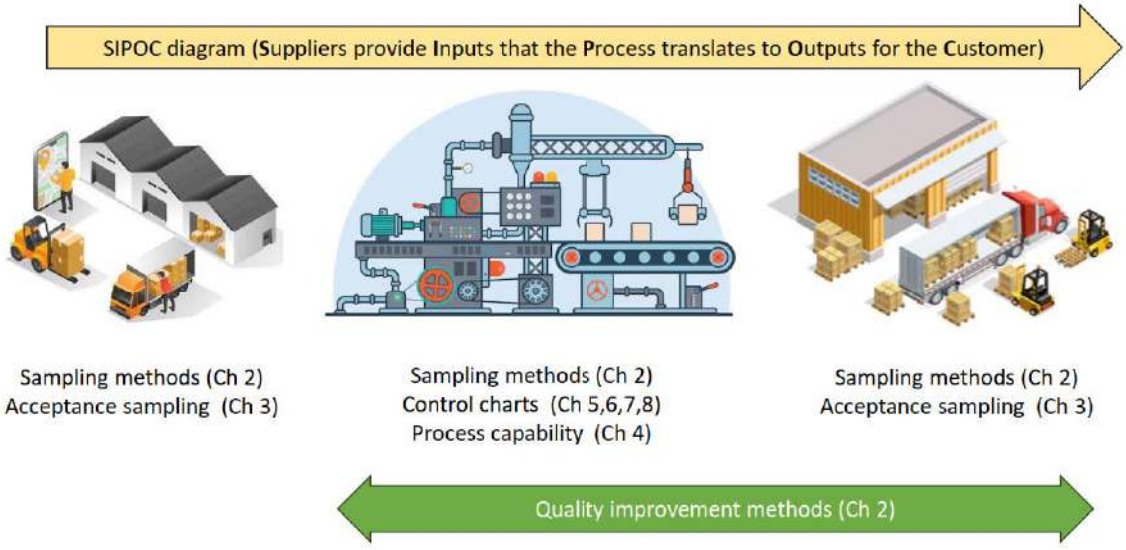
Chapter 2

Quality Overview

Quality Span



Statistical Quality Control Description

- *Statistical Quality Control includes both*
  1. *the application of statistical sampling theory that deals with quality assurance and*
  2. *the use of statistical techniques to monitor and control a process.*
- *The former includes acceptance sampling procedures for inspecting incoming parts or raw materials, and the latter (often referred to as statistical process control or SPC) employs the use of control charts, continuous improvement tools, and the design of experiments for early detection and prevention of problems, rather than correction of problems that have already occurred.*

Sampling Techniques

- *Consider you conduct research about a group of people/product/animal/etc, it's rarely possible to collect data from every item in that group.*
- *Instead, you select a* ***sample****.*
- *The sample is the group of* ***individuals*** *who will actually participate in the research.*
- *To draw valid conclusions from your results, you have to carefully decide how you will select a sample that is representative of the group as a whole.*
- *This is called a* ***sampling method****.*

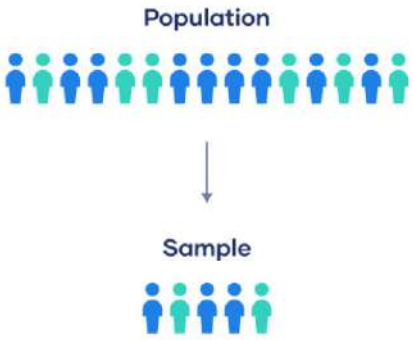
Sampling Techniques

- *There are two primary types of sampling methods:*
  - ***Probability sampling*** *involves random selection, allowing you to make strong statistical inferences about the whole group.*
    - *Every member of the population has a chance of being selected.*
  - ***Non-probability sampling*** *involves non-random selection based on convenience or other criteria, allowing you to easily collect data.*
    - *Every member has <u>not</u> a chance of being selected.*

Sampling Techniques

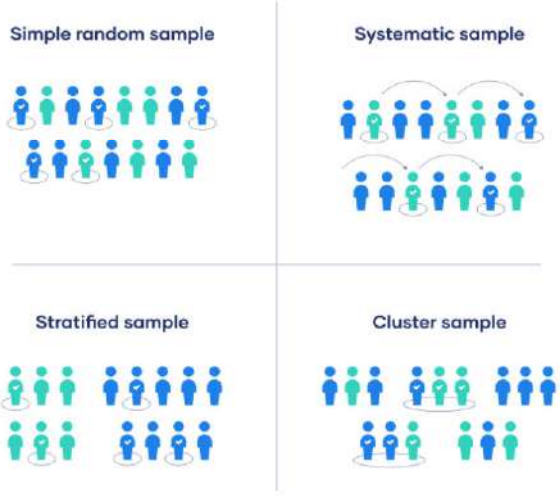
- *First, you need to understand the difference between a population and a sample:*
  - *The **population** is the entire group that you want to draw conclusions about.*
  - *The **sample** is the specific group of individuals that you will collect data from.*

