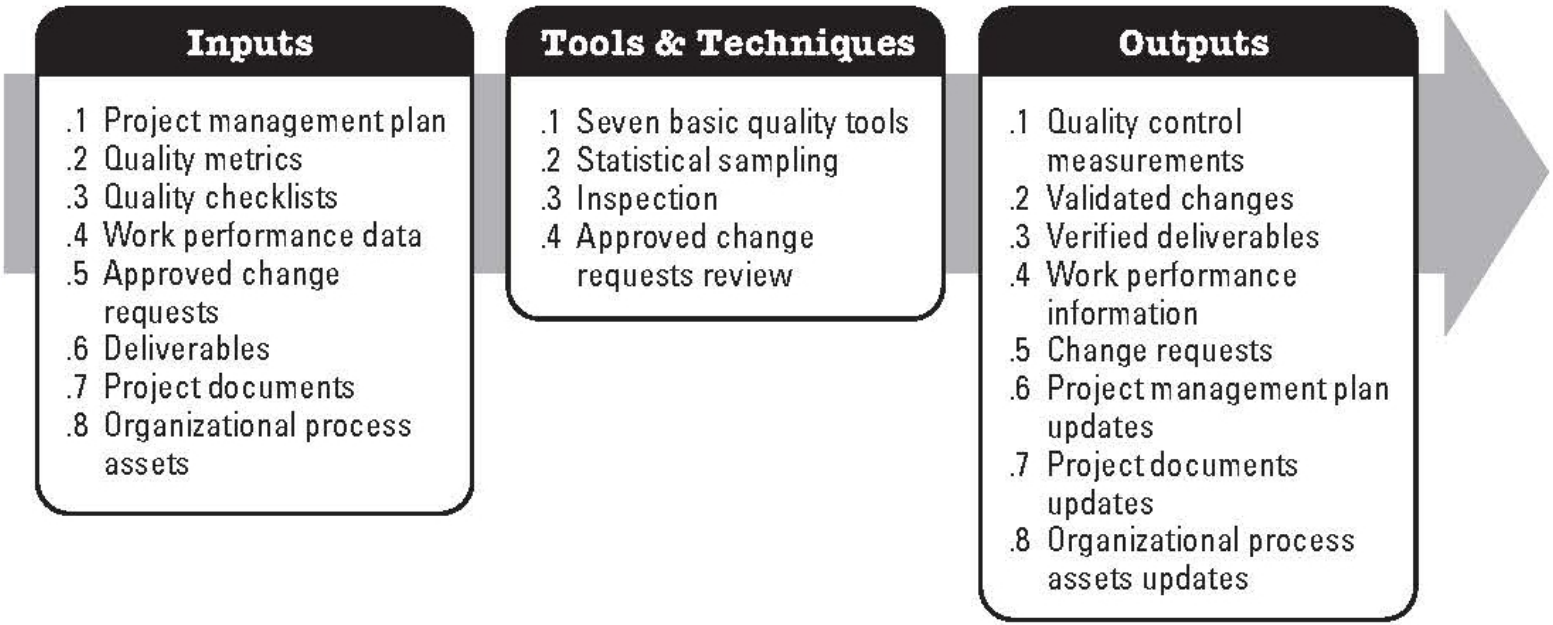


Figure 8-11. Control Quality: Inputs, Tools & Techniques, and Outputs

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

Cause and Effect Diagram

AKA Ishikawa Diagrams or Fishbone Diagrams

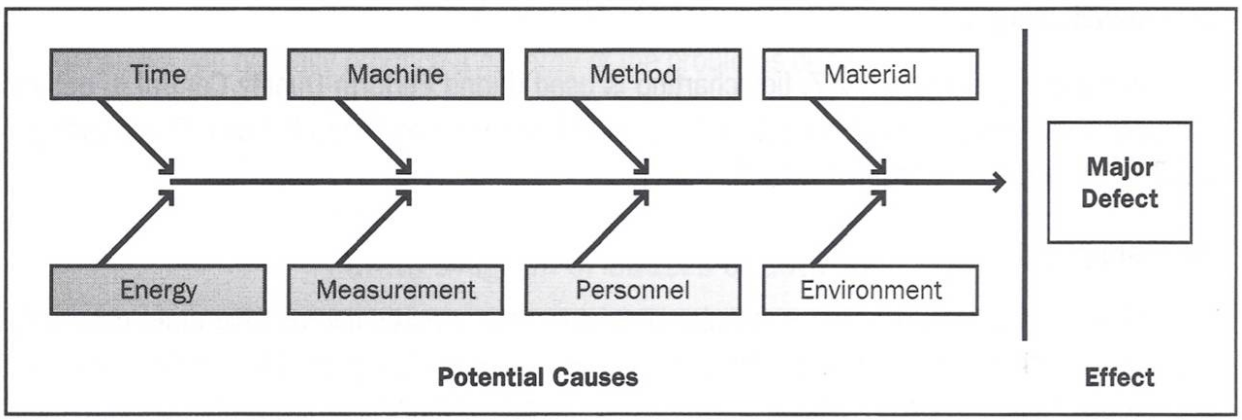


Figure 8-12. Classic Sources of Problems to Consider

Cause and Effect Diagram

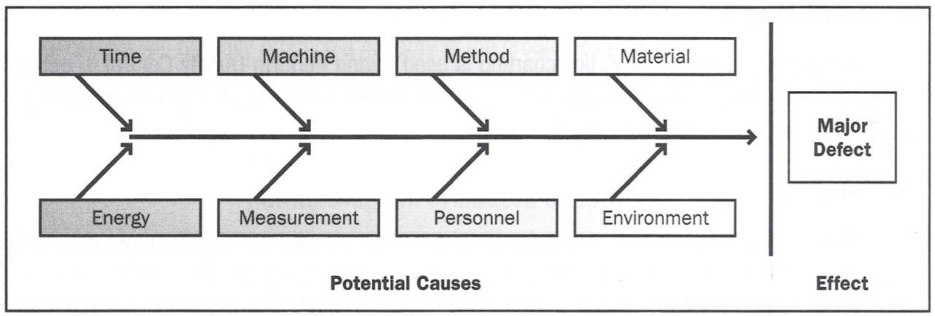


Figure 8-12. Classic Sources of Problems to Consider

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

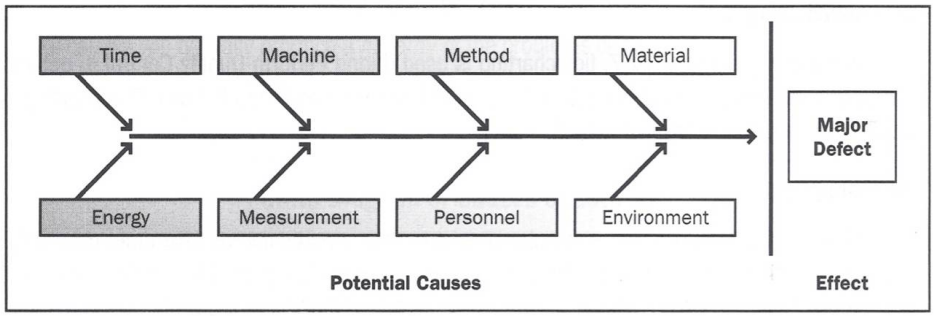


