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# **INTRODUCTION TO LEAN SIX SIGMA: A Course Overview**

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# Defining Quality

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- Quality is in the eyes of the beholder
  - Fitness for use ...
  - Customer satisfaction and loyalty ...
- Customer Focus/Customer Centered
- Measuring Quality:
  - Service speed, accuracy, availability
  - Courtesy, information, follow-up ...



# Defining Quality:

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- Big “Q” versus Little “Q”
    - From the Old to the New Quality
  - The Cost of Poor Quality (COPQ)
    - Up-Front and Hidden Costs
  - Delight your Customers:
    - Improve Quality and Speed
  - Improve your Processes:
    - Decrease Variation, Defects and Time
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# Two approaches to Quality

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- Little “q”
  - Traditional quality function:
  - Reactive, finding issues, manufacturing
  - Control Charts, Acceptance Sampling
- Big “Q”
  - New approach to Quality:
  - Proactive, preventing, all services
  - Product as well as Process



# Two Dimensions of Q

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- Features
    - Affects income (sales)
    - Ease of use, appearance, price, etc.
    - Refers to Quality of Design
  - Freedom from Deficiencies
    - Affects service costs
    - Defects, failures, waste, etc.
    - Refers to Quality of Conformance
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# Cost of Poor Quality (COPC)

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- Types: up-front and hidden costs
- Difficult to notice and/or recognize
- Service defects (unavailability)
- Inefficient processes (slow)
- Lost opportunities (sales/revenues)
- Appraisal and Prevention costs



# Improvement Advantages

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- Quality Improvement pays!
  - Increases customer loyalty
  - Increases your reputation
  - Increases customer base
  - Reduces customer complaints
  - Reduces warranty costs
  - Reduces service time/costs



# Improve your Process Quality

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- Optimize Process Flow: Lean
  - Document how work gets done
  - Examine and improve work flow
  - Eliminate waste and non-value added
  
- Minimize Variation: Six Sigma
  - Variation, variability and variance
  - Variation defines the Six Sigma level
  - Identify factors that increase variation



# Lean Manufacturing and Kaisen

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- Kaisen: Continuous Improvement
  - Achieved by reducing the three Evil M's
  - Muda: waste or non-value added
    - ◆ process activities
  - Mura: inconsistent use of people
    - ◆ And of processes
  - Muri: excessive demands on people
    - ◆ And on processes



# Lean Manufacturing and the 5 S's

- The Five Kaisen Principles
  - Sort: keep only necessary things
  - Set in Order: arrange efficiently
  - Shine: maintain cleanliness/avoid clutter
  - Standardize: proceed consistently
  - Sustain: cooperative working environment
    - ◆ Use Team Effort to Succeed!



# The Eight Wastes

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- Overproduction: too much or too early
- Waiting: for information, people, materials
- Transportation: moving things around
- Process Design: too many or too few steps
- Inventory: work in progress, electronic files
- Motion: poor layout and ergonomics
- Defects: errors, scrap, rework, etc.
- Under-utilization: of personnel or resources



# The Seven Basic Quality Tools

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- Flow Charts
- Ishikawa Diagrams
- Check lists
- Pareto Charts
- Histograms
- Scatter Diagrams
- Control Charts



