STATISTICAL QUALITY CONTROL

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The most important word in Statistical Quality control is *Quality*

The quality of a product is satisfactory when it is able to satisfy the stated and implied needs of the customer.

- Customer or consumer is a person or organization that use the product.
- Quality doesn't mean merely the goodness or fitness of a finished product. It is a relative term and is used generally with reference to the end use of the product.
- Since a product is manufactured for the use of a customer, the requirements of the customer dictates the quality of the product.

Quality is to be planned, achieved, controlled and improved continuously.

- Distinct meanings of quality
  - Quality of Design
  - Quality of Conformance

Quality of design refers to the differences in the specifications for products which have the same use.

Eg.: Different brands of razor blades may differ in their specifications w.r.to the steel used, sharpness, corrosiveness, price etc., though they serve the same functional purpose.

Quality of design thus refers to the method of construction, processing, material used, style factors, safety factors etc.

- Quality of conformance refers to the ability of the production process to maintain the specified quality of design in the long run.

In other words, Quality of conformance may be considered as the measure of truthfulness with which the product conforms to the design specifications.

- Quality control is a name given to the collection of techniques and devices used to manage, monitor and control all the steps in the production of a product of desired quality.

It is a powerful statistical technique for effective diagnosis of lack of quality (or lack of conformity to settled standards)in any of the materials, processes, machines or end products.

Aims or Objectives of SQC

- To improve the company's income by manufacturing products more acceptable to the customers, providing long life, greater usefulness, maintainability etc.
- To reduce company's cost through reduction of the losses due to defects(non conformities), ie. to achieve lower scrap, rework, customer returns etc.
- To produce optimum quality at minimum cost.
- To ensure satisfaction of consumers with products to build goodwill, confidence, reputation of manufacturers.
- Judging conformity of the products to the stated standards and taking suitable action where there are non conformities.
- Developing quality consciousness in the organization.
- Provide a running commentary on the performance of machines and operations in the production process.

Quality Characteristics:

When quality is considered, it is specified by one or more characteristics and can be studied independently or jointly.

- The quality may be
  - Technological

(Strength, Hardness, Diameter, Life length etc.)

  - Psychological

(Taste, Beauty, odour etc.)

  - Ethical

(Honesty, Integrity, Incorruptibility etc.)

  - Contractual

(Guarantee, Safety, Provisions etc.)

The quality characteristics observed in industry may be generally classified into any of the following categories

- **Directly measurable (Variable)**

  (Thickness, life length, temperature, tensile strength etc., producing continuous data)

- **Non-measurable (Attributes)**

  (Cracks, Breakages, Assembly defects, Air bubbles etc., producing discrete data)

Causes of Variation

Once the design of quality has been specified, the whole production process will be adjusted to manufacture the product according to the specifications.

- At this stage, the problem of conformance (producing items that conforms to the design specifications) starts.
- The problem arise from the fact that every manufacturing process exhibits variability.
- Variation in the quality of manufactured product in the repetitive process in industry is inherent and unavoidable.

- The variations affecting a production process are broadly classified as being due to two causes
  - Chance causes (common causes/random causes)
  - Assignable causes(non random causes or special causes)

Chance causes

- Minor causes that behaves in a random manner.
- The variation due to these causes is beyond the control of human hand
- Cannot be prevented or eliminated under any circumstances
- Many in number
- Each contribute a little to the variation
- Are continuously active in the process and are built in as a part of the process.

The natural or inherent variability of the process is the cumulative effect of these uncontrollable chance causes.

The range of such variations (called allowable variation) is known as natural tolerance of the production process.

- **Assignable causes**

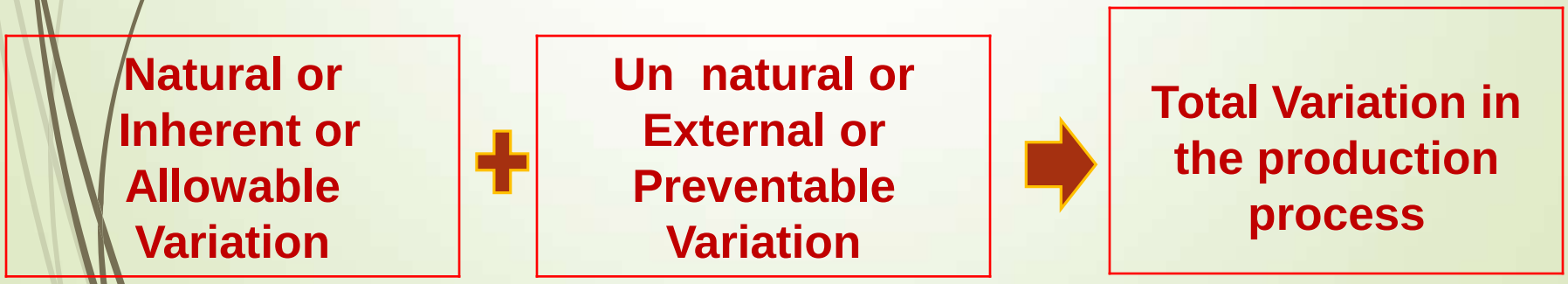
  Generally few in number

  Each has a significant effect in the variation of the output of the process.