Figure 8-12. Classic Sources of Problems to Consider

Material Grouping

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

Environment Grouping

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

Cause and Effect Diagram

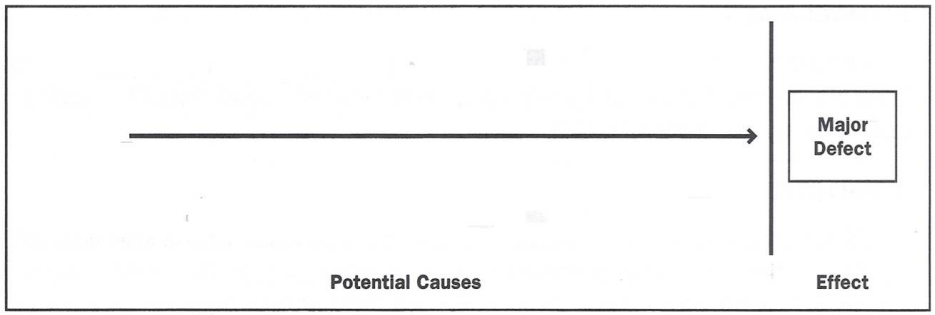
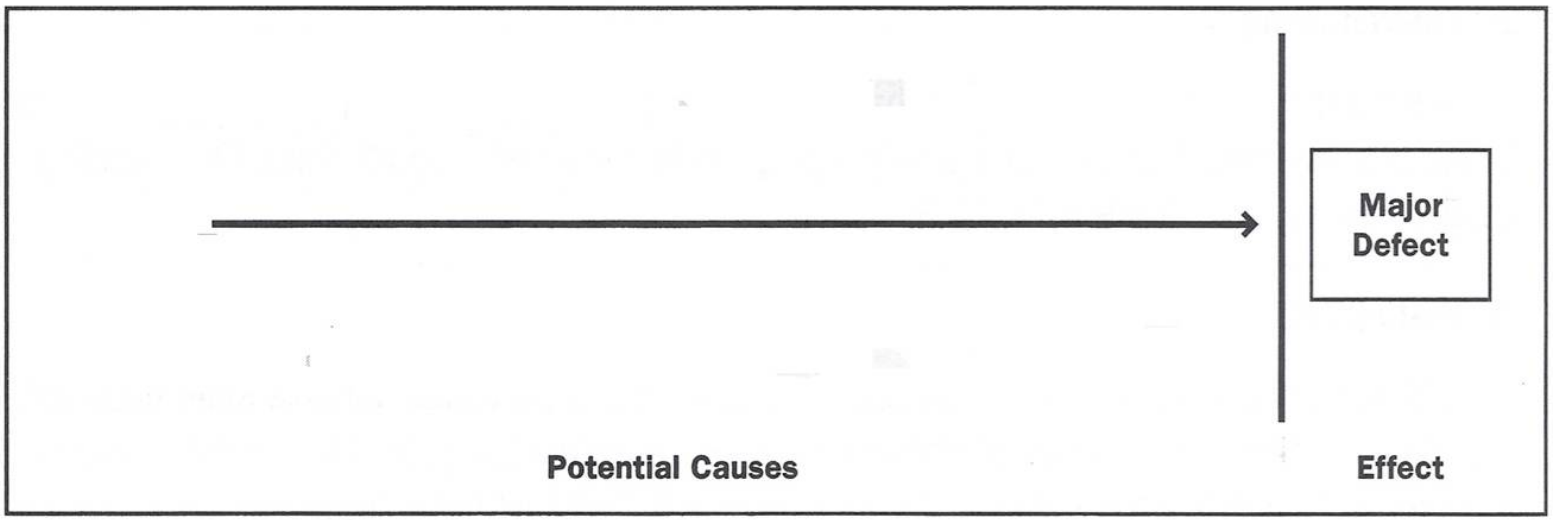


Figure 8-12. Classic Sources of Problems to Consider

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



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1. Identify the problem
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Cause and Effect Diagram

