

# PROCESS MASTERY WITH LEAN SIX SIGMA 2<sup>nd</sup> EDITION

A Practitioner's Guide to the Utilisation of Modern Day  
Lean Six Sigma Methodology

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## THE LEAN & SIX SIGMA TOOLKIT

The table below provides a summary of the most common tools associated with traditional Six Sigma and Lean Thinking as they relate to the full DMAIC sequence.

(NOTE: While this appears similar to the previous table, this one includes Lean tools.)

STEP	COMMON SIX SIGMA TOOLS	LEAN TOOLS	
<b>DEFINE</b>	Quality Function Deployment (QFD) Customer Comments Worksheet Customer Priority Worksheet Surveys, interview, focus groups etc.	CTQ Tree Diagram Kano Analysis SIPOC / IPO Mapping Project Stakeholder Worksheet Project Charter Process Mapping	Value Stream Analysis (Work Flow, Materials Flow, Information Flow) Cycle Time Analysis Cycle Time Driver Tree Time Value Analysis
<b>MEASURE</b>	XY Worksheet Data Collection Plan Sampling Stratification Plan Rolled Throughput Yield	Gage Accuracy Analysis Gage R&R (Reproducibility & Repeatability) Capability Indices Process Sigma	Process Efficiency Metrics (PCE, Total Lead Time, Little's Law)
<b>ANALYSE</b>	Control Charts, Run Charts Histograms Graphical Analysis Tools Multi Vari Analysis Hypothesis Testing Analysis of Variance (ANOVA)	Cause & Effect Relationship Diagrams / Tools Scatter Plots / Matrix Plots Correlation & Linear Regression Logistic Regression Experimental Design (DOE, RSM, Taguchi)	Takt Time Charts Spaghetti Diagrams Cross Functional Flowchart
<b>IMPROVE</b>	Regression Models Benchmarking Idea Generation and Decision Making Tools Process Design / Re-design Pilot Studies Implementation Planning Work Breakdown Structure (WBS) Critical Path Method (CPM)	Network Diagrams Program Evaluation and Review Technique (PERT) Schedule Bar Charts (Gantt Charts) Failure Mode & Effect Analysis (FMEA) Project Risk Management Communications Plan Project Management Tools and Techniques	5S / 6S Process Balancing Pull Systems Work Cell Optimisation Mistake Proofing & Mistake Prevention (Poka Yoke) Single Minute Exchange Die (SMED) Total Productive Maintenance
<b>CONTROL</b>	Standard Operating Procedures Training Plan SIPOC CE Tree Diagram CE Matrix	Performance Monitoring Plan Statistical Process Control Plan Control Charts Visual Controls	Visual Controls

## TOOL SUMMARY TABLE 1 – IN DMAIC SEQUENCE

### Arranged by DMAIC Step

The following is a list of the most common tools used for process improvement with modern Lean Six Sigma. These are arranged according to the phase of the DMAIC strategy where the tool is commonly used.

The number associated with the sub headings, for example ‘Voice of the Customer (Step 1)’, refers to the step on the DMAIC roadmap to which this piece applies.

TOOL	REF PAGES	D	M	A	I	C
<b>VOICE OF THE CUSTOMER (STEP 1)</b>						
Voice of the Customer Concepts (VOC)	109	●				●
Critical-to-quality (CTQ) Tree Diagram	746, 780	●				●
Customer Comments Worksheet	748, 781	●				●
Kano Analysis	751	●				●
Customer Priorities Worksheet	750, 782	●				●
<b>OPPORTUNITY GENERATION (STEP 1)</b>						
Project Idea Generation Tools (various)	106	●				
Process Documentation (SIPOC)	110, 778	●				
Value Stream Analysis	113, 134	●				
Project Prioritisation Matrix	--	●				
Quality Function Deployment	120, 138	●				
<b>CLARIFYING THE PROBLEM / OPPORTUNITY (STEP 3)</b>						
Project Charter	131, 144, 169	●				
Problem Statement	145	●				

