Unit 1:
L-6
Statistical Quality Control

Learning Objectives

A **control chart** is a graphical tool for monitoring the activity of an ongoing process. Control charts are sometimes referred to as **Shewhart control charts,** because Walter A. Shewhart first proposed their general theory. The values of the quality characteristic are plotted along the vertical axis, and the horizontal axis represents the samples, or subgroups (in order of time), from which the quality characteristic is found.

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- HISTORY OF SIX SIGMA
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MEANING OF SIX SIGMA

Six Sigma relies heavily on advanced statistical methods that complement and reduce the process and product variations. It is a new way of doing business that would eliminate the existing defects efficiently and would prevent defects from occurring

HISTORY OF SIX SIGMA

Motorola company that invented Six Sigma.

- The term "Six Sigma" was coined by Bill Smith, an engineer with Motorola
- Late 1970s - Motorola started experimentingwith problem solving through statisticalanalysis
- 1987 - Motorola officially launched it's Six Sigma program
- Motorola saved more than $ 15 billion in the first 10 years of its Six Sigmaeffort

SIX SIGMA AT MOTOROLA

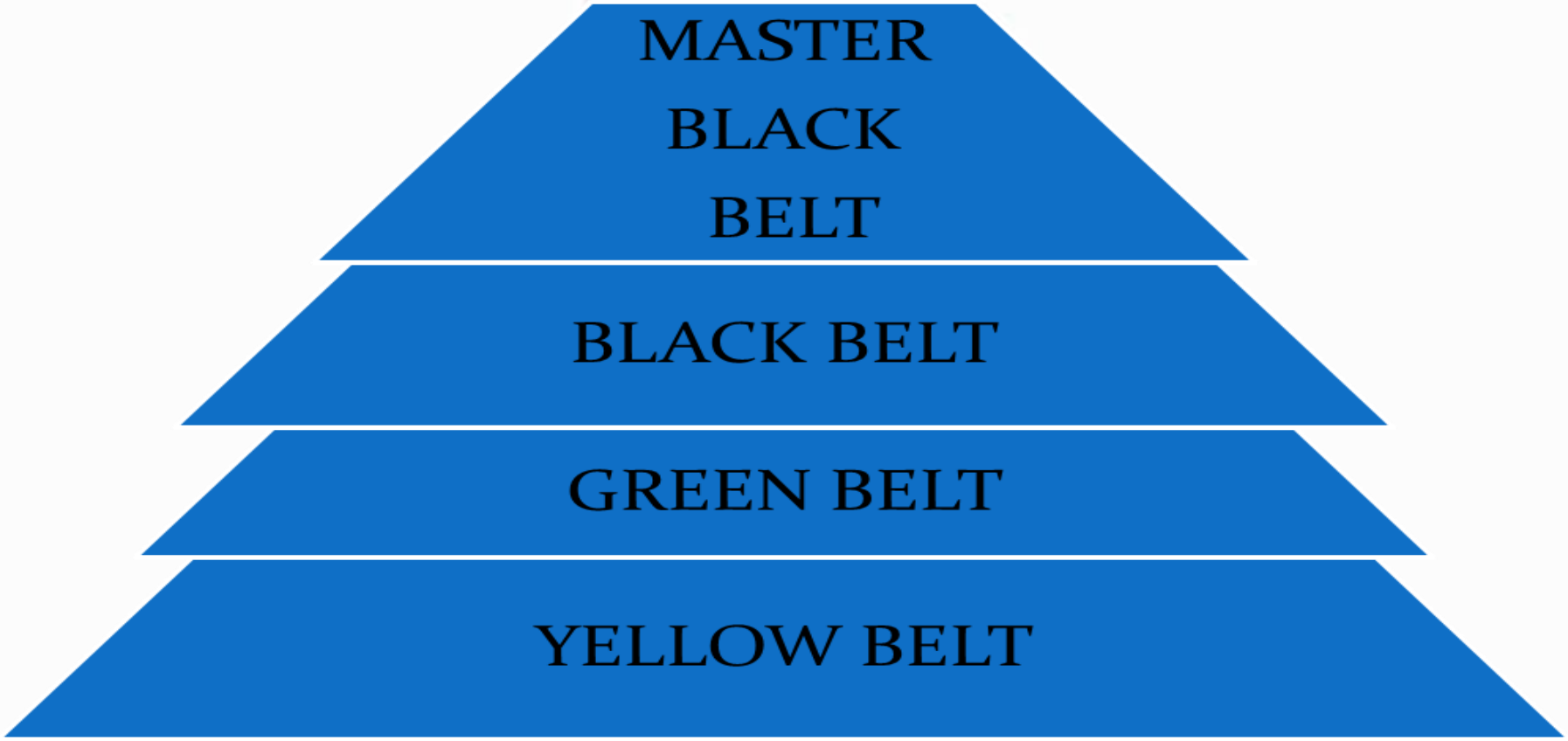
Motorola saved $17 billion from 1986 to 2004, reflecting hundreds of individual successes in all Motorola business areas including:

- Sales and marketing
- Product design
- Manufacturing
- Customer service
- Transactional processes
- Supply chain management

WHO ARE IMPLEMENTING SIX SIGMA

- Financial – bank of America, GE Capital,HDFC,HSBC,American Express
- ITES- ICICI One source, Accenture, Satyam PO, IBM Daksh
- Hospitality- ITC Hotels, GRT Hotels, Apollo Hospitals
- Manufacturing- GE Plastic, Johanson and Johnson, Motorola, Nokia, Microsoft, Ford, Wipro, Nestle, Samsung, Samtle
- Telecom- Bharti Cellular, Vodafone, Siemencs,Tata
- IT- Wipro, Satyam,Acenture, Infosys, TCS, Birla soft

LEVEL OF SIX SIGMA IMPLEMENTATION



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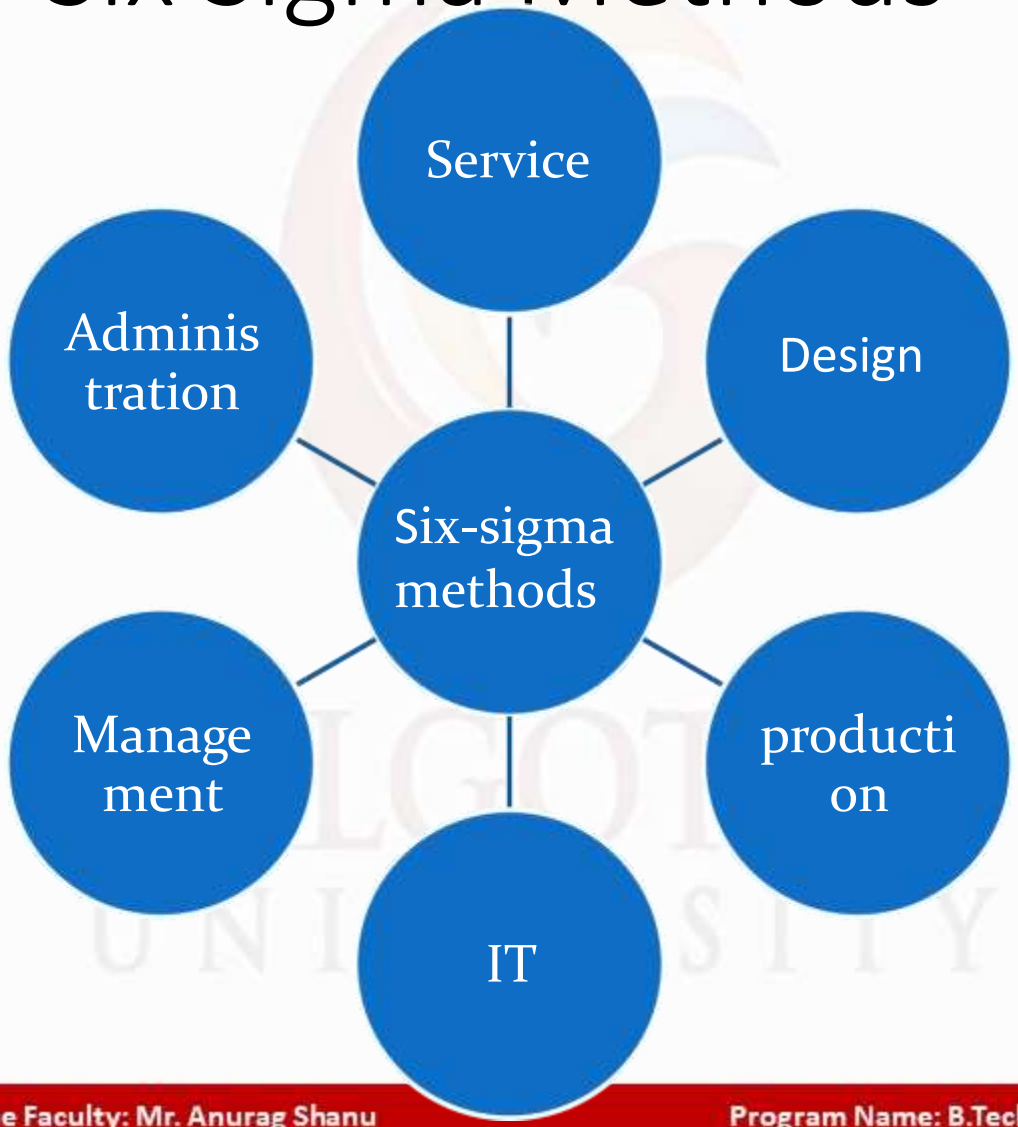
1. **Six Sigma Champion**: Champions undergo five days of training and are taught how to manage projects and act as advisors to various project teams.