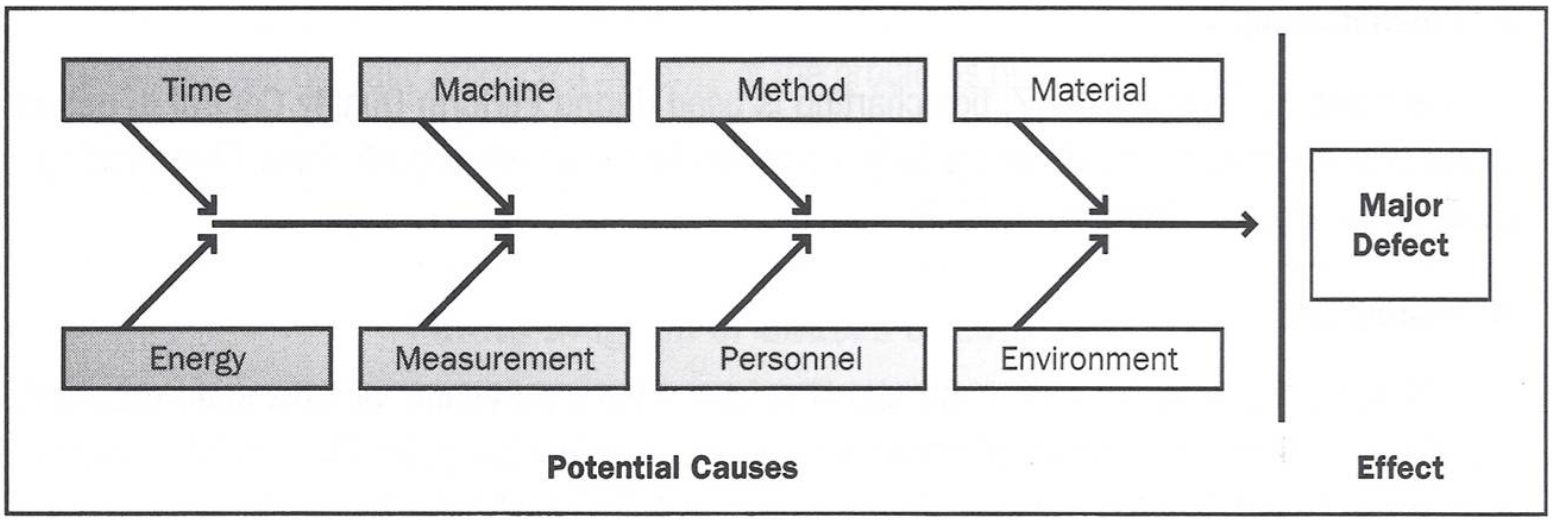


Figure 8-12. Classic Sources of Problems to Consider

3. Identify major categories

Cause and Effect Diagram

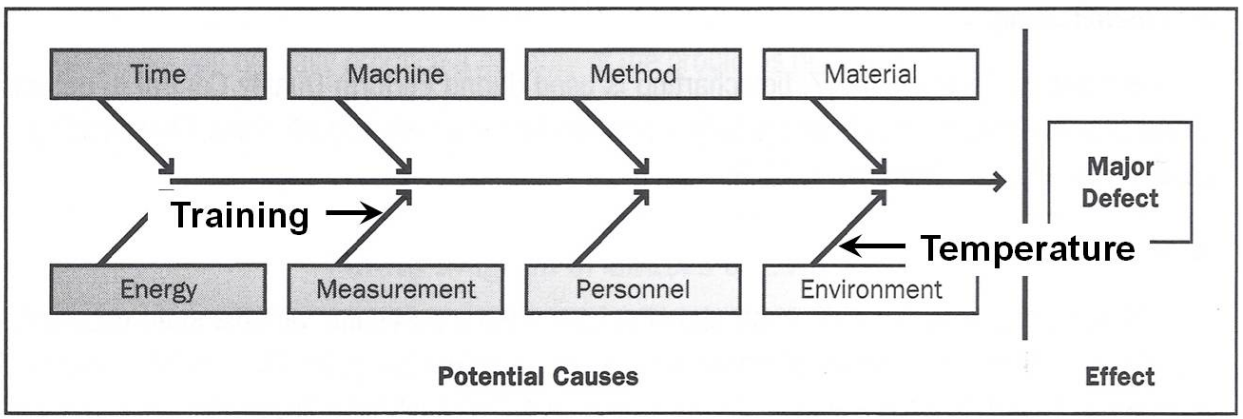


Figure 8-12. Classic Sources of Problems to Consider