  Can be detected

  Can be eliminated from the process

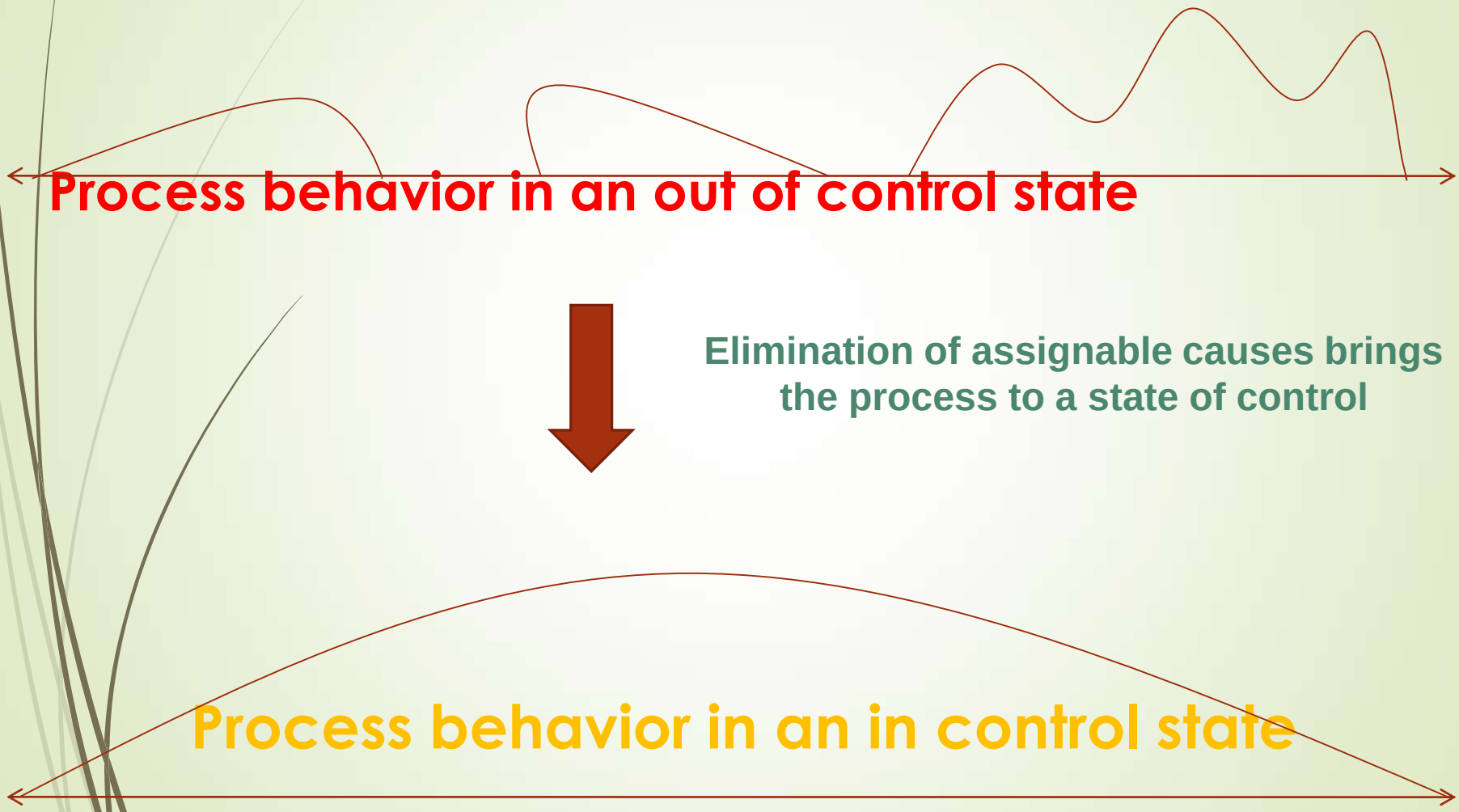
Such variations are termed as preventable variation.



The main purpose of Statistical Quality Control is to derive statistical techniques which would help us in separating the assignable causes of variation from the chance causes of variation, thus enabling to take actions whenever assignable causes are present in the production process.

