

## Six Sigma Methodologies

---

# DMAIC Vs. DMADV

When to Use

# Statistical Process Control (SPC) Tools

---

- Define
  - Benchmarking, Process Flow Mapping, Flowcharts
- Measure
  - Defect Metrics, Data Collection, Sampling
- Analyse
  - Fishbone diagrams, Failure Analysis, Root Cause Analysis
- Improve
  - Modeling, Tolerance Control, Defect Control, Design Changes
- Control
  - SPC Control Charts, Performance Management

# Six Sigma – Key Concepts

---

- Defect
  - Failing to deliver what the customer wants
- Variation
  - What the customer sees and feels
- Critical to Quality
  - Attributes most important to the customer
- Process Capability
  - What your process can deliver
- Stable Operations
  - Ensuring consistent, predictable processes to improve what the customer sees and feels
- Design for Six Sigma (DFSS)
  - Designing to meet customer needs and process capability

# Six Sigma Methodology

---

- Is a structured, **Data Driven** management methodology that can be applied to all aspects of business.
- The application of this methodology eliminates the use of opinion - “I think” and “I feel” - and drives the organisation to a more scientific means of decision-making.
- It is **not** a **statistics program**. Statistics are used solely as tools for interpretation and clarification of data.

# Six Sigma Methodologies

---

## DMAIC

An improvement system for existing processes falling below specification and looking for incremental improvement

Define  
Measure  
Analyse  
Improve  
Control

## DMADV

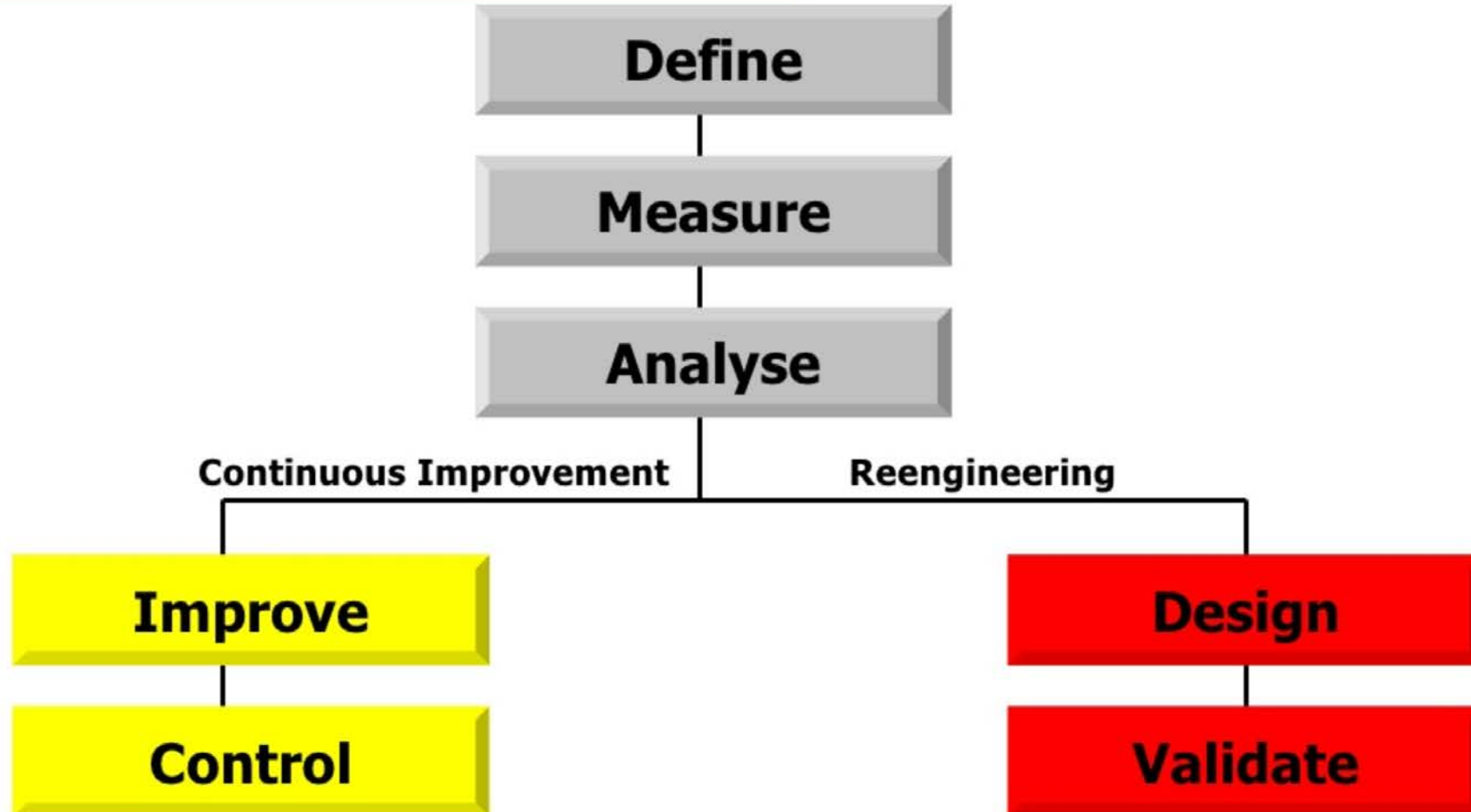
An improvement system used to develop new processes or products at Six Sigma quality levels