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

Control Quality

Part of the Monitoring and Controlling Process Group

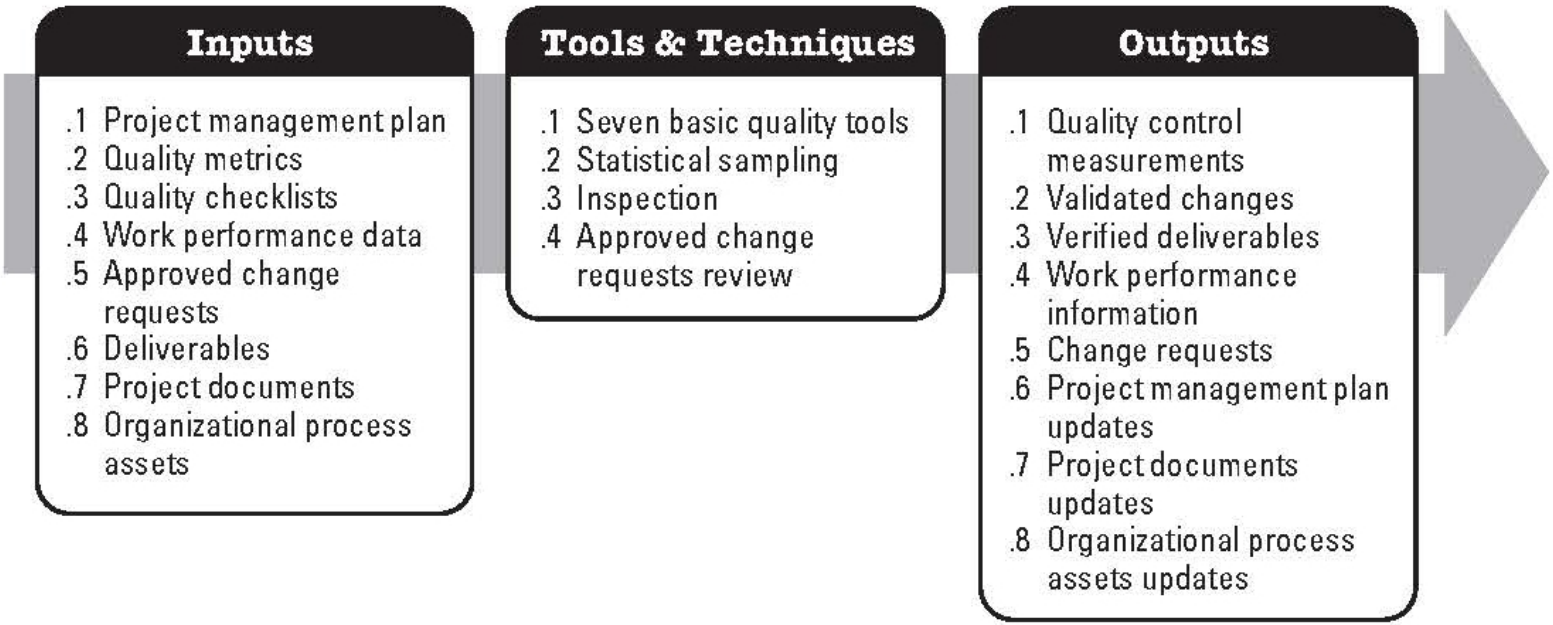
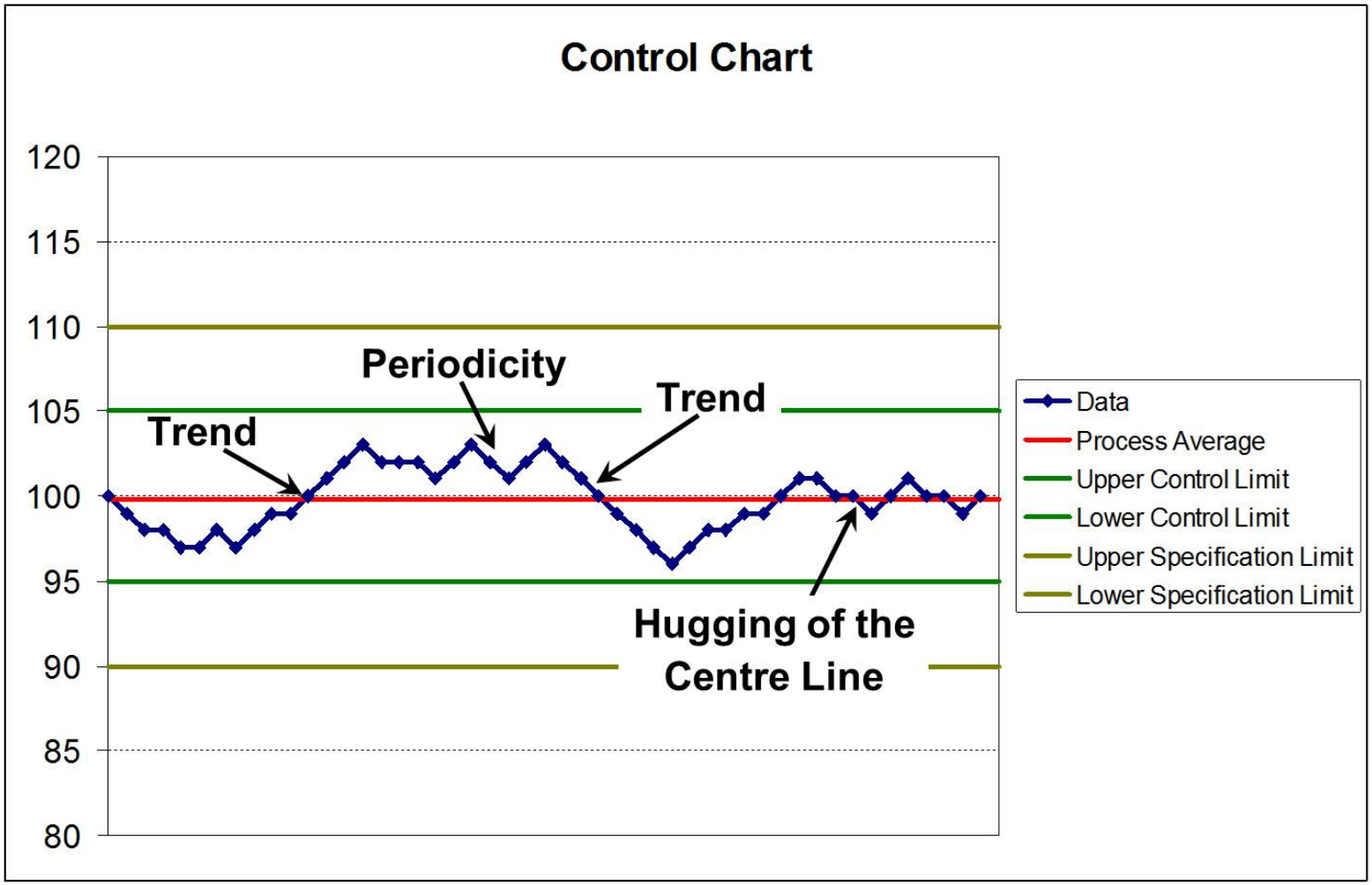