# Some Uses of these Tools

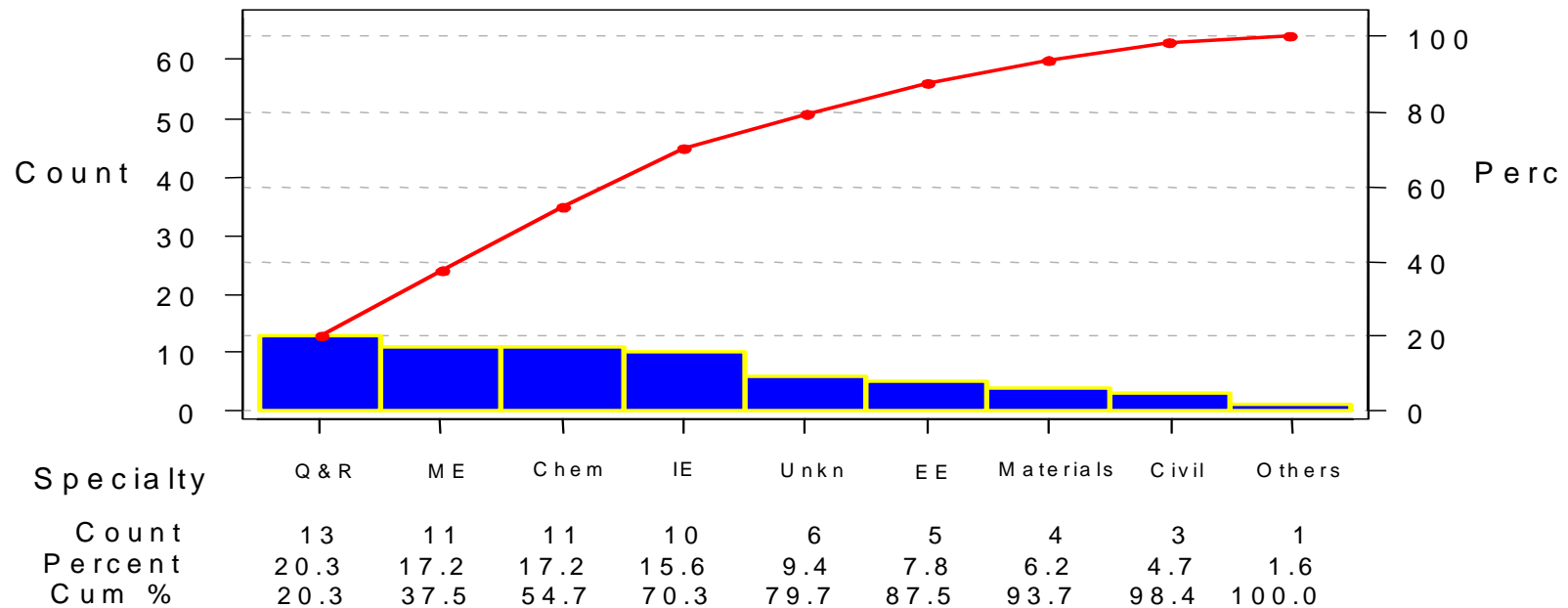
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- Pareto Charts
  - Identify the Relevant Few Factors
- Ishikawa Charts
  - Identify Factors Impacting Response
- Affinity Diagrams
  - Groupings of Similar Ideas
- Check Lists
  - Provide Order and Inclusion