Define  
Measure  
Analyse  
Design  
Verify

Both DMAIC & DMADV are inspired by Deming's Plan-Do-Check-Act Cycle

# DMAIC vs. DMADV

---



# DMAIC Method

---

- **Define**
  - Process improvement goals that are consistent with customer demands and the enterprise strategy
- **Measure**
  - Key aspects of the current process and collect relevant data
- **Analyse**
  - Data to verify cause-and-effect relationships and to determine the root cause(s) of the defects
  - Determine what the relationships are and attempt to ensure that all factors have been considered
- **Improve or Optimise**
  - The process based upon data analysis using techniques like Design of Experiments and to eliminate defects
- **Control**
  - To ensure that any deviations from target are corrected before they result in defects and to control future process performance
  - Set up pilot runs to establish process capability, move on to production, set up control mechanisms and continuously monitor the process

# DMADV (aka. DFSS) Method

---

- **Define**
  - Design goals that are consistent with customer demands and the enterprise strategy
- **Measure**
  - Identify CTQs (characteristics that are **Critical To Quality**), product capabilities, production process capability, and risks
- **Analyse**
  - Develop and design alternatives
  - Create a high-level design
  - Evaluate design capability to select the best design
- **Design**
  - Optimise the design and plan for design verification
- **Verify**
  - The design, set up pilot runs, implement the production process and hand it over to the process owners

# DMAIC Vs. DMADV

## DMADV

Develop  
Measurement  
Criteria

Analyse

Design

Verify

Define

Does a  
process  
exist?

NO

YES

Measure  
Existing  
Process

In  
Control?

Remove  
Special  
Causes

Capable?

NO

Analyse

Improve

Control

## DMAIC

## When to use...

---

- When to use DMAIC
  - used when a product or process is in existence and is not meeting customer specification or is not performing adequately
- When to use DMADV
  - A product or process is not in existence and one needs to be developed
  - The existing product or process exists and has been optimised (using either DMAIC or not) and still doesn't meet the level of customer specification or six sigma level

## Similarities - DMAIC / DMADV

---

- Six Sigma methodologies used to drive defects to less than 3.4 per million opportunities.
- Data intensive solution approaches. Intuition has no place in Six Sigma -- only cold, hard facts.
- Implemented by Green Belts, Black Belts and Master Black Belts.
- Ways to help meet the business / financial bottom-line numbers.
- Implemented with the support of a champion and process owner