Figure 8-11. Control Quality: Inputs, Tools & Techniques, and Outputs

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.

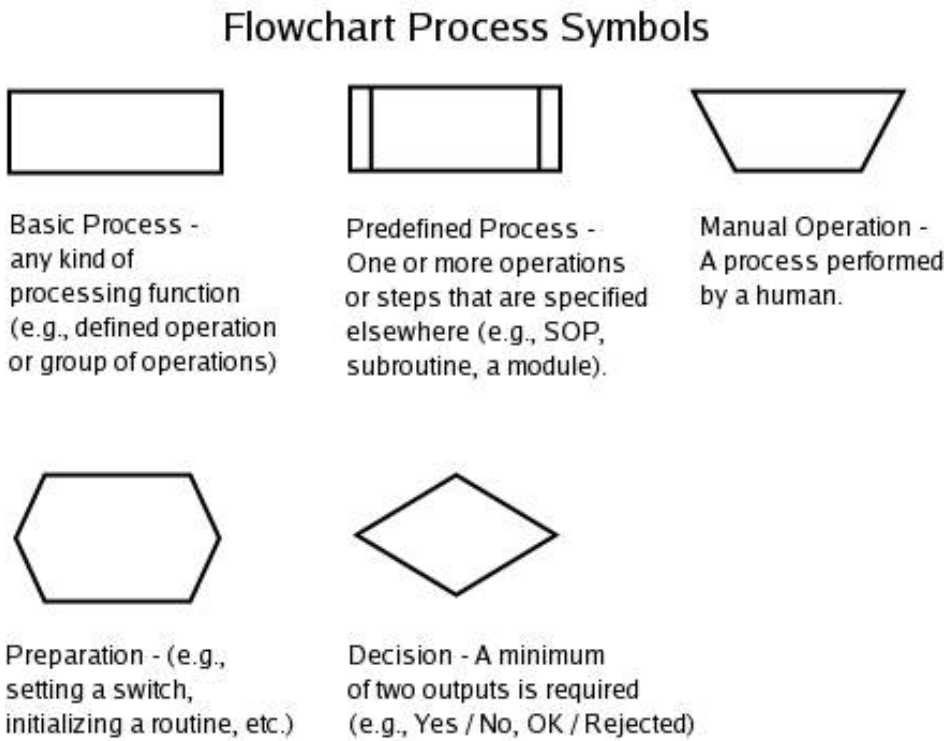
Periodicity

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

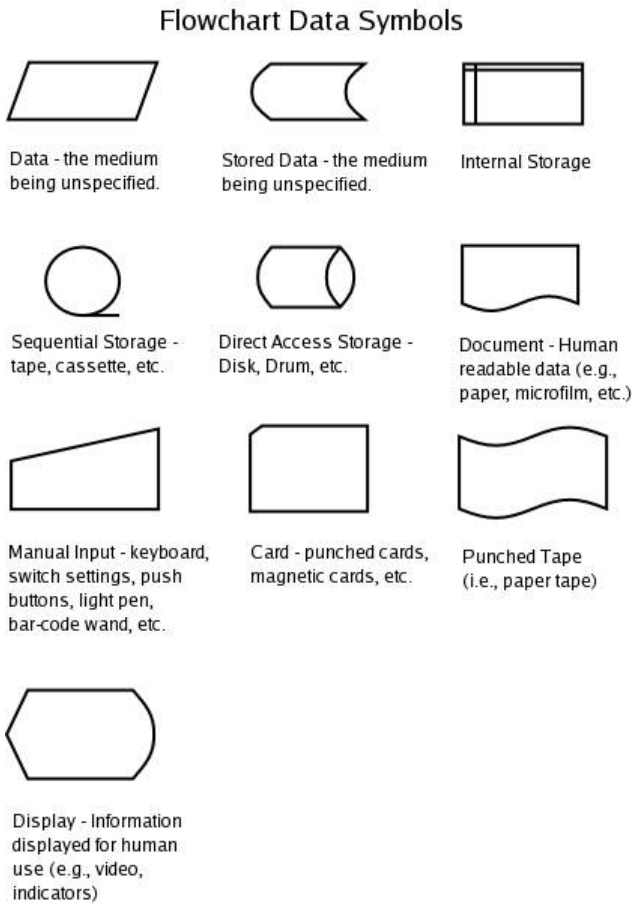
Hugging of the Centre Line

- 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

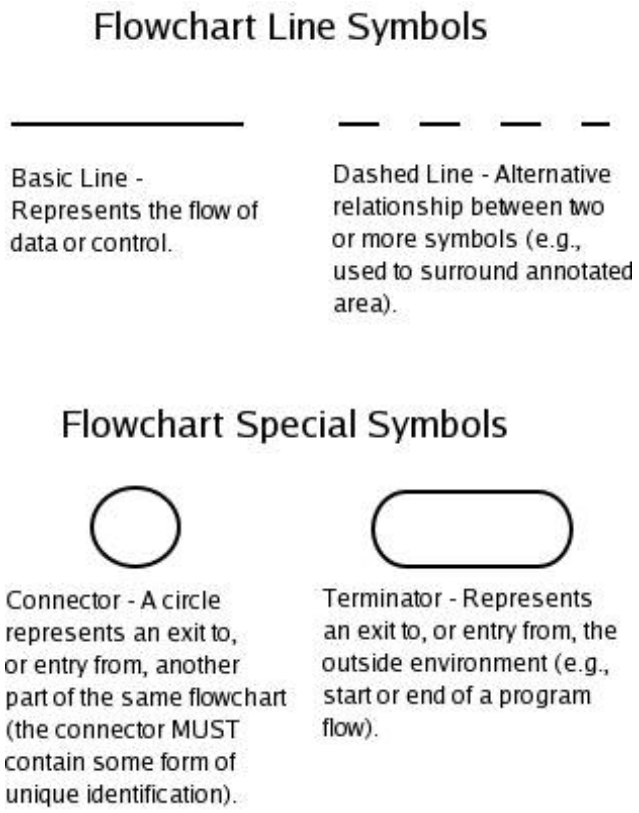

Flowchart Process Symbols
Basic Process - any kind of processing function (e.g., defined operation or group of operations)
Predefined Process - One or more operations or steps that are specified elsewhere (e.g., SOP, subroutine, a module).
Manual Operation - A process performed by a human.
Preparation - (e.g., setting a switch, initializing a routine, etc.)
Decision - A minimum of two outputs is required (e.g., Yes / No, OK / Rejected)

Flow Chart Symbols (ISO5807:1985)



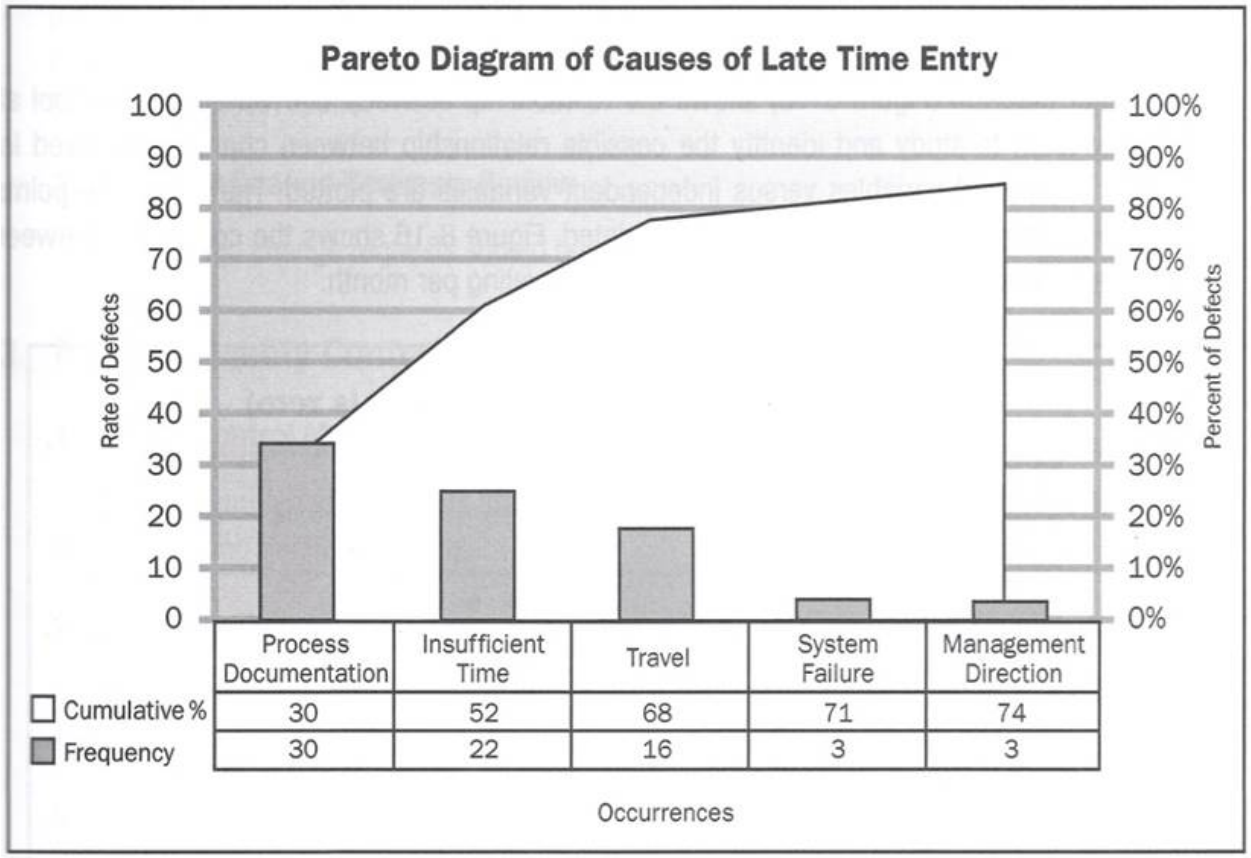
Flow Chart Symbols (ISO5807:1985)

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



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.



