FDE 418
FOOD QUALITY CONTROL
LESSON-7

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Measurement Techniques and Quality Strategies

- ✓ Seven statistical quality control tools for analyzing and interpreting numerical data:
  - ✓ (1) data sheet
  - ✓ (2) cause-and-effect diagram
  - ✓ (3) scatter diagram
  - ✓ (4) flowchart
  - ✓ (5) Pareto chart
  - ✓ (6) histogram
  - ✓ (7) control chart

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Data Sheet

- ✓ Data from a table, form, query, view or stored procedure displayed in a row-and-column format
- ✓ A structured, prepared form for collecting and analyzing data
- ✓ A generic tool that can be adapted for a wide variety of purposes

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Cause-and-Effect Diagram

- ✓ Causes are arranged according to their level of importance or detail, resulting in a depiction of relationships and hierarchy of events
- ✓ This helps to identify areas where there may be problems and allows for comparison of their relative importance
- ✓ CEDs are typically constructed through brainstorming techniques

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Cause-and-Effect Diagram

- ✓ Causes in a cause-and-effect diagram are frequently arranged into the four most common major categories

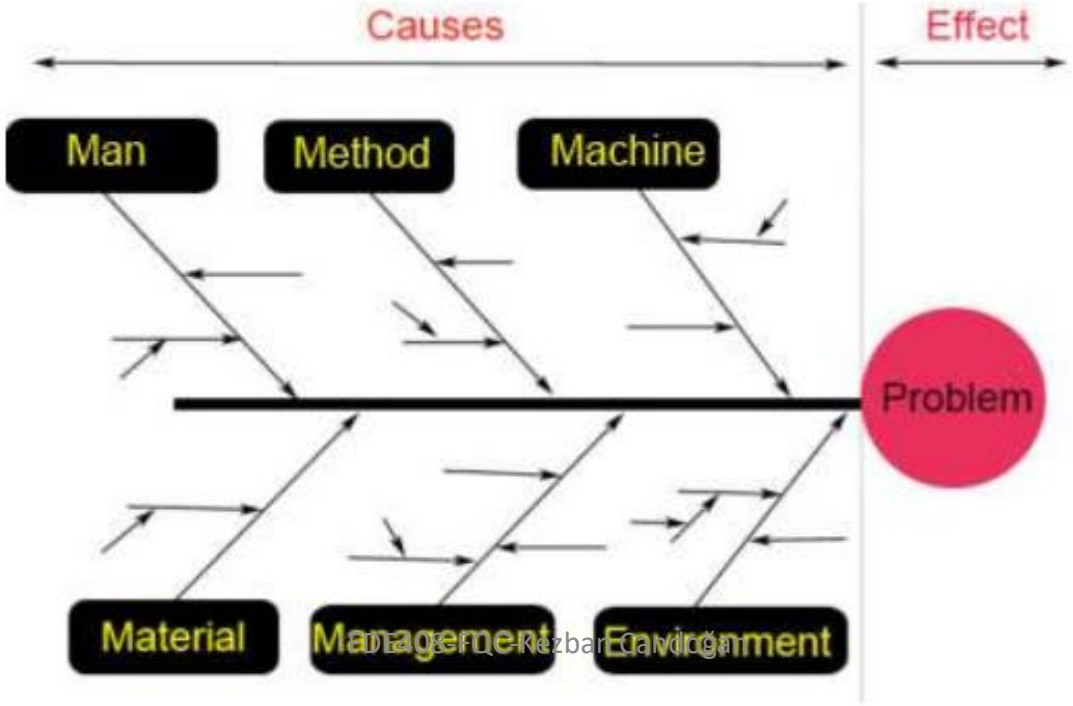
a) **For manufacturing: Manpower, methods, materials and machinery**

b) **For administration and planning: Equipment, policies, procedures, and people**

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Cause-and-Effect Diagram

- ✓ The cause-and-effect diagram is also known as “Ishikawa diagram” or “fishbone diagram”
- ✓ It was drawn to resemble the skeleton of a fish with the main causal categories drawn as bones attached to the spine of the fish



Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Scatter Diagram (scatter chart)

- ✓ Similar to a line graph, except that the data points are plotted without a connecting line drawn between them
- ✓ Suitable for showing how data points compare to each other
- ✓ At least two measured objects are needed for the query (one for the *x*-axis and one for the *y*-axis)
- ✓ Scatter diagrams are used to study possible relationships between two variables

