€TRAINING

Decision Making using Statistical Process Control

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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 that produce the finished products.

Statistics play an important role in Quality management. It provides 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 analyze 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.

Course Objectives:

At the end of this course the participants will be able to:

- Know more about the concept, sources, and measurement of variation in work processes.
- Understand the importance of data/data quality in SPC.
- Use of the normal distribution and its importance in SPC.
- Control charts available for different SPC processes.
- Apply appropriate statistical tools to the analysis of quality control data.
- Interpret statistical output into meaningful management action.
- Know more about the concept, purpose, and measurement of process capability.

Targeted Audience:

- Managers, Supervisors, and Team Leaders
- Professionals in management support roles
- Analysts who typically encounter data / analytical information regularly in their work environment
- Those who seek to derive greater decision making value from data analytics

Course Outlines:

Unit 1: 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 the 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, categorized 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.

Unit 2: 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.
- Xbar 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.

Unit 3: 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 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.

Unit 4: 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 analyze sample datasets for validity tests and process capability.
- Interpretation / Discussion of findings in the context of the work environment.
- Exercises and Discussion.

Unit 5: 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: a 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.