2. **Green Belts:** They undergo two weeks of training that includes project-oriented tasks. They act as team members to the Six Sigma project team. Their cooperation and involvement is necessary for projects success.

3. **Black belts**: They receive four weeks of trainings and are directly involved in the implementation of Six Sigma Projects. They are the project leaders and go through in-depth training on Six Sigma approach and tools and work full time on the project.

4. **Master Black Belts**: These are the people who conduct Six Sigma Training and also have on the job training and experience

Six Sigma Methods



APPROACHES OF SIX SIGMA

- **DMAIC APPROACH**

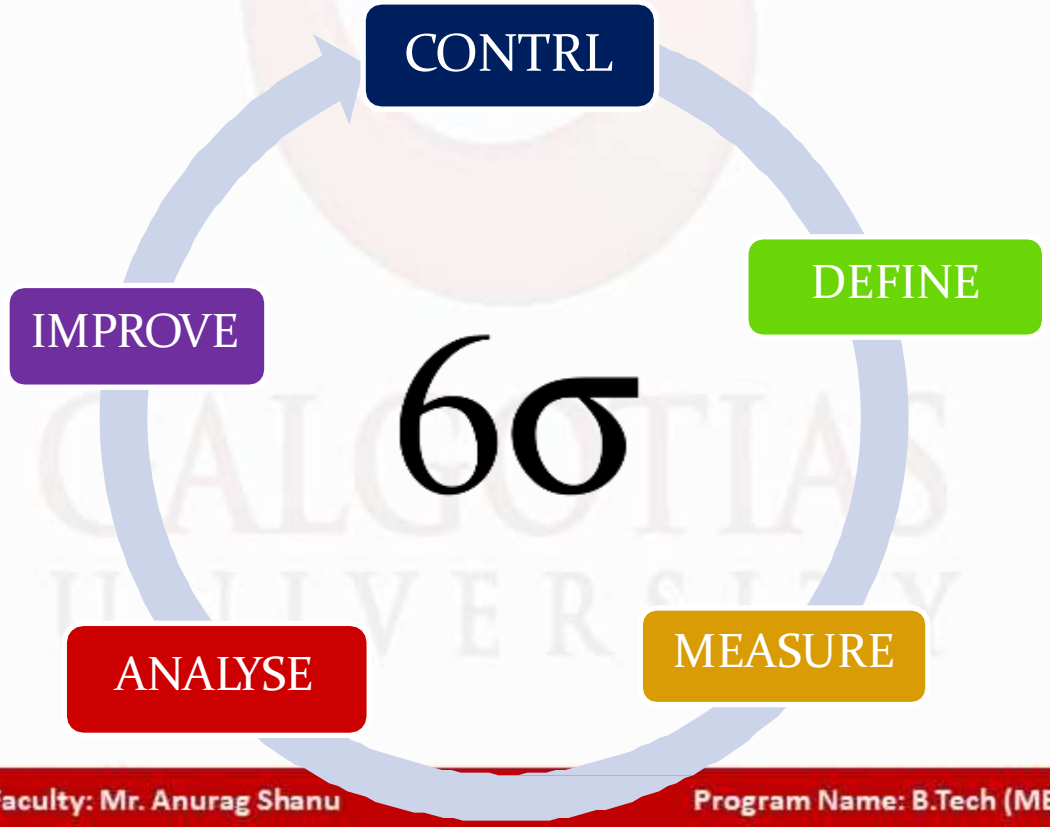
THIS IS ORGANIZATIONAL BASED

- **DMADV APPROACH**

THIS IS BASED ON CUSTOMER NEEDS AND SATIFACTIONS

DMAIC APPROACH

It approach undertaken to improve existing business process



CONTINUE...

1. ***Define*** high-level project goals and the current process.

2. ***Measure*** key aspects of the current process and collect relevant data.