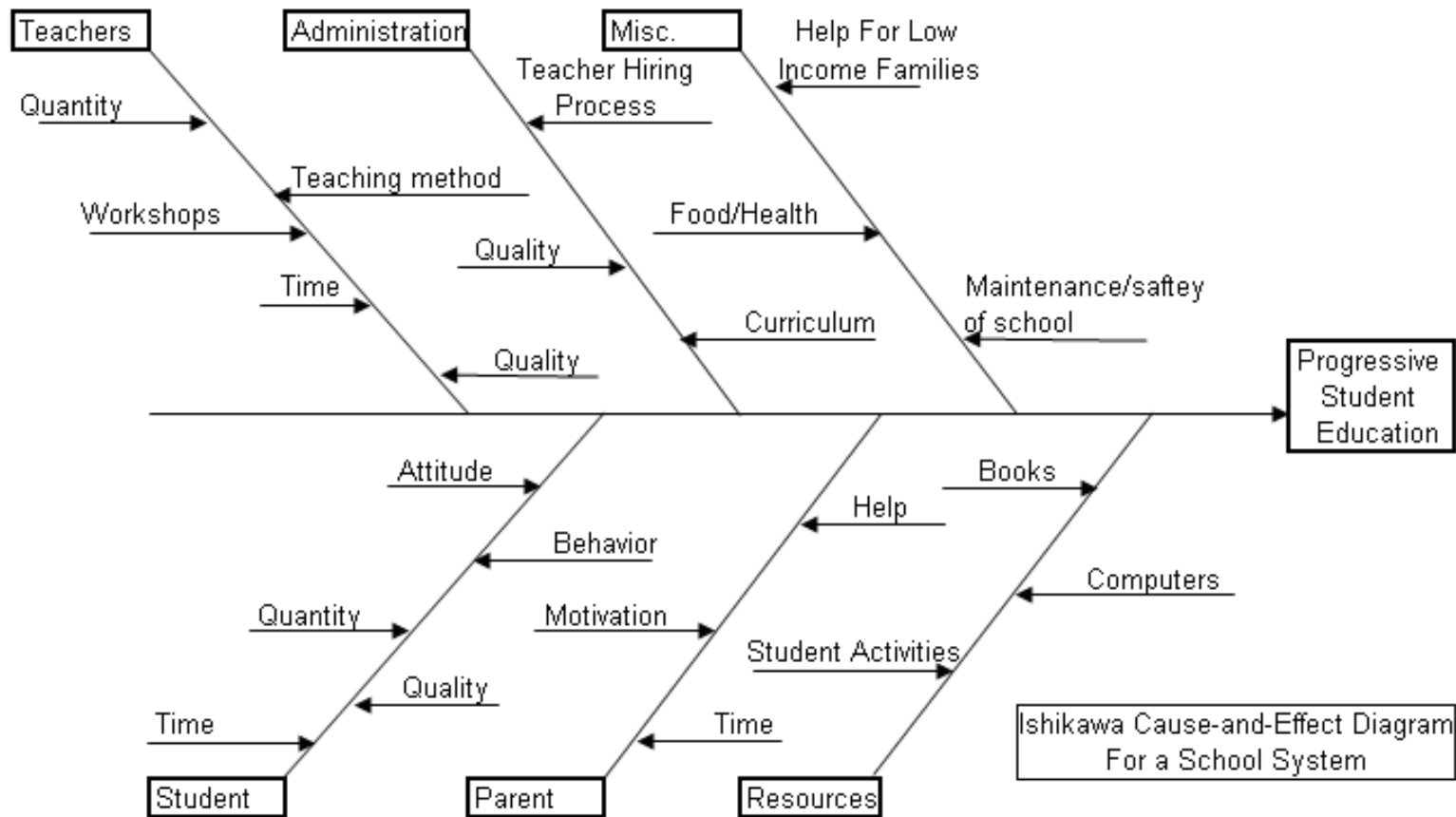
# Example of Pareto Chart

Pareto Chart for Special



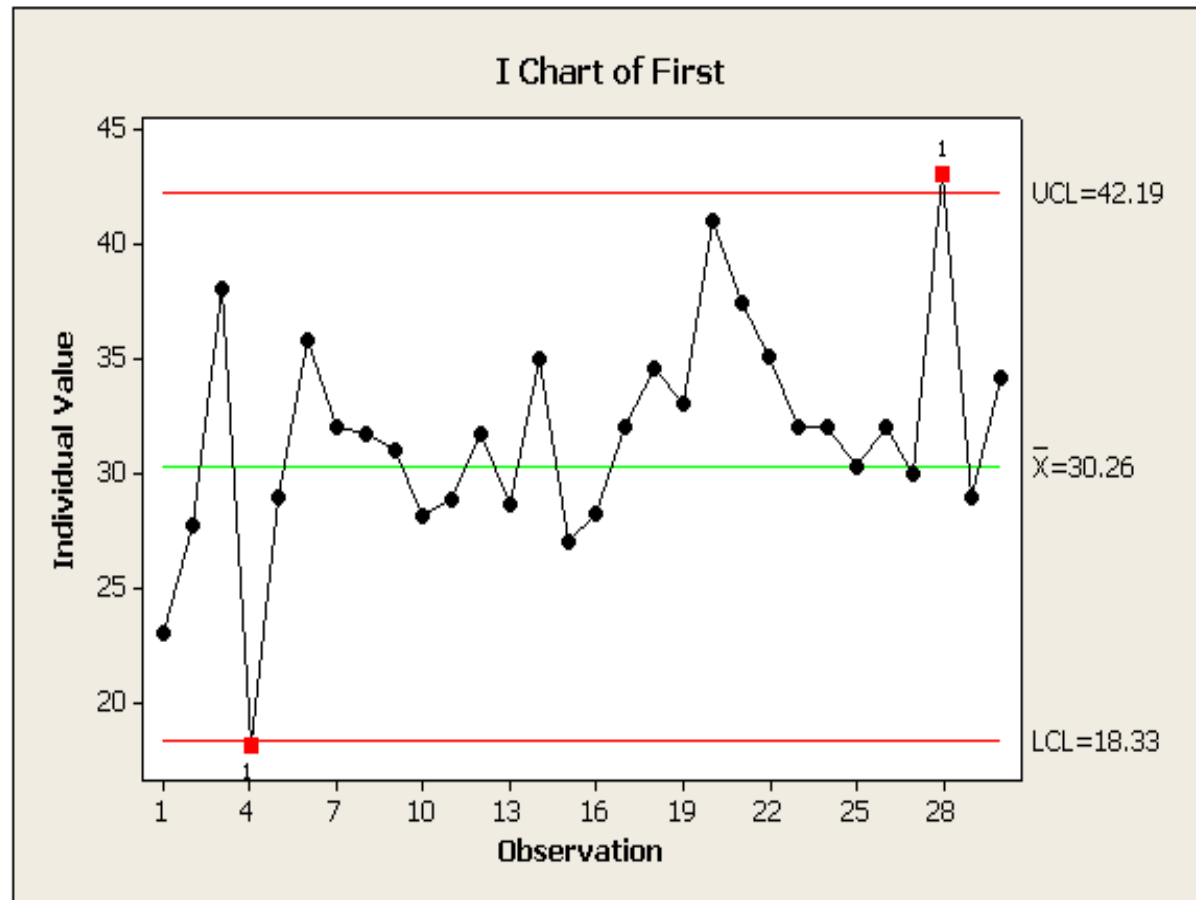


# Ishikawa or Fishbone Chart





# Control Chart for Number of Errors





# Value Stream and State Maps

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- Flowchart of process activities (map)
- Include in each node, information on:
  - Average Time in Node
  - Up Time (percentage)
  - Delays and Queues
  - Activity Yield/Output
  - Manpower Required
  - Other Information



# Value-Added work

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- The contribution to item real value
  - Is in the eyes of your customer
- Non-Value-Added work (waste)
  - Can be dismissed without loss
- Main Goal of Lean (and Six Sigma)
  - Eliminate all possible waste
- Identify waste in the process flow!



# SIPOC Charts for Key Activities

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## **Supplier:**

Who provides you with input?

## **Input:**

What input is being provided?

## **Process:**

What do you add to product?

