0.1 INTRODUCTION TO LEAN & SIX SIGMA
WHAT IS LEAN SIX SIGMA?

More things:

1. **Process Improvement** (Y = process output = symptom.. X’s = process inputs = causes)
2. **Toolbox** (from easy soft tools to powerful statistical tools)
3. **Quality level** (3.4 mistakes on 1 mil. opportunities)
4. **Problem Solving Methodology** (Define-Measure, Analyze, Improve, Control)
5. **Fact Based Decisions** (Statistical validation instead of Gut feeling)
6. **Breakthrough Improvement** (more than 50%, diff. to Continuous improvement)
7. **Y = f (X1, X2, X3,...,Xn)** (funnel down from all potential causes to root causes)
WHAT IS SIX SIGMA? (CONTINUATION)

8. Improvements project by projects (no other way for real improvements)

9. Projects run by **full** time BB or part time GB (+resources & support)

10. **Six Sigma Infrastructure** (Mngm, Champions, Sponsors, Belts, Controllers, Teams)

11. **Six Sigma reduces variation** (by optimizing vital inputs)
„ELEVATOR SPEECH”

• Lean Six Sigma is the powerful methodology for process improvement

• What ever we do ....... can be presented as a process

• So, Lean Six Sigma is methodology to improve almost anything what we do.
• Don’t blame the People ….. blame the process !

• Without data …… you are just another person with an opinion !

• In God We Trust .... All Others Bring Data ! (fact based decisions)

• What gets measured …. gets done !

• Six Sigma means… Never Having To Say You’re Sorry !!!
**Process**: A *value-adding* activity which takes resources/row material (X’s) from a supplier and produces an output (Y) which *meets customer requirements*.
What ever is the problem it must have been created in a certain set of activities
What ever we do, this can be presented in the form of Process (“If we can not present it in the form of process… than we don’t know what we are doing”)
So, we first need to define the Process (and the Scope) in which our Problem could have been generated.
The Problem (i.e. the thing that we want to improve) we designate with “Y”, and present it as outcome (i.e. Output) from that Process.
Once we have defined above Process, we can relax and follow the Steps of Lean Six Sigma methodology that will help us to discover and prove the Root- causes of the problem, and find the optimal solution.
HOW WE IMPROVE A PROCESS?

For any improvement, we need to improve **2 THINGS, only:**

1. **EFFICIENCY**
2. **EFFECTIVENESS**

Efficiency = Doing things right
Effectiveness = Doing right things

• When working on improvement project we might chose to focus on one of them
• What about right balance?

What are examples?
HOW WE MEASURE EFFICIENCY AND EFFECTIVENESS

X1 X2 X3 X4

PROCESS

EFFECTIVENESS
Is Quality of our process output (Y) and we measure it in SIGMA level

EFFICIENCY
Resources consumed in the process (lead-time, manpower, money, etc)

Improve mainly with LEAN

Improve mainly with 6 Sigma

$\$
**Six Sigma** is about improving quality of our process output (effectiveness), mainly by reducing variation.

**Lean** is about reducing the waste from our process and improving the lead time (efficiency).

Still, some effectiveness will be improved with Lean, and some efficiency with Six Sigma.

**Six Sigma and Lean are Complementary Methodologies.**
LEAN ENTERPRISE

- **Value Added**
  Any activity that increases the market form or function of the product or service. (These are things the customer is willing to pay for.)

- **Non-Value Added (Waste)**
  Any activity that does not add market form or function or is not necessary. (These activities should be eliminated, simplified, or reduced.)

**Business Non-Value Added ("Required Waste")**
Any activity that is Non-Value Added but is required.
DEFINING THE VALUE OF AN ACTIVITY

Is the customer willing to pay?  
No → Non-Value Added

Is the good or service being transformed?  
No → Non-Value Added

Is it a business requirement?  
No → Non-Value Added

Is it done for the first time?  
No → Non-Value Added

Yes → Business Non-Value Added

Yes → Value Added
THE CONCEPT OF VALUE ADDED

Value Added (≈3 to 5%)

Example:
- Satisfying customer Requirement

Waste (≈85%)

Examples:
- Excessive Walking
- Waiting time
- Paper storage
- Paper sorting
- Correct defects
- Transport