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

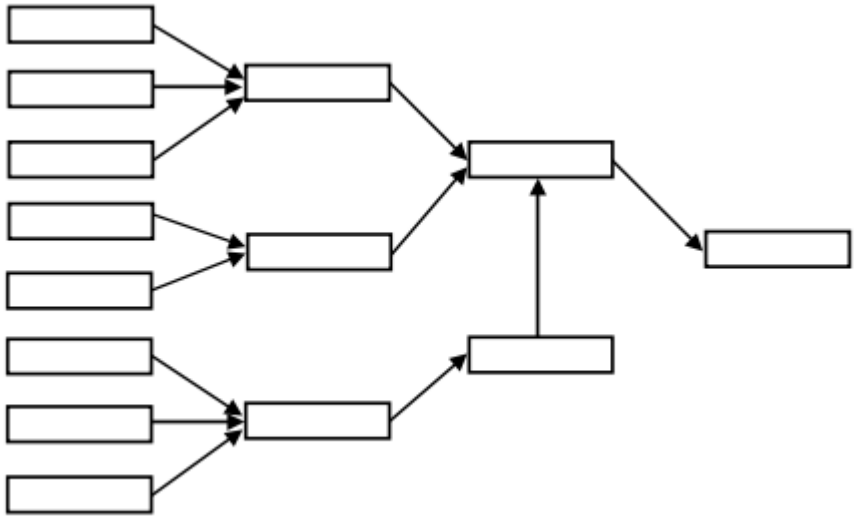
Flowchart

- ✓ An important project development and documentation tool
- ✓ A graphic representation employing standard graphic icons, usually a series of blocks with each block representing one major process
- ✓ Describes an operation that is studied or is used to plan stages of a project
- ✓ Provides an excellent form of documentation for a process operation, and often are useful when examining how various steps in an operation work together

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Flowchart

- ✓ Visually records the steps, decisions, and actions of any manufacturing or service operation and defines the system, its key points, activities, and role performances
- ✓ The description of each process is written inside the blocks
- ✓ Any other significant information is usually written outside the blocks.Each block is connected with an arrow to show where that process leads



Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Histograms and pareto charts

- ✓ Histogram is a bar chart to show frequencies of causes of problems to understand preventive or corrective action
  - ✓ shows a distribution of variables or causes of problems
- ✓ A Pareto chart is a specific type of histogram that represents causes of problems by their overall influence
- ✓ This is an effective tool to prioritise corrective action as errors with greatest impact are displayed in descending order of frequency

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Histograms

- ✓ They can be constructed by segmenting the range of the data into equal-sized bins (segments, groups, or classes)
- ✓ The vertical axis of the histogram is the frequency (the number of counts for each bin) and the horizontal axis is labeled with the range of the response variable
- ✓ The number of data points in each bin is determined and the histogram constructed
- ✓ The user defines the bin size

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Histograms

- ✓ A histogram can help answer questions such as:
  - ✓ What is the most common system response?
  - ✓ What distribution (center, variation and shape) do the data have?
  - ✓ Do the data look symmetric or skewed to the left or right?
  - ✓ Do the data contain outliers?

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Pareto Charts

- ✓ It graphically summarizes and displays the relative importance of the differences between groups of data
- ✓ A Pareto chart can be constructed by segmenting the range of the data into groups (also called segments, bins or categories)
- ✓ The number of data points in each group is determined and the Pareto chart is constructed
- ✓ Unlike the bar chart, the Pareto chart is ordered in descending frequency magnitude

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Pareto Charts

- ✓ The groups are defined by the user
- ✓ The Pareto chart is valuable in answering questions such as:
  - ✓ What are the largest issues facing a team or business?
  - ✓ What efforts should be focused on to achieve the greatest improvements?
  - ✓ What 20% of sources are causing 80% of the problems (80/20 rule)?

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Pareto Charts

- ✓ The idea: by doing 20% of the work you can generate 80% of the benefit of doing the entire job
- ✓ Take quality improvement, for example, a vast majority of problems (80%) are produced by a few key causes (20%)
- ✓ The 80/20 rule can be applied to almost anything:
  - ✓ 80% of customer complaints arise from 20% of your products and services
  - ✓ 20% of your products and services account for 80% of your profit
  - ✓ 20% of a systems' defects cause 80% of its problems

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Control charts

- ✓ Proven techniques to improve the process
- ✓ When used correctly, control chart can:
  - ✓ improve productivity
  - ✓ reduce scrap and rework
  - ✓ prevent defects
  - ✓ avoid problems in the next operation
  - ✓ avoid under- and over-control
  - ✓ fill the communication gap between the workers and their job

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Control charts

- ✓ A graphical display of a quality characteristic that has been measured or computed from a sample vs. the sample number or time
- ✓ One of the most technically sophisticated tools of statistical quality control universally used to present quality data
- ✓ Based on continuous monitoring of process variation
- ✓ The chart contains a center line that represents the average value of the quality characteristic corresponding to the in-control state