## **Output:**

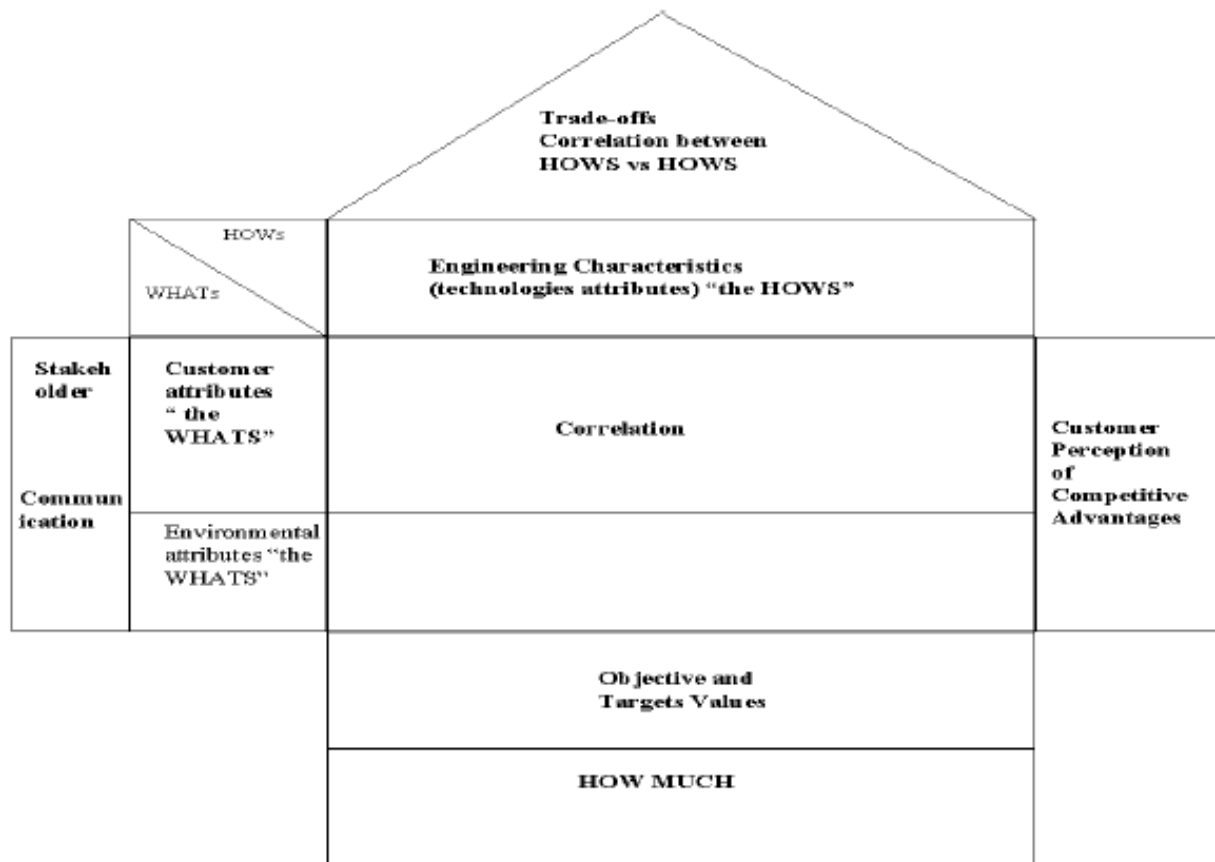
What is such contribution result?

## **Customer:**

Who do you pass the product to?