# Six-Sigma Metrics

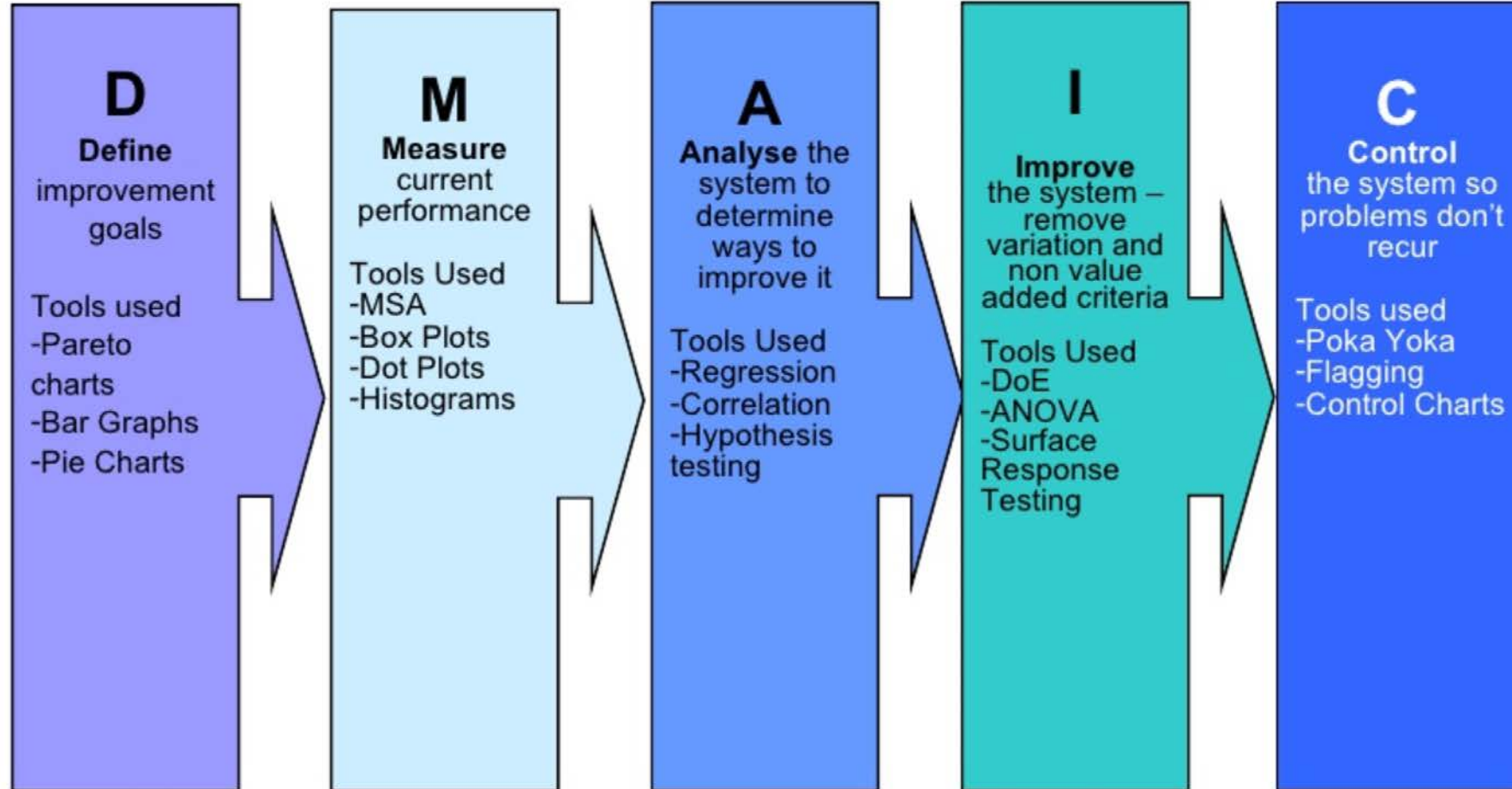
---

- Defect
  - any mistake or error that is passed on to a customer
- Defects per unit (DPU)
  - $\text{Number of defects discovered} \div \text{number of units produced}$
- Defects per million opportunities (dpmo)
  - $\text{DPU} \times 1,000,000 \div \text{opportunities for error}$
- Defective
  - A product or service that is unacceptable to a customer due to one or more defects