Business Non-Value Added (≈10 to 15%)

Examples:
- Type in information first time
- Get paper
- Answer customer call

Examples:
- Excessive Walking
- Waiting time
- Paper storage
- Paper sorting
- Correct defects
- Transport
8 TYPES OF WASTE – "DOWNTIME"
MANUFACTURING - OFFICE

1. **Defects** – Correction, errors in documents
2. **Overproduction** - Doing unnecessary work not requested
3. **Waiting** for the next process step
4. **Non-engaged Employees** - Under-utilised employees
5. **Transportation** - Transport of documents
6. **Inventory** - Backlog in work queues
7. **Motion** - Unnecessary motions
8. **Extra Processing** - Process of getting approvals

- **Three New Wastes:**
  Inappropriate systems, wasted utility resources, wasted materials
## WHAT IS A GOOD SIGMA LEVEL?

<table>
<thead>
<tr>
<th>Yield (How good we are)</th>
<th>Process Sigma</th>
<th>Defect per 1.000.000</th>
</tr>
</thead>
<tbody>
<tr>
<td>99,9966 %</td>
<td>6</td>
<td>3,4</td>
</tr>
<tr>
<td>99,9970 %</td>
<td>5,5</td>
<td>30</td>
</tr>
<tr>
<td>99,9770 %</td>
<td>5</td>
<td>230</td>
</tr>
<tr>
<td>99,8650 %</td>
<td>4,5</td>
<td>1.350</td>
</tr>
<tr>
<td>99,3790 %</td>
<td>4</td>
<td>6.210</td>
</tr>
<tr>
<td>97,730 %</td>
<td>3,5</td>
<td>22.700</td>
</tr>
<tr>
<td>93,320 %</td>
<td>3</td>
<td>66.800</td>
</tr>
<tr>
<td>84,20 %</td>
<td>2,5</td>
<td>158.000</td>
</tr>
<tr>
<td>69,20 %</td>
<td>2</td>
<td>308.000</td>
</tr>
<tr>
<td>50 %</td>
<td>1,5</td>
<td>500.000</td>
</tr>
<tr>
<td>31 %</td>
<td>1</td>
<td>690.000</td>
</tr>
</tbody>
</table>

### The rule of thumb:
- below 3 Sigma is bad
- 3-4 average
- 4-5 very good
- >5 perfection

- Airplanes are flying on 6,2 Sigma level
- While luggage process is operating on 4 Sigma level
# PURPOSE PER PHASE
## MANDATORY ACTIVITY STEPS

<table>
<thead>
<tr>
<th>Define</th>
<th>Measure</th>
<th>Analyse</th>
<th>Improve</th>
<th>Control</th>
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</thead>
<tbody>
<tr>
<td>Define the Project Goals and Deliverables</td>
<td>Measure and Validate Baseline Process Parameter</td>
<td>Identify Vital Few Process Inputs that affect the Output</td>
<td>Generate and Implement Optimal Solution</td>
<td>Ensure that the Result Will Last</td>
</tr>
</tbody>
</table>

### Activity Steps: Mandatory for Each Phase

- **Define**
  - Develop project charter
    - Define CTQ / goals
    - Outline project Y
    - Identify problem to be addressed
    - Define team and stakeholder
    - Define defect
    - Define benefit
    - Project plan / scope
      - High level process map
  - Review with Sponsor

- **Measure**
  - Baseline CTQ
    - Visualise value stream
    - Streamline value stream
  - Eliminate waste
  - Implement quick hits
  - Visualise process
  - Identify all inputs (X’s)
  - Verify data reliability (Y)
  - Collect output data
  - Baseline Y performance
  - Characterise variation
  - Review with Sponsor

- **Analyse**
  - Filter out Key Process Inputs X’s - using subjective tools
  - Address special causes if applicable
  - Validate data reliability (X)
  - Collect data on X’s
  - Validate vital few X’s with data
  - Analyse root cause
  - Review with Sponsor

- **Improve**
  - Generate possible solutions
  - Prioritise solutions
  - Validate/test (pilot) solutions
  - Develop execution plan