	Process Documentation	Insufficient Time	Travel	System Failure	Management Direction
Cumulative %	30	52	68	71	74
Frequency	30	22	16	3	3

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

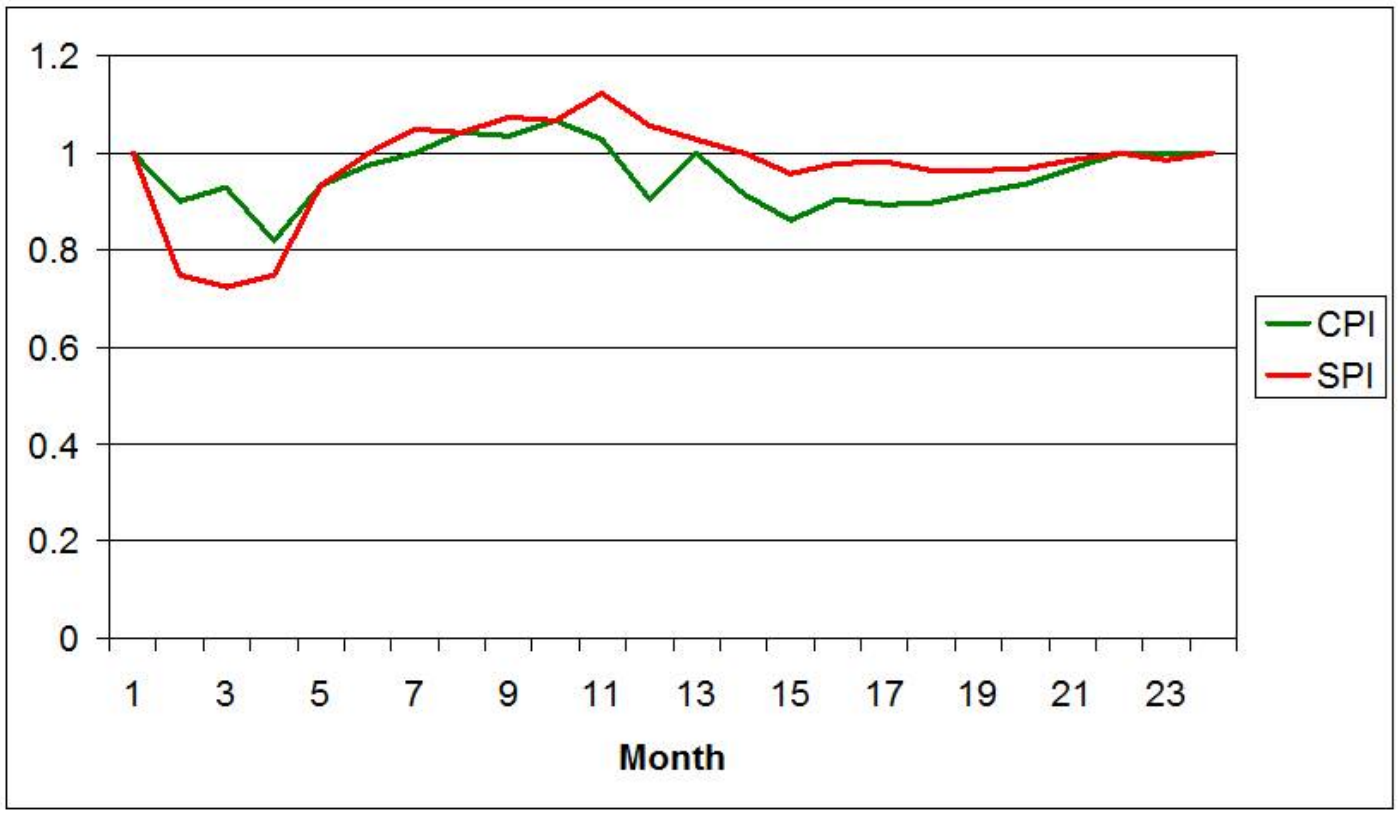
- Combines two or more Pareto Charts for the same process variable for comparison

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:

