
LEAN SIX SIGMA TOOLKIT

The Lean Six Sigma methodology includes a set of tools that allow LSS professionals to improve processes, i.e., to eliminate waste and reduce variation. In particular, Six Sigma is mainly based on statistical tools that require a specific software (such as Minitab) in order to perform data analysis quickly and effectively.

However, in real-case scenarios, most of these tools can be implemented in Excel, which is probably one of the most common tools used by companies worldwide.

This provides several benefits:

- companies don't need any license to perform statistical analysis
- students can practice at home, understanding how to implement formulas without buying special and expensive tools
- professionals can use a set of different templates and create their own toolbox, depending on their specific needs
- tools standardization allows to share files within and between organizations

This toolkit has been thought to provide support in all different stages of a Lean Six Sigma project: Define, Measure, Analyze, Improve and Control.

Following, you will find the Toolkit list, as well as a short description of every tool.

However, for a better understanding on how to use them, we recommend to request a virtual class (webinar) or a face-to-face training.

More details at <https://www.accialiniconsulting.com/service/lean-six-sigma/>

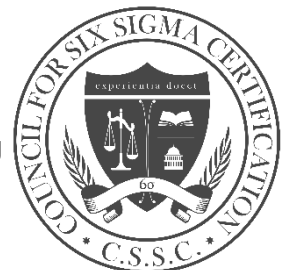
I hope you will enjoy our tools and you will apply them successfully in your daily work.

For any inquiries, please contact us: info@accialiniconsulting.com

Best Regards,

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1. DEFINE

1.1 PROJECT PRIORITIZATION MATRIX

This simple Excel template supports you in the project selection phase. In the Set-up spreadsheet, you need to digit your rate limits, then define your rating criteria and assign a weight to each of them. Then, provide a value description for each rate (from 1 to 5). In the Priority Calculator spreadsheet, provide a short description about your solutions and rate them against your rating criteria. In the total column, you will get your final rating result.

1.2 PUGH MATRIX

Similarly, to the Prioritization Matrix, a Pugh Matrix help your team to prioritize projects against a pre-defined baseline.

First, describe what your baseline is. Second, describe your options/projects. Third, define and weight your CTQ's factors. Then, rate your options with keys (better "+", worse "-", the same "S") against your baseline. Last, check the final score to prioritize your solutions.

1.3 GANTT CHART

You don't need MS Projects to plan your activities. In most cases, an Excel template is more than enough! This template will help you to create effective Gantt Chart for your LSS Project.

1.4 TEAM DEFINITION

This Excel template will help you to track members, their contacts, roles and responsibilities.

1.5 COMPETENCE SKILLS MATRIX

This template helps the team leader to track team members skills and to identify potential skill gaps.

1.6 RACI MATRIX

A RACI matrix is the simplest, most effective means for defining and documenting project roles and responsibilities. Knowing exactly who is responsible, who is accountable, who needs to be consulted, and who must be kept informed at every step will significantly improve your chances of project success.

1.7 STAKEHOLDER MANAGEMENT

Stakeholder Management is the systematic identification, analysis, planning and implementation of actions designed to engage with stakeholders. This Excel template will help you to manage your Stakeholders. You will find 2 spreadsheets:

- The Stakeholder Map sheet: identify your stakeholders based on “Degree of Power and Influence” and “Stakeholder position”;
- The Manage Stakeholders sheet: define how to manage your stakeholders and in case which actions should be taken.

1.8 COMMUNICATION PLAN

An effective communication is a key aspect of any project. This template helps you to plan your communication strategy.

1.9 QUALITY FUNCTION DEPLOYMENT

This Excel template will enable you to develop a Quality Function Deployment (QFD), also called House of Quality. The QFD is a structured approach to defining customer needs or requirements and translating them into specific plans to produce products to meet those needs. The “voice of the customer” is the term to describe these stated and unstated customer needs or requirements.

Please use the instructions provided in the Info spreadsheet to fill in the QFD properly.

1.10 PROJECT CHARTER

The Project Charter is a living document that outlines a process improvement project for both the team as well as leadership. Teams use the charter to clarify the process issue being addressed, the reason for addressing it and what “success” looks like for those working on it. It’s also used to clarify what’s not being addressed. It is the first step in a Lean Six Sigma project, and therefore takes place in the Define Phase of DMAIC. The Project Charter is periodically reviewed and refined throughout the project.

