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Decision Making using Statistical Process Control

30 December 2024 - 10 2025

Amsterdam (Netherlands)

Decision Making using Statistical Process Control

course code: M1149 From: 30 December 2024 - 10 January 2025 Venue: Amsterdam (Netherlands) - course Fees: 6750 Euro

Introduction

Quality and productivity are essential for survival in the global economy. Customers expect products and services to meet acceptable standards of quality. Quality control involves measuring and managing the variation inherent in processes which produce the finished products.

Statistics plays an important role in Quality management. It provides the objective evidence to managers to monitor and control the performance of production processes and assess the quality of finished products. This is integral to the Total Quality Management approach to product and service delivery.

It is therefore essential that every manager who is responsible for the production of a finished product or the delivery of a service to clients be familiar with the statistical tools that can be used to analyse process output that impacts on product or service quality. In addition such managers should develop quantitative reasoning skills to meaningfully and validly interpret statistical process control findings themselves or question the interpretations given by others.

Objectives

In particular, this program will help you to learn:

- About the concept, sources and measurement of variation in work processes
- To understand the importance of data / data quality in SPC
- About the use of the normal distribution and its importance in SPC
- About the various control charts available for different SPC processes
- To apply appropriate statistical tools to the analysis of quality control data
- To interpret statistical output into meaningful management action
- About the concept, purpose and measurement of process capability

Training Methodology

To make the learning experience more beneficial, delegates will, throughout the program, apply Statistical Process Control tools and other Statistical models to small-scale case study data using laptops with Excel capabilities.

Each session will therefore be interactive, participative, practice-orientated and computer-based. Trainer-led sessions will guide the learning process and workshops with delegates acquiring hands-on exposure by processing both the supplied databases.

It is intended that each delegate will have access to the Excel-based SPC software called SPC IV Excel .

SEMINAR OUTLINE

Setting the Statistical Scene for SPC

- Overview of SPC
    - Process Analysis Fundamentals (Relationship of Quality and Variation)
    - SPC within the framework of Six Sigma
    - The role of Statistics and Data Analysis in Quality Control
    - Data types (Variable / Attribute Data) and Importance of Data Quality
- Introduction of Basic Statistical Concepts and Tools of relevance to SPC
- Summary tables and graphs
- Examine the Distribution of Data using Summary tables and Graphs
    - Frequency distributions and Histograms
    - One-way and two-way pivot tables; breakdown tables
    - Simple, multiple and stacked bar charts
    - Pareto Charts
- Descriptive statistical measures
- Central location, quartiles, percentiles, dispersion, skewness
- Box plots, categorised box plots
- The Normal Probability Distribution (z statistics)
- Excel analysis of sample QC datasets using Basic Statistical tools
- Discussion of findings in the context of the work environment
- Exercises and Discussion

Review of SPC Tools

- Overview and Framework of SPC tools (terms and definitions)
    - Sub-group formation
    - Control Charts (Types; Data requirement; Importance; Methodology; Benefits / advantages; Interpretation; Uses and Applications)
    - Each control chart will be examined under the following headings: Purpose / Uses / Data / Methodology / Computation / Interpretation / Application
- Variable Control Charts - Control Charts for Continuous data measures
- For subgroups (samples of data) (review purpose and
- X(bar) chart (Shewhart sample mean) [Process location]
- R chart (Shewhart sample range) [Process variability / stability]
- Sigma chart (standard deviation plot) [Process variability / stability]
- CUSUM chart (Cumulative Sum) [Location Trend tracking]
- EW Moving Average charts [Location Trend tracking]
- Excel analysis of sample datasets for each Control Chart type
- Interpretation / Discussion of findings in the context of the work environment
- Exercises and Discussion

Review of SPC Tools (continued……)

- Control Charts for Individual data
    - X chart (Shewhart individual x’s)
    - IX / MR charts (Individual x’s and Moving Range) [Variability tracking]
- Attribute Control Charts - Control Charts for Discrete/Countable data measures

- p chart (Sample proportion defective) (based on a Bernoulli process)
- np chart (Sample number of defectives) (i.e. Bernoulli process)
- c chart (Sample number of defectives per sub-group) (Poisson process)
- u chart (or c(bar) chart) (Sample number of defects per unit)
- Excel analysis of sample datasets for each Control Chart type
- Interpretation / Discussion of findings in the context of the work environment
- Exercises and Discussion

Validity Tests and Process Capability

- Tests and Conditions of Valid SPC Analysis
    - Control Chart Assumptions (normal pdf; independence)
    - Curve Fitting (Normal Distribution) (K-S hypothesis test for Normality)
    - Run Chart and Run Test Rules
- Process Capability Analysis
- Overview of Process Capability analysis (Evans / Olson p155/156)
- Process Capability Index (Cp)
- Process Performance Index (Cpk)
- Using Excel to analyse sample datasets for validity tests and process capability
- Interpretation / Discussion of findings in the context of the work environment
- Exercises and Discussion

More Advanced Statistical Tools in SPC

- Statistical Methods to make Inferences about Process Behaviour
    - Sampling and sampling distributions
    - Confidence limits – Use and Interpretation
    - Hypothesis tests (t-test: two sample test of means) – Use and Interpretation
    - Analysis of Variance (Anova) – Use and Interpretation
    - Regression Analysis (scatter plots; correlations)
- Exercises and Discussion
- Excel analysis of sample datasets to illustrate each of the Statistical Tools in SPC
- Interpretation / Discussion of findings in the context of the work environment
- Discussion
- “How to integrate SPC into the work domain”
- Focus on an action plan for each delegate to take back to his/her organization
- Workshop Review Session
- Evaluation and Closure

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