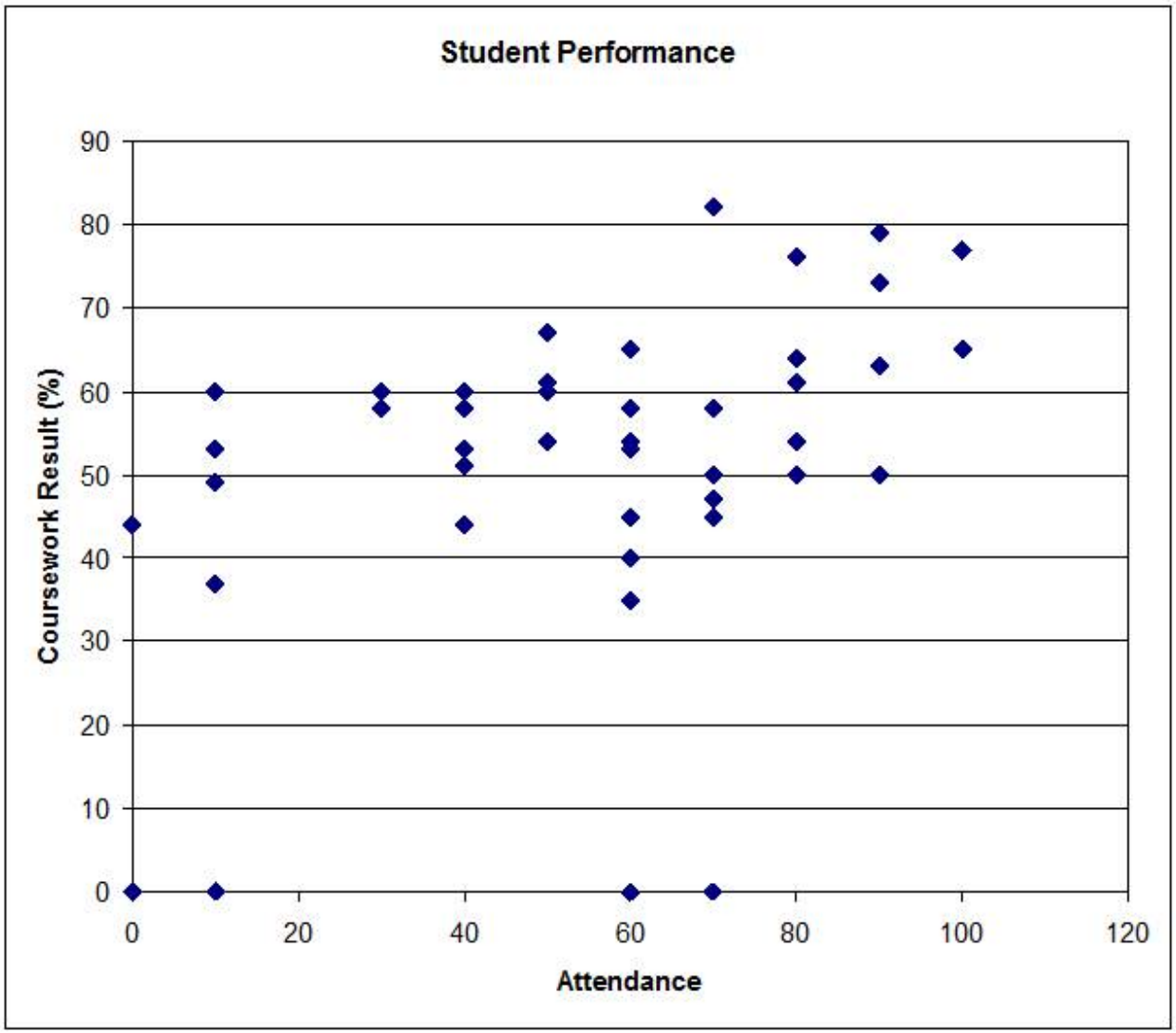
- History
- Pattern of Variation

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

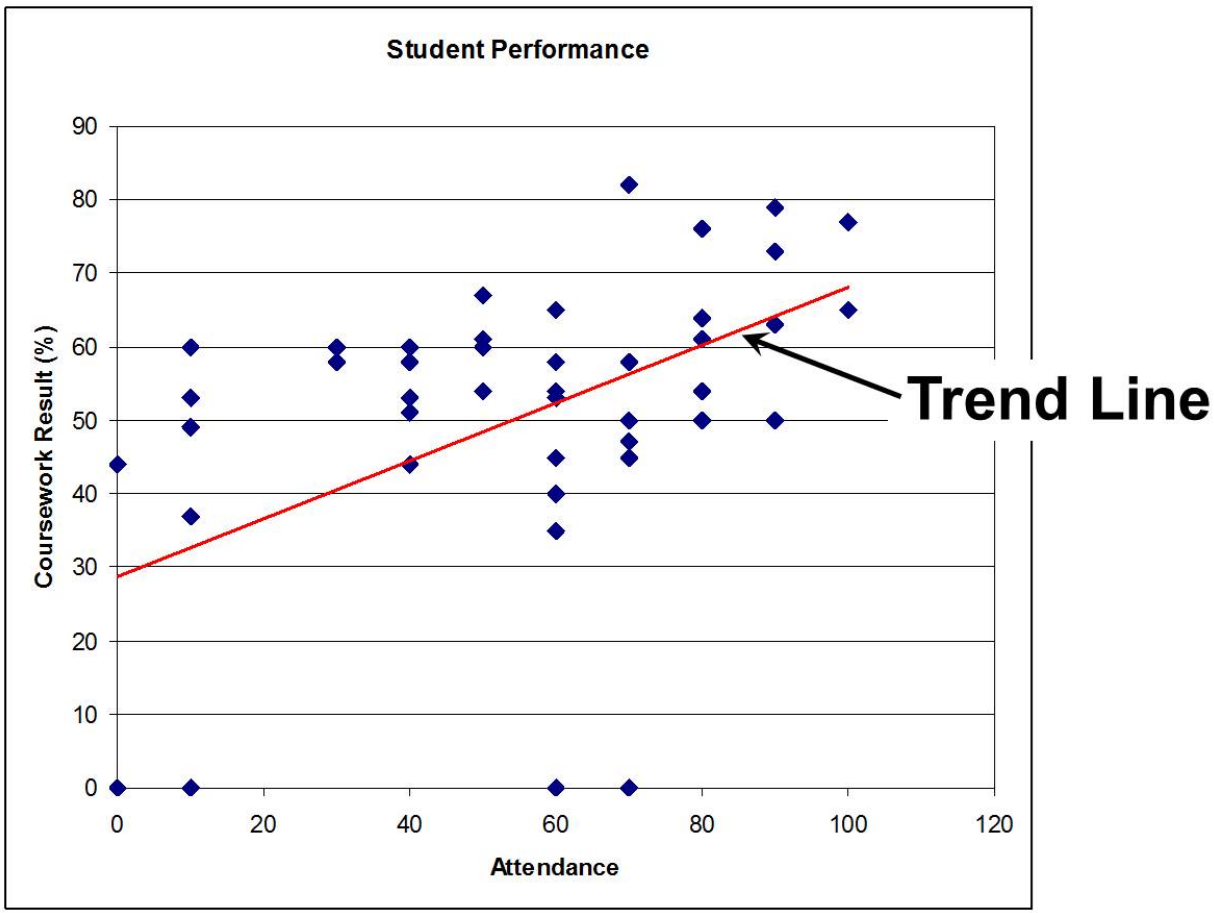
Trend Analysis

- 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