- *Mind the difference between SAMPLE SIZE vs SAMPLE #*



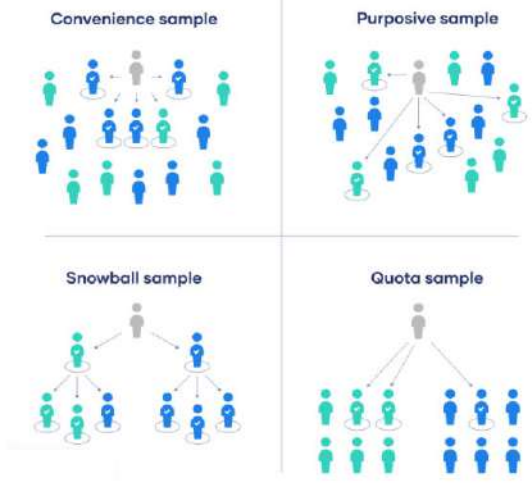
Probability Sampling Techniques

1. ***Simple random sample**, every member of the population has an equal chance of being selected.*
2. ***Systematic sampling** every member of the population is listed with a number, individuals are chosen at regular intervals.*
3. ***Stratified sampling** dividing the population into subpopulations that may differ in important ways.*
4. ***Cluster sampling** dividing the population into subgroups, you randomly select entire subgroups.*



Non-probability Sampling Techniques

1. ***Convenience sample,** includes the individuals who happen to be most accessible*
2. ***Purposive sampling,** a sample that is most useful to the purposes of the research*
3. ***Snowball sampling,** used to recruit participants via other participants.*
4. ***Quota sampling,** relies on the non-random selection of a predetermined number or proportion of units*



Important Terms

- ***Item/Individual:*** *a single unit that is being inspected or tested, for example, in a car in a manufacturing process, a piece of machinery, or single transaction in service industry.*
- ***Sample:*** *a group of items randomly selected from a population (or lot) for the purpose of statistical analysis.*
- ***Batch:*** *a smaller group of items (than lot) that are produced together in a single run, for example, in pharmaceutical industry, a batch could refer to all the tablets that are produced in a single production run.*
- ***Lot:*** *a larger group of items that are produced under similar conditions with similar attributes and are considered to be homogeneous, for example: the product's processing location and its manufacture or expiration date.*
- ***Population:*** *the entire group or set of items that are being considered for analysis or inspection.*

Quality Characteristics

- *Attributes*
- *Variables*

Quality Control Approaches

- *Generally, there are two approaches for inspection and controlling the quality of what we want to evaluate:*

1. *Discrete inspection: acceptance sampling problem*
   i. *ASP plans for attributes*
   ii. *ASP plans for variables*

2. *Continuous inspection: control charts*
   i. *Control charts for attributes*
   ii. *Control charts for variables*

The Acceptance-Sampling Problem

- *A typical application of acceptance sampling is as follows:*
  1. *A company receives a shipment of product from a supplier*
  2. *This product is often a component or raw material used in the company's manufacturing process*
  3. *A sample is taken from the lot, and some quality characteristic of the units in the sample is inspected*
  4. *On the basis of the information in this sample, a decision is made regarding lot disposition*
  5. *Usually, this decision is either to* ***accept*** *or to* ***reject*** *the lot*
- *There are other uses of sampling methods.*
  - *For example, frequently a manufacturer will sample and inspect its own product at various stages of production.*
  - *Lots that are accepted are sent forward for further processing, and rejected lots may be reworked or scrapped.*

The Acceptance-Sampling Problem

- *Generally, there are three approaches to lot sentencing:*
  1. *Accept with no inspection*
  2. *100% inspection—that is, inspect every item in the lot, removing all defective1 units found*
  3. *Acceptance sampling*

The Acceptance-Sampling Problem

- *Acceptance sampling is most likely to be useful in the following situations:*
  1. *When testing is destructive*
  2. *When the cost of 100% inspection is extremely high*
  3. *When 100% inspection is not technologically feasible or would require so much calendar time that production scheduling would be seriously impacted*
  4. *When there are many items to be inspected and the inspection error rate is sufficiently high that 100% inspection might cause a higher percentage of defective units*
  5. *When the supplier has an excellent quality history, and some reduction in inspection from 100% is desired*
  6. *When there are potentially serious product liability risks, and although the supplier's process is satisfactory*

The Acceptance-Sampling Problem

- *When acceptance sampling is contrasted with 100% inspection, it has the following advantages:*
  1. *It is usually less expensive because there is less inspection*
  2. *There is less handling of the product, hence reduced damage*
  3. *It is applicable to destructive testing*
  4. *Fewer personnel are involved in inspection activities*
  5. *It often greatly reduces the amount of inspection error*

The Acceptance-Sampling Problem

- *Acceptance sampling also has several disadvantages. These include the following:*
  1. *There are risks of accepting "bad" lots and rejecting "good" lots*
  2. *Less information is usually generated about the product or about the process that manufactured the product*
  3. *Acceptance sampling requires planning and documentation of the acceptance-sampling procedure whereas 100% inspection does not*