1.11 DMAIC PROJECT CHECKLIST

This checklist supports the team and the project leader throughout the 5 stages of a Lean Six Sigma project. Use this checklist to be sure you have accomplished all your goals before a gate review.

1.12 LEAN SIX SIGMA PROJECT GENERIC TEMPLATE

This is a simple template that can be used to present results to the team members, stakeholders and panel members.

1.13 A3 TEMPLATES

The A3 template is a tool to help see the thinking behind the problem-solving. Don’t mistake A3s as a document to be completed after the problem is solved. It’s important to use the A3 while working through the problem. The practice of using A3s forces project teams to focus their efforts. At the same time, A3s make it easier for a leader or coach to review a problem solver’s work.

2. MEASURE

2.1 PROBABILITY DISTRIBUTION TABLES

This pdf file provides you four commonly used tables of probability distributions:

- Table A.1 - The Standard Normal Distribution
- Table A.2 - The Student's t Distribution
- Table A.3 - The Chi-Square Distribution
- Table A.4 - The F-Distribution

2.2 NORMAL PROCESS CAPABILITY ANALYSIS

Use Normal Capability Analysis to evaluate the potential (within) and overall capability of your process based on a normal distribution. Using this analysis, you can do the following:

- Determine whether the process is capable of producing output that meets customer requirements.
- Compare the overall capability of the process with its potential (within) capability to assess opportunity for improvement

2.3 NON-NORMAL PROCESS CAPABILITY ANALYSIS

Use Normal Capability Analysis to evaluate the potential (within) and overall capability of your process based on a normal distribution. Using this analysis, you can do the following:

- Determine whether the process is capable of producing output that meets customer requirements.
- Compare the overall capability of the process with its potential (within) capability to assess opportunity for improvement

2.4 GAGE R&R CONTINUOUS DATA

A Measurement System Analysis is a key part of the LSS Measure Phase project. To confirm validity and reliability of a measurement instrument, a Gage R&R study can be used to conduct an audit on a continuous data measurement system. This involves using multiple people, multiple items, and multiple measurements to complete the audit.

2.5 GAGE R&R ATTRIBUTE DATA

If you deal with attribute data rather than continuous data, please use this template to perform a Gage R&R study.

2.6 BOXPLOT

This template helps you to create boxplots just using Excel core charts. A box plot (or boxplot) is a method for graphically depicting groups of numerical data through their quartiles. Box plots may also have lines extending from the boxes (whiskers) indicating variability outside the upper and lower quartiles, hence the terms box-and-whisker plot and box-and-whisker diagram.

2.7 HISTOGRAM

This template helps you to create histograms just using Excel core functions and charts. Histograms give a rough sense of the density of the underlying distribution of the data, and often for density estimation: estimating the probability density function of the underlying variable.

2.8 PARETO CHART

This template helps you to create Pareto Charts just using Excel core functions and charts. A Pareto chart is a type of chart that contains both bars and a line graph, where individual values are represented in descending order by bars, and the cumulative total is represented by the line.

2.9 DESCRIPTIVE STATISTICS

Did you know that Excel has an easy way to calculate descriptive statistics of data sets? Descriptive statistics help describe and understand the features of a specific data set by giving short summaries about the sample and measures of the data. The most recognized types of descriptive statistics are measures of center: the mean, median, and mode, which are used at almost all levels of math and statistics.

2.10 Z-SCORE CALCULATION

This simple template helps to calculate the Z-score of a data set. Z-score is useful to standardized the values (raw scores) of a normal distribution by converting them into z-scores because:

- it allows researchers to calculate the probability of a score occurring within a standard normal distribution;
- enables us to compare two scores that are from different samples (which may have different means and standard deviations).

2.11 SIGMA LEVEL TABLE

This table lists Defects Per Million Opportunities with the corresponding Sigma Level and defects %.

2.12 SIPOC TEMPLATE

This file provides a simple template to create a SIPOC diagram. A SIPOC (suppliers, inputs, process, outputs, customers) diagram is a visual tool for documenting a business process from beginning to end prior to implementation. SIPOC diagrams are also referred to as high level process maps because they do not contain much detail.