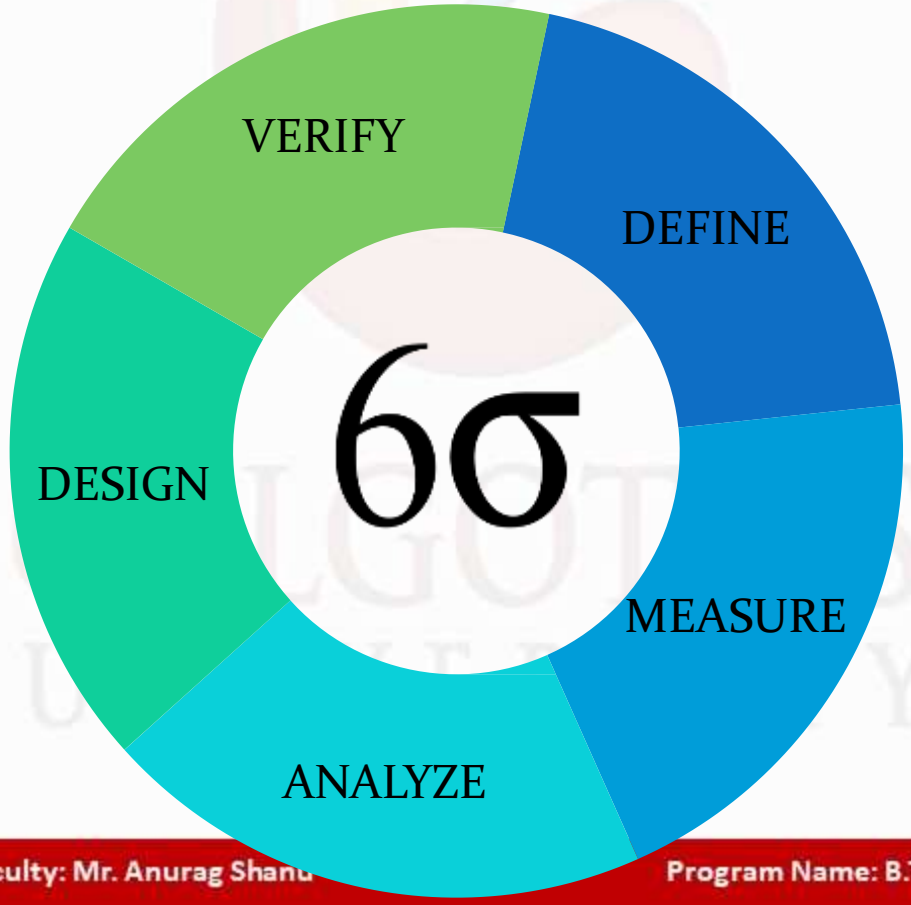
3. ***Analyze*** the data to verify cause-and-effect relationships. Determine what the relationships are, and attempt to ensure that all factors have been considered.

4. ***Improve*** or optimize the process based upon data analysis using various tools

5. ***Control*** to ensure that any deviations from target are corrected before they result in defects.

DMADV APPROACH

This approach is undertaken when there is a need to create new design or product:



CONTINUE...

- ***Define*** design goals that are consistent with customer demands and the enterprise strategy.
- ***Measure*** and identify CTQs (characteristics that are **C**ritical **T**o **Q**uality), product capabilities, production process capability, and risks.
- ***Analyze*** to develop and design alternatives, create a high-level design and evaluate design capability to select the best design.
- ***Design*** details, optimize the design, and plan for design verification. This phase may require simulations.
- ***Verify*** the design, set up pilot runs, implement the production process and hand it over to the process owners.

DMADV is also known as DFSS, an abbreviation of "**D**esign **F**or **S**ix **S**igma

DMAIC

- Defines a business process.
- Measuring current process
- Identify root cause of the recurring
  - PROBLEMS
- Improvements made to reduce defects
- Keep check on future performance

DMADV

- Define customer needs
- Measure customer needs & specification
- Analyze options to meet customer satisfaction.
- Model is deigned to meet customer needs
- Model put through simulation tests for verification

PROCESS SIGMA TABLE

SIGMA LEVEL	DEFECT RATE	YIELD
1σ	691,500 dpmo	30.85%
2σ	308,770 dpmo	69.10000%
3σ	66,811 dpmo	99.33000%
4σ	6,210 dpmo	99.38000%
5σ	233 dpmo	99.97700%
6σ	3.44 dpmo	99.99966%

Summary:

This lecture has introduced the basic concepts of control charts for statistical process control. The benefits that can be derived from using control charts have been discussed. This lecture covers the statistical background for the use of control charts, the selection of the control limits, and the manner in which inferences can be drawn from the charts. The two types of errors that can be encountered in making inferences from control charts are discussed.

References:

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- ASQ(1993). ANSI/ISO/ASQ. *Statistics—Vocabulary and Symbols-Statistical Quality Control,*A3534-2. Milwaukee, Wi: American Society for Quality.
- Wadsworth, H. M., K. S., Stephens, and A. B. Godfrey, (2001). *Modern Methods for Quality Control and Improvement,* 2nd ed. New York: Wiley.