<b>TOOL</b>	<b>REF PAGES</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>I</b>	<b>C</b>
Goal Statement	149	●				
Constraint Analysis	150	●				
Project Scoping	151	●				
Cost Benefit Forecasting	156	●				
Project Participant Worksheet	159	●				
<b>START UP THE PROJECT (STEP 4)</b>						
Operating Agreement	174	●				
Meeting Agenda	175, 193	●	●	●	●	●
Communications Planning	177, 192	●			●	
Elevator Speech	178	●	●	●	●	●
<b>PROCESS DOCUMENTATION (STEP 5)</b>						
IPO Worksheet	183, 190, 779	●				
Activity Flowcharting	181, 188, 191	●			●	●
<b>KEY PROCESS VARIABLES (STEP 6)</b>						
Descriptive Statistics	210		●			
Confidence Intervals / Interval Estimation	215		●			
Variable Types	219		●			
<b>PLANNING DATA COLLECTION (STEP 6)</b>						
Data Collection Plan	229, 339		●			
XY Worksheet	232, 338		●			

TOOL	REF PAGES	D	M	A	I	C
Stratification Plan	238		●			
Operational Definition	236, 340		●			
Sampling Concepts	240		●			
Sample Size Calculations	243, 341, 342		●			
<b>COLLECTING DATA (STEPS 7 &amp; 8)</b>						
MSA Concepts	255		●			
Gage Bias	256		●			
Gage Linearity	256		●			
Gage Stability	257		●			
Gage Discrimination	257		●			
Gage R&R (Variables)	258		●			
Gage R&R (Attribute)	--		●			
Data Compilation Worksheet	271		●			
<b>BASELINE PERFORMANCE (STEP 9)</b>						
Normality Testing	292		●			
Project Sigma (DPMO Method)	303, 343		●			
Process Sigma (Z Score Method)	306, 344		●			
Short-term / Long-term Variation	308		●			
Capability Indices	311		●			
Capability Indices with Transformation	322		●			

<b>TOOL</b>	<b>REF PAGES</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>I</b>	<b>C</b>
Final Yield	325		●			
Rolled Throughput Yield	326		●			
Process Cycle Efficiency (PCE)	327, 345		●			
Time Value Analysis	328, 346, 347		●			
Total Lead Time (Little's Law)	335, 345		●			
<b>PROCESS STABILITY (STEP 10)</b>						
Statistical Process Control Concepts	354			●		
Run Charts	357			●		
Control Charts (Attributes)	373, 554			●		
Control Charts (Variables)	378, 555			●		
<b>FINDING THE SOURCE OF VARIATION (STEP 11)</b>						
Graphical Data Analysis	390			●		
Stratification	395			●		
Pivot Charts	399			●		
Central Limit Theorem	404			●		
Hypothesis Testing	410, 450, 557			●		
2 Way Analysis of Variance (ANOVA)	519			●		
<b>FINDING THE SOURCE OF WASTE (STEP 11)</b>						
Takt Time Chart	453, 558			●		
Spaghetti Diagram	456, 559			●		

TOOL	REF PAGES	D	M	A	I	C
Cross Functional Flowchart	458			●		
<b>STUDYING CAUSE &amp; EFFECT RELATIONSHIPS (STEP 12)</b>						
Cause Effect Diagram	462, 560			●		
Cause Effect Chain (5 Whats)	464, 561			●		
Cause Effect Structure Tree	465, 562			●		
Comparative Cause Effect Analysis	--			●		
<b>VALIDATING CAUSE &amp; EFFECT RELATIONSHIPS (STEP 12)</b>						
Scatter Plot	471			●		
Matrix Plot / Scatter Matrix	488.			●		
Pearsons Correlation	477, 490			●		
Linear Regression	480, 494			●	●	
Binary Logistics Regression	507			●		
Ordinal Logistics Regression	510			●		
Nominal Logistics Regression	512			●		
Design of Experiments	532, 565			●	●	
<b>IDENTIFYING SOLUTIONS - Clues from Others (STEP 13)</b>						
Benchmarking	577				●	
<b>IDENTIFYING SOLUTIONS - Treating Causes (STEP 13)</b>						
Linear Regression (response optimization)	480, 494				●	
Design of Experiments (response optimization)	532, 565			●	●	