# Example of House of Quality





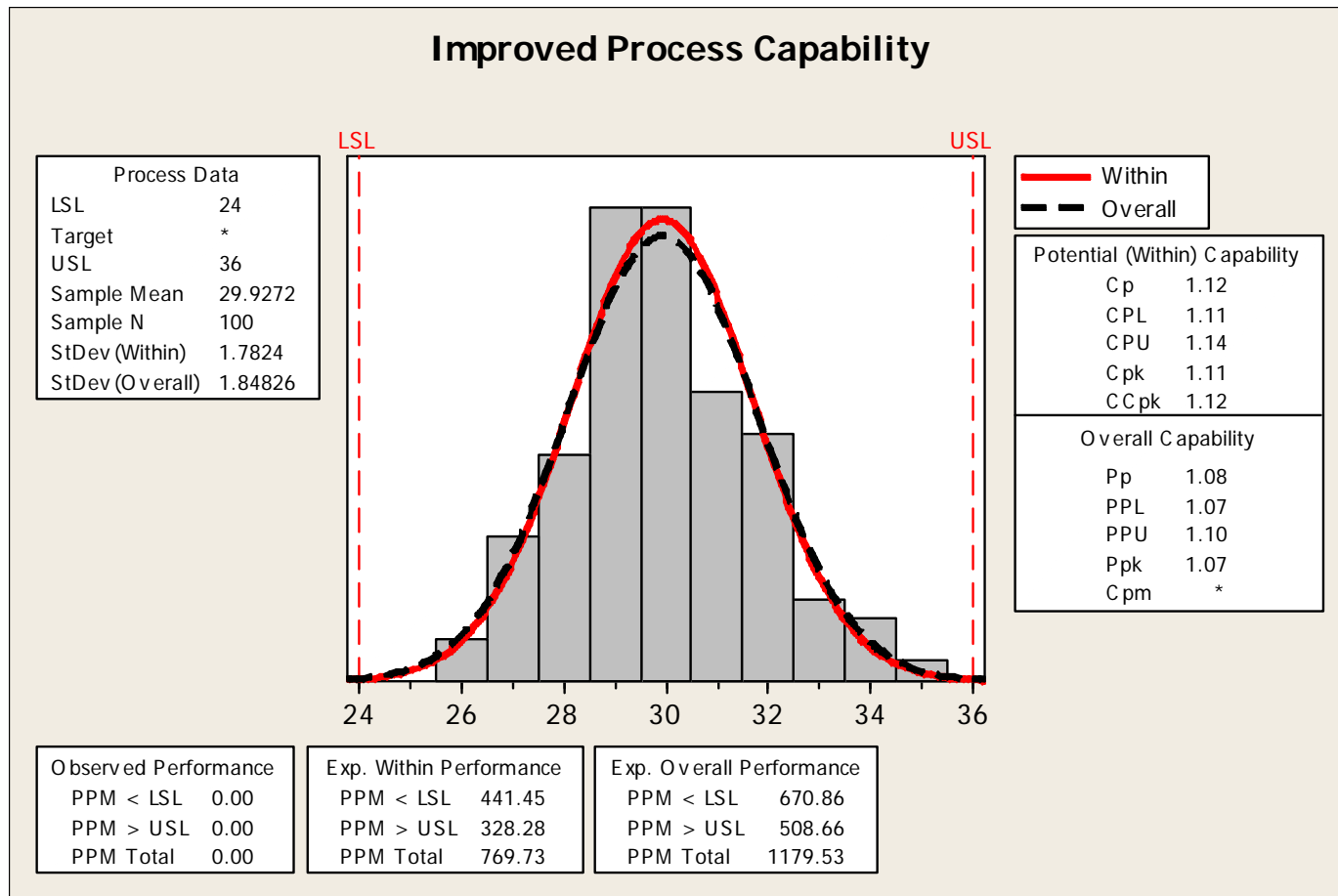
# Six Sigma Philosophy: DMAIC

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- 1. Define: identify areas of variability
- 2. Measure: data collection
- 3. Analyze: relevant information
- 4. Improve: selected areas
- 5. Control: manage changes
  - Result: Sustained change.



# Assessing Process Capability





# Combining Lean and Six Sigma

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- Lean: reduces waste; improves flow
  - Streamlines your operation to a new level
- Six Sigma: reduces process variation
  - Optimizes your current operation
- Lean alone: cuts process extra fat
- Six Sigma: improves “as is” system
- Their Combination: New and Improved!



# Implementing/Staffing Lean-Six Sigma

- Champion: Executive sponsoring Lean
- Process Owner: has a vested interest
- Black Belt: technically trained in job
- Master Black Belt: BB plus experience
- Green/Yellow/White Belts: lower levels
  - Intermediate, introductory, awareness
  - Green Belts can lead small projects.



# Examples of Lean-Six Sigma

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- Lean:
  - Streamlining and organizing
  - Eliminating superfluous steps
  - Shortening the processing time
- Six Sigma:
  - Identifying areas of variability
  - Reducing overall variability
  - Improving Process Capability
- Combined: streamline and optimize!



# Bibliography

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- What is Lean-Six Sigma?
    - ASQ; George, Rowlands & Kastle (2004)
  - Quality Toolkit
    - RIAC; A. Coppola (2002)
  - Total Quality Management TQM Toolkit
    - RIAC; A. Coppola (1993)
  - A Guide for Implementing TQM
    - RIAC; Crosier (1990)
-