- **Control**
  - Establish operating tolerances (x)
  - Re-verify data reliability
  - Implement sustainable control plan
  - Standardise, update documents
  - Quantify benefits
  - Develop transition and training plan (if applicable)
  - Review with Sponsor
# LEAN SIX SIGMA ROADMAP

Six Sigma Methodology and Roadmap for Common Tool Usage

<table>
<thead>
<tr>
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<th>Measure</th>
<th>Analyse</th>
<th>Improve</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Charter</td>
<td>SIPOC</td>
<td>MSA &amp; Baseline Study on Y(s)</td>
<td>Value Stream Map and Lean Tools</td>
<td>Implement Quick Hits at Any Time with Validated Data</td>
</tr>
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<td></td>
<td>Celebrate</td>
</tr>
</tbody>
</table>

- **Define:**
  - Project Charter
  - SIPOC
  - MSA & Baseline Study on Y(s)

- **Measure:**
  - Value Stream Map and Lean Tools
  - Process Map
  - Cause & Effect Study

- **Analyse:**
  - Potential Failure Mode and Effects Analysis
  - Measurement Systems Analysis
  - Data Collection & Sampling

- **Improve:**
  - Statistical Process Behaviour
  - Capability Study
  - Quantitative X,Y Relationships
  - Statistical Validation

- **Control:**
  - Control Plan

*back*
The main Lean diagnostic tool is Value Steam Map. We move from Current to Future Value Stream Map by help of different tools, like the following ones:

**Lean Toolbox 1**
1. Standardised Work and Operator Balance
2. Quality at the Source
3. Workplace Organisation
4. People Involvement
5. Visual Controls and Management
6. Batch Reduction or Elimination

**Lean Toolbox 2**
7. Poka Yoke
8. Cellular Teaming Concepts
9. Pull Systems
10. Equipment Reliability
11. Levelling, Management Timeframe and Takt Image
12. SMED
WHAT IS VARIATION?

Which pilot do you prefer?
A vital part of Six Sigma is to discover relations of:

\[ Y = f (X_1 + X_2 + X_3 + \ldots + X_n) \]

- \( Y \) = Dependent, Outcome, Symptom
- \( X \) = Independent, Cause, Problem

\( Y \) = Process Output

\( X \) = Process inputs or whatever influence \( Y \)

- Our Outputs (\( Y \)) are determined by our Inputs (\( X \)’s). If we know enough about our \( X \)’s we can accurately predict \( Y \).
- By knowing and controlling the \( X \)’s, we reduce the variability in \( Y \). Example of \( Y = f(X) \) …. Profit = \( f \) (Customer, Process, Employee)
Imagine you are the General Manager of a supermarket chain with many employees. You will be out of the country for three months and have asked your staff to fax you a weekly report on every Monday morning. What information/metrics would you like to see in that fax?

**Allstores Inc. Weekly Report**
You are headed to the supermarket ...

The things you would like to buy are available at several supermarkets in your area. All are almost equidistant from your home.

What criteria do you use to decide to which supermarket to go?

Criteria To Decide To Which Supermarket I Should Go

back
SUPERMARKET EXERCISE (PART 3)

- Compare your General Manager list vs. your Customer list.
  - How well do your lists match?

Criteria To Decide Which Supermarket to go shopping

Allstores Inc. Weekly Report

- If you were to redo the General Manager’s list ... What would the list look like now that you know what the customer wants?
**Project Sponsor**, supports the project leader and is the customer and resource provider to the project. Follow-up the Six Sigma project and leverage the gains.

**Black/Green Belts**, leading teams in getting results through Six Sigma projects. Black Belts are full-time committed and Green Belts part-time.

**Project Team Members**, cross functional, with good business process knowledge.

**Master Black Belt**, is a specially trained and very experienced Black Belt Provides Black/Green Belt and Champion training and coaches the Belts in projects. May lead own projects.

**Six Sigma Steering Group**, i.e. Management team, responsible for running the Six Sigma programme within the organisation scope.

**Six Sigma Champion**, Group, Division and BU-level Deployment responsibility and the programme process owner within the organisation.

**Process Owner**, is responsible for the design of the common process and decides on any changes of that process.

**Controller**, Initial evaluator of the project to define the potential economical gains. Monitor and confirm project results.