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Calculating Variation

Agenda

1. Variation: What is it ?
2. Calculating Variation purpose and benefits
3. The Six Sigma Approach
4. Statistics to Manage Variation
5. Takeaways

Introduction

What is it ?

Six Sigma is a disciplined, **data-driven approach** and methodology for eliminating **defects** and **minimizing variability** in any process, from manufacturing to transactional and from product to service.

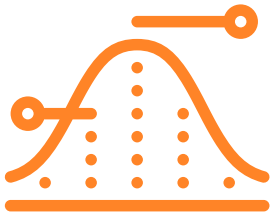
Lean Methodologies are focused on Waste, **Six Sigma** is focused on understanding and controlling variation.

Lean Six Sigma leverages the **best problem-solving methodologies** to help organizations achieve their missions and become competitive.

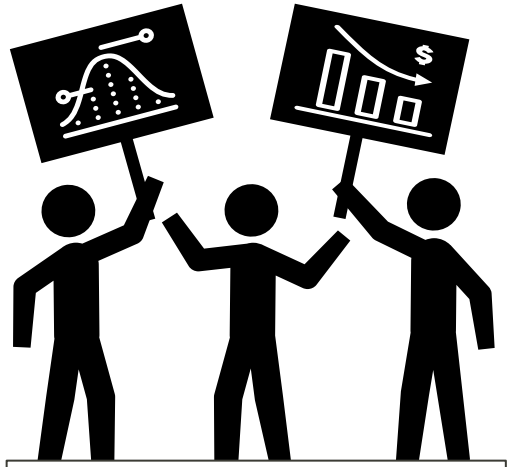
LEAN

Lean foundations and methodologies to achieve continuous improvement

SIX SIGMA



DMAIC framework and statistical analysis to achieve continuous improvement



LEAN SIX SIGMA

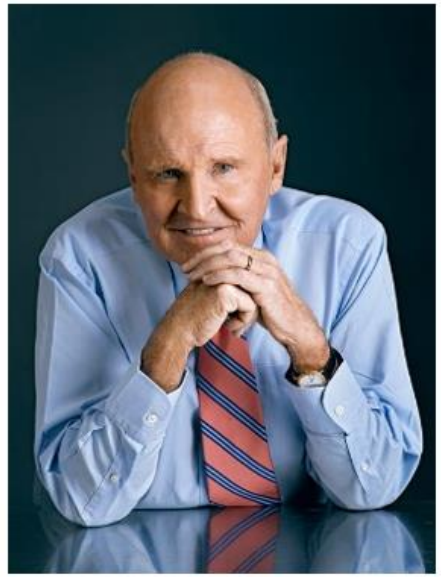
Introduction

Purpose and Benefits

1. Six Sigma is a measure of quality that **strives for near perfection** and **reduces variation** at its lowest economically possible level.

2. The fundamental objective of the Six Sigma methodology is the implementation of a measurement-based strategy that focuses on **process improvement** and **variation reduction** through the application of Six Sigma improvement projects.

   We accomplish this using two Six Sigma methodologies: **DMAIC** and **DMADV**.



"Six Sigma is a quality program that, when all is said and done, improves your customer's experience, lowers your costs, and builds better leaders."

Jack Welch

Introduction

Purpose and Benefits

DMAIC

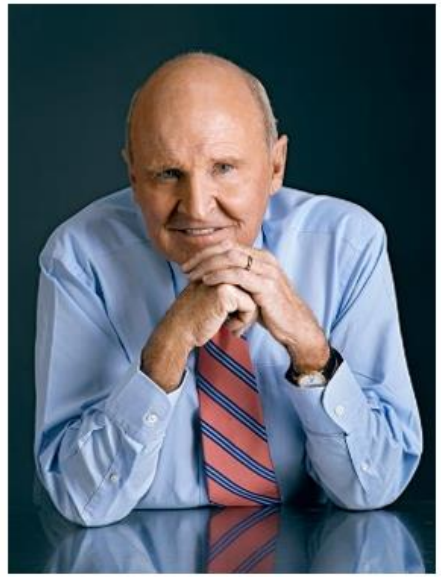
Define, measure, analyze, improve, control

Is an improvement system for existing processes falling below specification and looking for incremental improvement.

DMADV

Define, measure, analyze, design, verify

Is an improvement system used to develop new processes or products at Six Sigma quality levels.