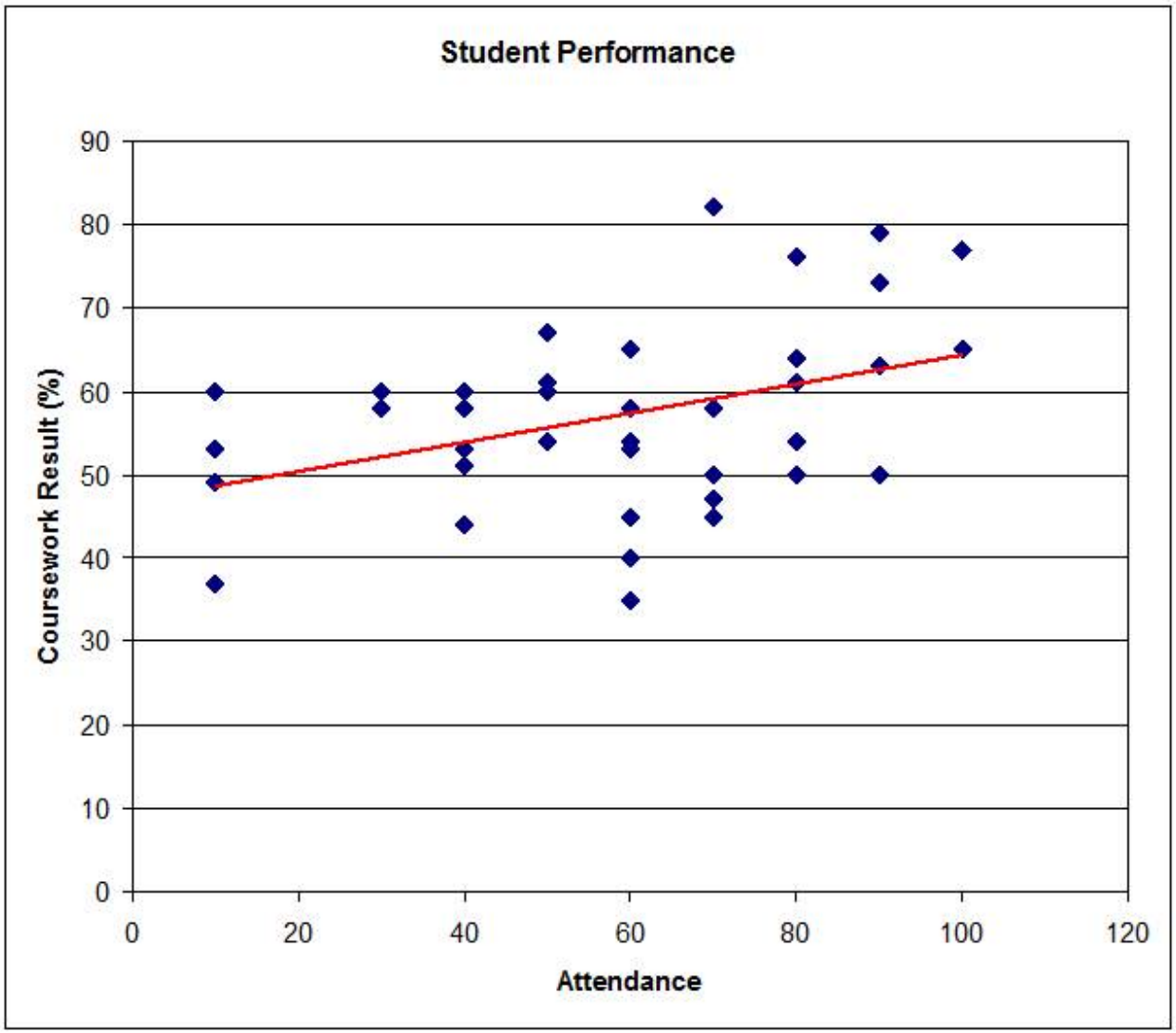
Scatter Diagram - Student Performance



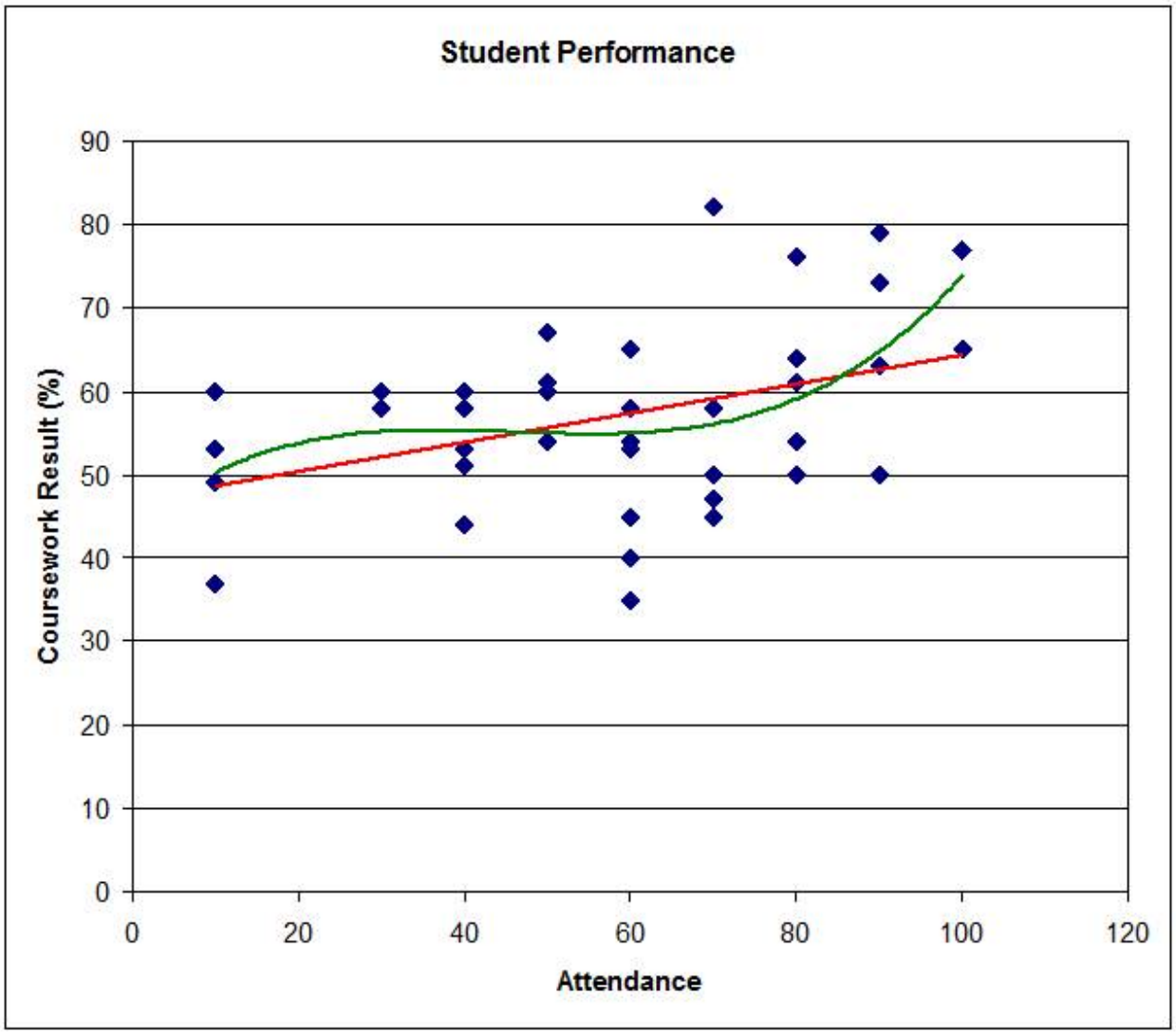
Student Performance - Trend Line



Scatter Diagram - Outliers Removed



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.