# Tools

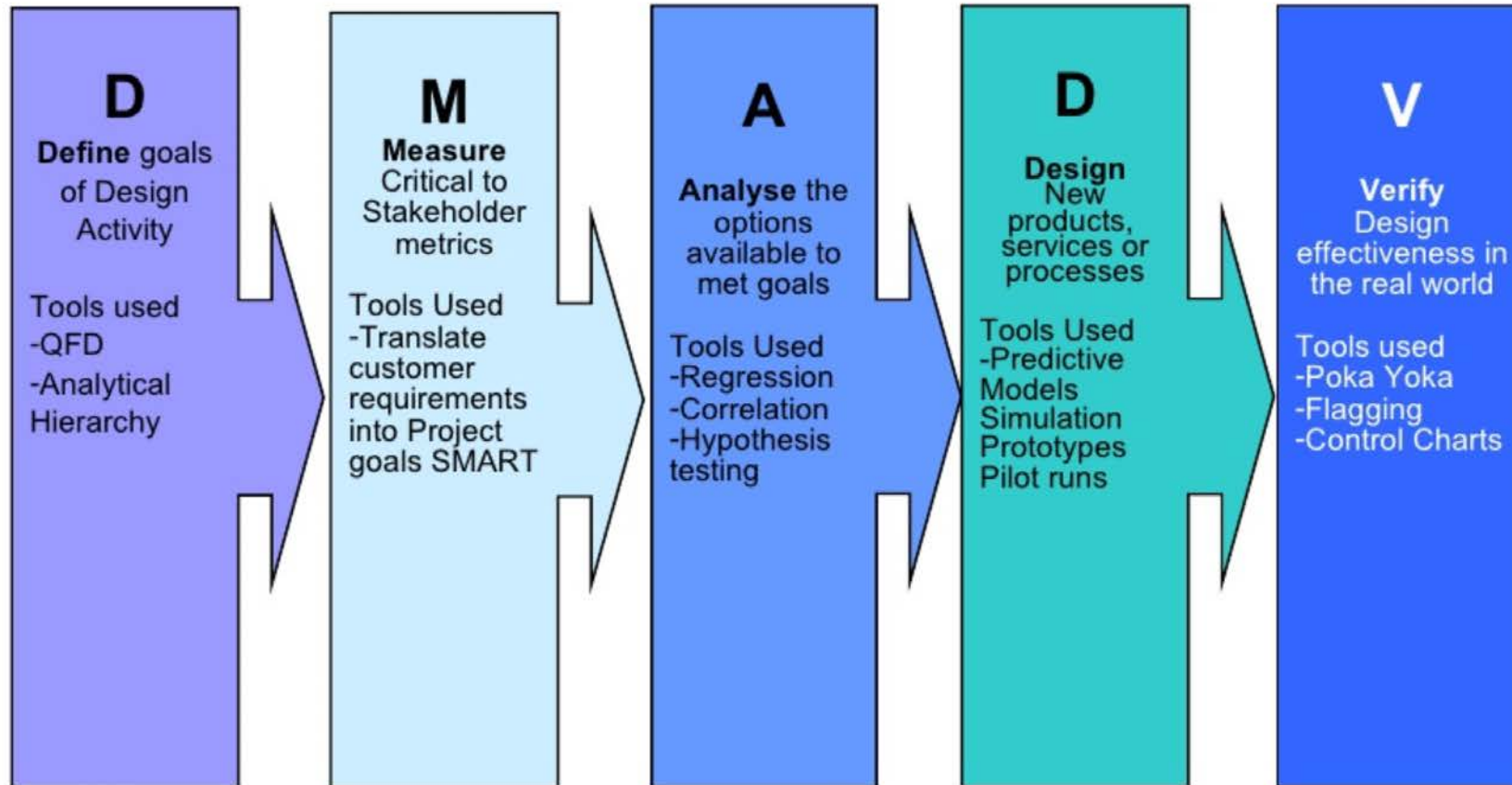
| Define                              | Measure                                                                             | Analyse                | Improve                | Control             |
|-------------------------------------|-------------------------------------------------------------------------------------|------------------------|------------------------|---------------------|
| Benchmarking                        | Value Stream Map                                                                    | Fishbone Diagrams      | Modeling               | SPC Charts          |
| Process Flow Mapping                | Cause & Effect                                                                      | FMEA                   | Tolerance Control      | Performance Metrics |
| Flow charts                         | Defect Metrics                                                                      | Root Cause Analysis    | Defect Control         | Multiple Regression |
| Project Charter as a Team           | Statistical Analysis                                                                | ANOVA                  | Design Changes         | Train               |
| Set Up a Plan & Guidelines for Team | Data Collection<br>Run Charts, Time Series Charts, Time Value Charts, Pareto Charts | Cause & Effect Diagram | Piloting               |                     |
| Review Existing Data                | Sampling                                                                            | Scatter Plots          | Best Practices         |                     |
| SIPOC                               | Benchmarking                                                                        |                        | DOE, Mistake Proofing, |                     |

# DMAIC - Tools



DMAIC provides structure and rigor to problem solving

# DMADV - Tools



DMADV drives customer needs into product and service design



“Quality is never an accident; it is always the result of high intention, sincere effort, intelligent direction and skillful execution; it represents the wise choice of many alternatives.”

- William A. Foster