TOOL	REF PAGES	D	M	A	I	C
Brainstorming	680				●	
Channel Brainstorming	682				●	
Nominal Group Technique	681				●	
Solution Thought Mapping	683				●	
<b>IDENTIFYING SOLUTIONS - Innovation (STEP 13)</b>						
Creativity Principles and Concepts	583				●	
Anti Solution Brainstorming	681				●	
Word Association Brainstorming	--				●	
Picture Association Brainstorming	--				●	
Process Analogy Brainstorming	685				●	
Moments of Truth	739				●	
<b>IDENTIFYING SOLUTIONS - Organising Ideas (STEP 13)</b>						
Advocacy	688				●	
Affinity Grouping	688				●	
Multi Voting	687				●	
Multi Voting (weighted)	687				●	
<b>IDENTIFYING SOLUTIONS - Deciding (STEP 13)</b>						
Payoff Analysis	691				●	
Potential Failure Analysis	691					
Absolute Criteria Screening	690				●	

TOOL	REF PAGES	D	M	A	I	C
Weighted Criteria Rating	693				●	
Paired Ranking	695				●	
Payback Period	598				●	
Return on Investment (ROI)	600				●	
Net Present Value (NPV)	601				●	
Internal Rate of Return (IRR)	604				●	
<b>IDENTIFYING SOLUTIONS - Lean Principles (STEP 13)</b>						
6S	605				●	
Process Balancing	609, 697				●	
Pull Systems	612, 698				●	
SMED	614, 699				●	
Total Productive Maintenance	618, 702				●	
Work Cell Optimisation	617, 701				●	
<b>FAILURE / CONSEQUENCE MITIGATION (STEP 14)</b>						
Potential Consequence Analysis	622				●	
Failure Mode and Effect Analysis (FMEA)	623, 704				●	
Mistake Prevention & Mistake Proofing	638, 703				●	
<b>IMPLEMENTATION PLANNING (STEP 15)</b>						
Project Management	639				●	
Work Scheduling (Gantt / Schedule Bar Charts)	643, 653, 705				●	

TOOL	REF PAGES	D	M	A	I	C
Work Breakdown Structure	644, 706				●	
Network Diagram	646, 706				●	
PERT	647, 707				●	
Critical Path Method (CPM)	649, 708				●	
Responsibility Matrix	709				●	
Project Risk Management Planning	655, 714				●	
Stakeholder Commitment Evaluation	667, 710				●	
Stakeholder Engagement Planning	668, 711				●	
Communication Planning	670, 712				●	
Force Field Analysis	671, 713				●	
Solution Piloting	672, 716				●	
<b>STANDARDISE PROCESSES (STEP 17)</b>						
Process Documentation	724					●
Training Plan	725					●
<b>PERFORMANCE MONITORING PLANNING (STEP 18)</b>						
Voice of the Customer Concepts (VOC)	733	●				●
Critical-to-quality (CTQ) Tree Diagram	746, 780	●				●
Customer Comments Worksheet	748, 781	●				●
Kano Analysis	751	●				●
Customer Priorities Worksheet	750, 782	●				●

<b>TOOL</b>	<b>REF PAGES</b>	<b>D</b>	<b>M</b>	<b>A</b>	<b>I</b>	<b>C</b>
SIPOC	728, 778	●				●
Cause Effect Tree Diagram	758, 783	●				●
Cause Effect Matrix	761, 784	●				●
Process Performance Monitoring Plan	726, 763, 786	●				●
<b>PROCESS PERFORMANCE CONTROL PLANNING (STEP 18)</b>						
Visual Controls	767					●
Takt Boards	768					●
Production Boards	769					●
Performance Dashboards	769					●
Process Performance Control Plan	772, 787					●
<b>MISCELLANEOUS</b>						
Project Posters and Storyboards		●	●	●	●	●
Accelerated Improvement Projects / Kaizen	811	●	●	●	●	●