- The elimination of assignable causes is described as bringing a process *under control*.
- A production process is said to be under statistical control

  (or simply under control), if it is governed by chance causes only, in the absence of assignable causes of variation.


Process behavior in an out of control state
Elimination of assignable causes brings the process to a state of control
Process behavior in an in control state

Basic principles of SQC

In a production process, we are trying constantly to make products that meet the customers requirements.

- We are also trying to make each items or products as much like as the others as possible.
- For this we must keep control of our operations.
- Just like a doctor use temperature, pulse rate, blood pressure readings, sugar levels, cholesterol levels etc. to keep track of the patients condition, we use control charts to monitor the condition of our production process .
- When properly used, control charts will tell us three things,
  - When we are doing some thing we should not
  - When we are not doing something we should
  - When we are doing things right

Generally, control charts will indicate how well our job is. They will provide us with STOP and GO signals.

The ideas and techniques of statistical process control are based on the following six principles.

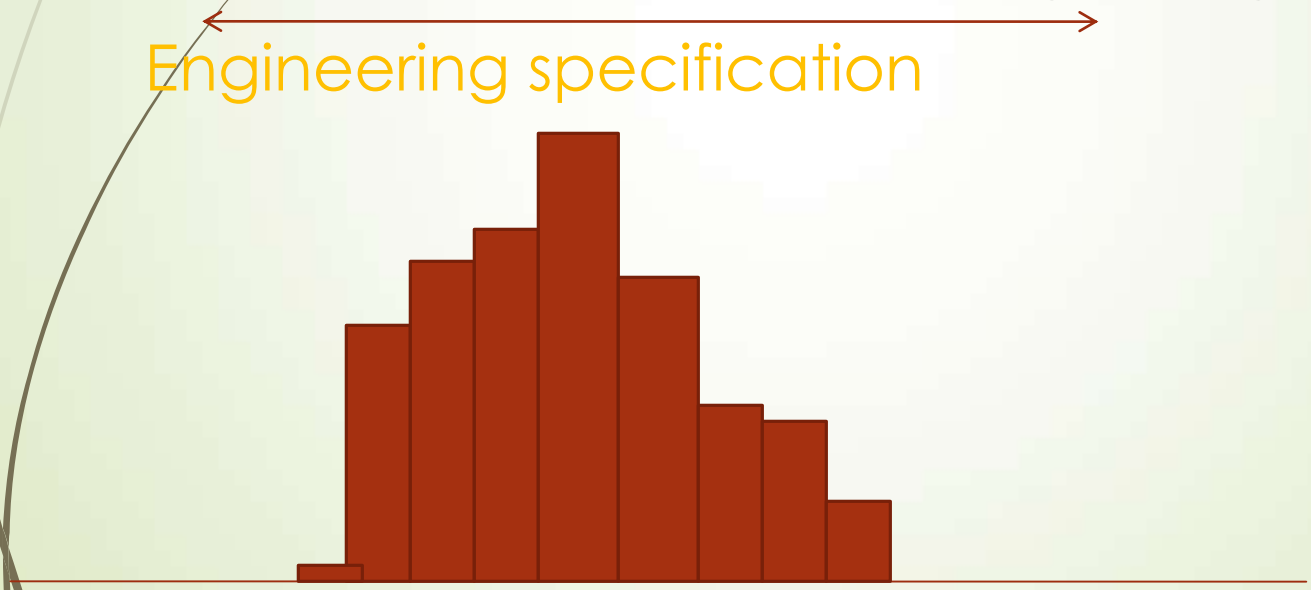
- No two things are exactly alike(ie. Variability is inherent in all production processes.
- Variation in a product or process can be measured.
- Things vary according to a definite pattern
- Whenever things of the same kind are measured, a large group of the measurements cluster around the middle (normal curve assumption)
- It is possible to determine the shape of the distribution curve for products manufactured by any process.
- Variation due to assignable causes tend to distort the normal distribution curve.

Statistical methods give us a way to picturise and control quality through use of Histograms and Control charts

The Histogram

In many families, it is customary to have a picture taken each year.

- Just as a family photo, the histogram is a snapshot or still photo of a group of products fro the manufacturing process.
- It shows how a process is operating at a given time.



Three questions can be answered by a quick look at the pattern of the histogram.

1. Is the process producing items according to the bell shaped curve (Normality)
2. Where is the process centered (Aimed at value)
3. Is the process is capable of meeting the engineering specifications (Process capability)

•Since histogram is merely a snapshot of the process, if we collect another set of observations from the process at another time, the picture may be different.

•So histogram is not suitable for continuously monitoring the process.

To monitor the performance of a production process continuously, we have another useful tool – the control chart

- Thank You…!