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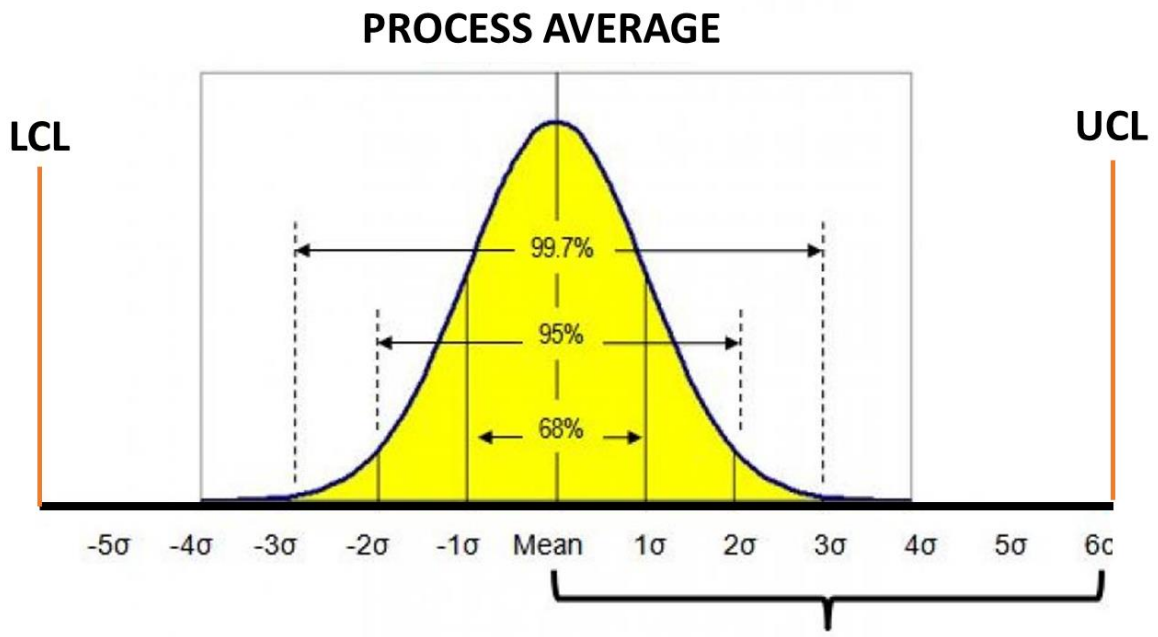
Calculating Variation

The Six Sigma Approach



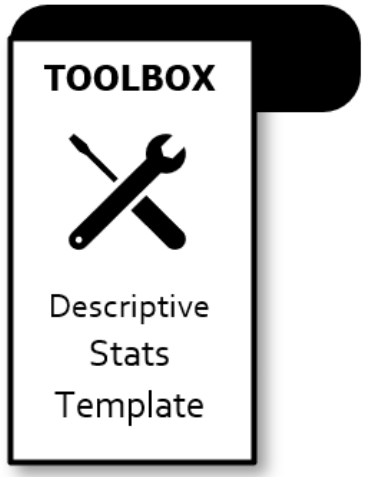
Calculating Variation

The Six Sigma Approach

The **standard deviation** (Sigma, σ for the population, or S for a sample within the population) of a data series is a measure related to the **distribution** of the numbers in that series.

It is a value that tells us how much on average we deviate from the mean. The smaller the standard deviation (and thus the spread), the better it is.

Descriptive Statistics Template



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t-Test

Data Group ONE	Data Group TWO
23	23
22	24
25	24
23	24
23	23
23	25
23	26
27	23
	23

F-Test Two-Sample for Variances

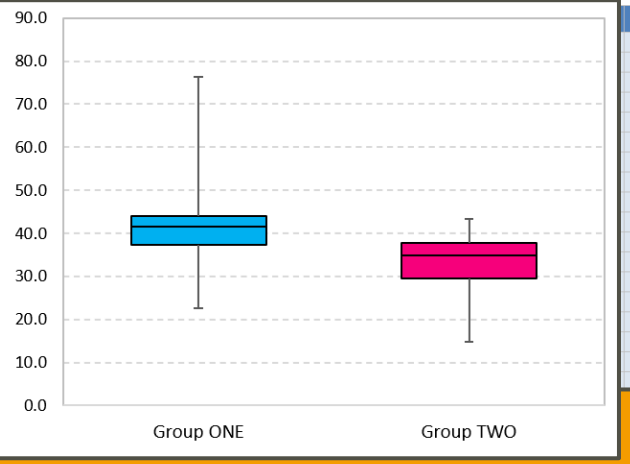
α 0.05 95% Confidence Interval

	Data Group ONE	Data Group TWO	95% Confidence Interval	
Mean	23.625	23.88888889		
Variance	2.553571429	1.111111111	0.469	10.41
Observations	8	9		
df	7	8		
F	2.30			
P(F<=f) one-tail	0.133	0.267	Two-tail	
F Critical one-tail	3.50	4.53	Two-tail	
One-tail	Accept Null Hypothesis because p > 0.05 (Variances are the same)			
Two-tail	Accept Null Hypothesis because p > 0.05 (Variances are the same)			

t-Test: Two-Sample Assuming Equal Variances
Unequal Sample Sizes

	Data Group ONE	Data G
Mean	23.625	
Variance	2.553571429	
Observations	8	
Pooled Variance	1.784259259	
Hypothesized Mean Difference	0	
df	15	
t Stat	-0.390	
P(T<=t) one-tail	0.351	
T Critical one-tail	1.753	
P(T<=t) two-tail	0.702	