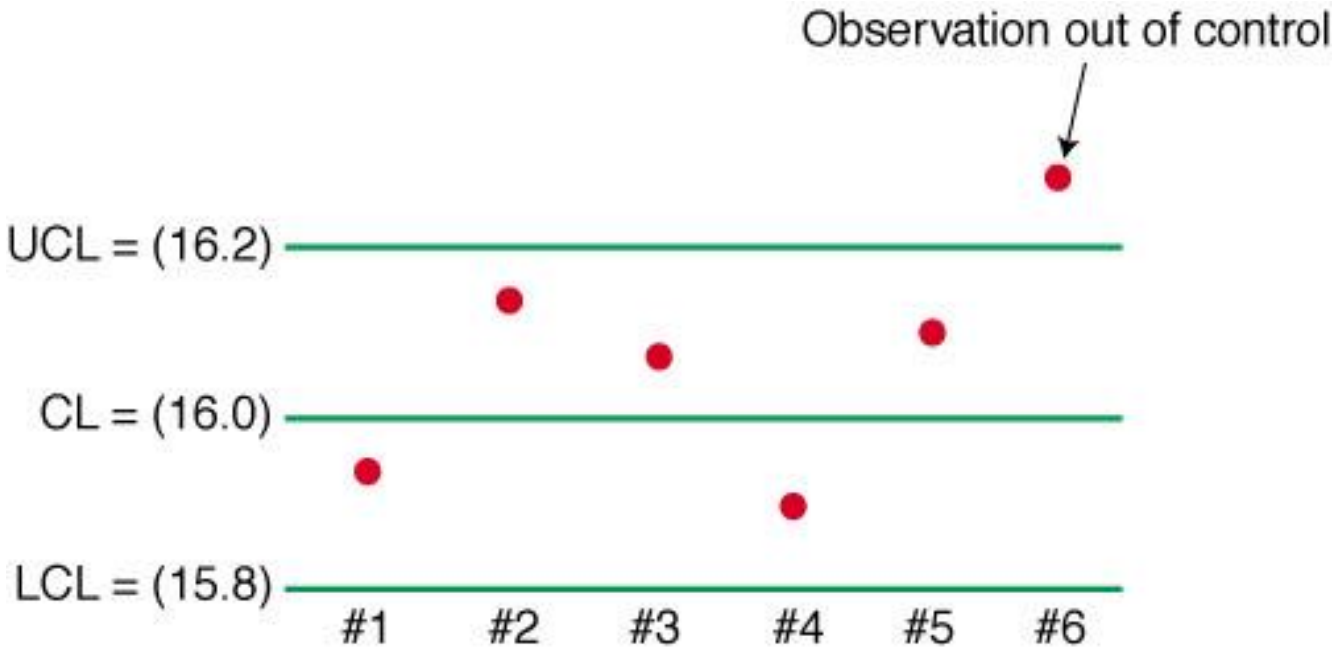
Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

Control charts

- ✓ Two other horizontal lines called the upper control limit (UCL) and the lower control limit (LCL) are also drawn
- ✓ These control limits are chosen so that if the process is in control, nearly all of the sample points will fall between them

Developing Control Charts

- ✓ ***Control Charts*** show sample data plotted on a graph with CL, UCL and LCL
- ✓ ***Control chart for variables*** are used to monitor characteristics that can be measured, e.g. length, weight, diameter, time
- ✓ ***Control charts for attributes*** are used to monitor characteristics that have discrete values and can be counted, e.g. % defective, # of flaws in a shirt, etc.



Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

X-Bar and R Charts

- ✓ The most commonly used of the control charts and the most valuable
- ✓ Easy to prepare, simple to understand and extremely useful in locating problems
- ✓ Ideal tools to improve product quality and process control and can help to drastically reduce scrap and rework while assuring the production of only satisfactory products

Statistical Analysis Tools for Analyzing and Interpreting Numerical Data

X-Bar and R Charts

- ✓ In the food industry they can be used for controlling every step of a production process, ***for the acceptance or rejection of lots and for early detection of equipment or process failures***

- ✓ The X-bar and the R charts are used for control of variables that are expressed in discrete numbers such as inches, pounds, pH units, angstroms, percent solids or degrees of temperature

Other Tools for Analyzing and Interpreting Numerical Data

- ***Spider charts:*** graphically display the performance of multiple variables on a single page providing easy-to-read data
- Depicts an activity's performance compared to other like activities

- ***Pie Chart:*** a circle graph divided into pieces or segments, each displaying the size of some related piece of information. They do not show changes over time