14	46.008	37.091
15	47.067	32.737
16	36.684	29.720
17	42.308	34.090
18	39.653	27.970
19	30.800	28.323
20	42.392	26.829
21	22.543	14.725
22	37.960	41.006
23	42.793	38.619
24	47.884	33.289
25	36.595	39.382
26	33.964	36.747
27	37.466	30.576
28	39.448	39.520



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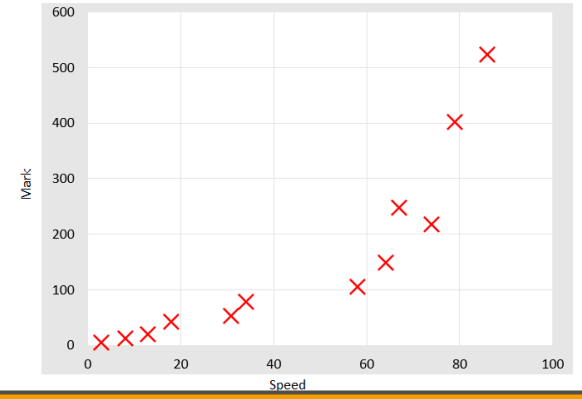
SCATTER DIAGRAM

Process:
Description: This data illustrates the number of fouls committed by twelve basketball players along with the number of points they have scored during a season.
Area:
Process Owner:

Output (y)
Mark
4.0
12.0
19.0
41.0
52.0
78.0
105.0
148.0
218.0
247.0
401.0
522.0



Takeaways

- Six Sigma Tools are the foundations for Statistical Process Control
- Processes with high variation or "out of control" must be solve first before initiating a Lean Transformation strategy.
- Lean and Six Sigma work together

  Lean -> Improve flow and reduce waste

  Six Sigma -> Minimize variation in processes
- When applied, will: -> reduce costs

  -> improve quality

  -> shorten process times

  -> improve employee engagement

Thank You

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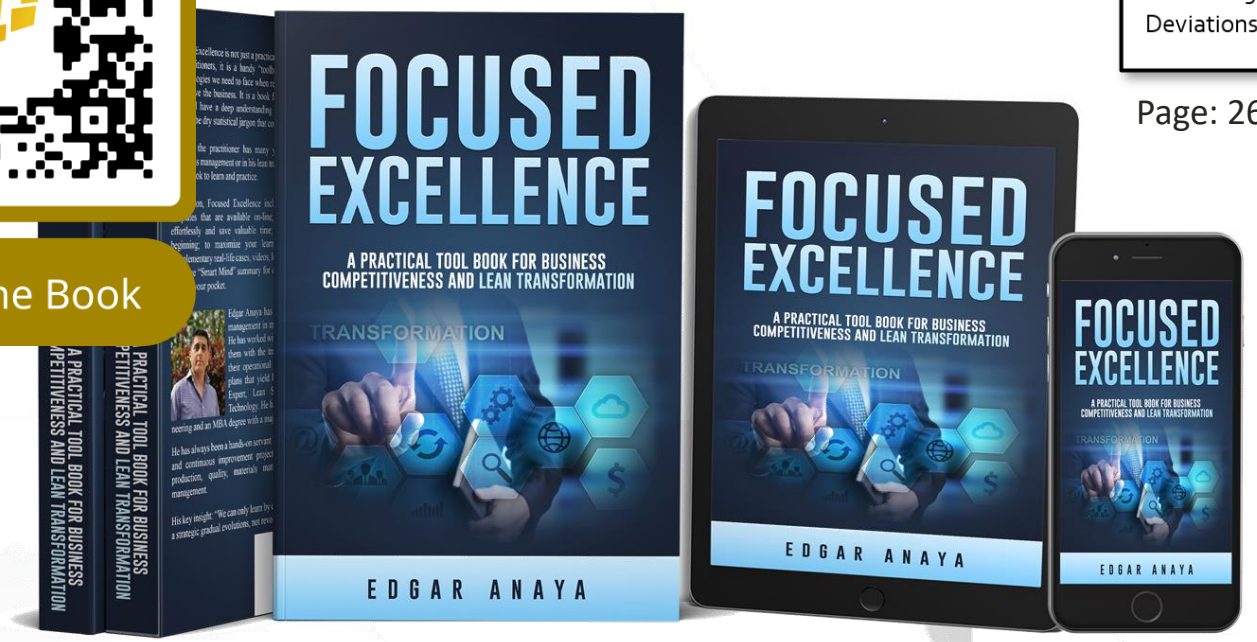

TOPIC

Calculating Deviations

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Reference: Focused Excellence
by Edgar Anaya
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A Practical Tool Book for
Business Competitiveness and
Lean Transformation