SIPOC diagrams are useful for focusing a discussion, helping team members agree upon a common language and understanding a process for continuous improvement.

2.13 VALUE STREAM MAP

This file provides an effective solution to create a Value Stream Map. Value-stream mapping is a lean-management method for analyzing the current state and designing a future state for the series of events that take a product or service from the beginning of the specific process until it reaches the customer. A value stream map is a visual tool that displays all critical steps in a specific process and easily quantifies the time and volume taken at each stage. Value stream maps show the flow of both materials and information as they progress through the process.

2.14 TAKT TIME CALCULATOR

This file helps to easily calculate the TAKT TIME of a process. Takt time, or simply Takt, is a manufacturing term to describe the required product assembly duration that is needed to match the demand. Often confused with cycle time, takt time is a tool used to design work and it measures the average time interval between the start of production of one unit and the start of production of the next unit when items are produced sequentially. The takt time is based on customer demand; if a process or a production line are unable to produce at takt time, either demand leveling, additional resources, or process re-engineering is needed to ensure on-time delivery.

3. ANALYZE

3.1 HYPOTHESIS TESTING PLAN

This file supports the team to properly plan the Hypothesis Testing phase. In fact, Hypothesis Tests are effective tools used during the Analyze phase to tell us whether exists statistically significant difference between the data sets for us to consider that they represent different distributions.

3.2 HYPOTHESIS TESTS

This file supports the team to perform hypothesis tests. More specifically, the hypothesis tests that can be performed with this file are the following:

- 1-proportion Z-test (attribute data – 1 sample)
- 1-Proportion Binomial Test (attribute data – 2 samples)
- Multiple proportion Chi-squared test (attribute data – more than 2 samples)
- 1-Mean Z test (variable data – mean – one sample – variance known)
- 1-Mean t-test (variable data – mean – one sample – variance unknown)
- 2-Mean Z-Test (variable data – mean – two samples – variances known)
- 2-Sample Pooled t-test (variable data – mean – two samples – variances unknown – assumed equal)
- 2-sample t-test (variable data – mean – two samples – variances unknown – assumed unequal)
- Paired t-test (variable data – mean – two samples – variances unknown – paired data)
- F-test ANOVA (variable data – mean – more than two samples)
- Chi-square test (variable data – variance – one sample)
- F-Ratio (variable data – variance – two samples)

3.3 1-SAMPLE T-TEST

Did you know that you can perform a 1-sample t-test with the function embedded in Excel? This file explains the simple steps to perform it.

3.4 2-SAMPLE T-TEST

Did you know that you can perform a 2-sample t-test with the function embedded in Excel? This file explains the simple steps to perform it.

3.5 ANOVA

Did you know that you can perform an ANOVA test with the function embedded in Excel? This file explains the simple steps to perform it.

3.6 CHI-SQUARED TEST

This type of test can be performed using the file described in section 3.2. However, you can also use the tool provided in this section.

3.7 DATA COLLECTION SAMPLING PLAN

A sampling plan tells which category is to be surveyed, what should be the sample size and how the respondents should be chosen out of the population. With this easy file, you can plan your data collection and sampling activity in a more effective way.



work better, work smart

3.8 SAMPLE SIZE CALCULATION

Sample size is a critical value required to perform statistically significant analysis. If your sample is too small, the level of uncertainty is too high. On the other hand, if your sample is too big, it's simply expensive. This tool helps to identify the correct sample size.

3.9 SCATTER PLOT

Scatter plots are visual tools to identify potential correlations between data sets. A scatter plot can be used either when one continuous variable is under the control of the experimenter and the other depends on it or when both continuous variables are independent. This file describes how to create a scatter plot with Excel basic functions.

3.10 CORRELATION ANALYSIS

Correlation is used to test relationships between quantitative variables or categorical variables. In other words, it's a measure of how things are related. The study of how variables are correlated is called correlation analysis.

With this tool you can perform a correlation analysis using the basic function in Excel.

3.11 PROCESS FAILURE MODE AND EFFECT ANALYSIS (PFMEA)

A PFMEA supports the team in discovering potential failures during the manufacturing design process. This means that in some cases a Design Change will be required in order to lower the RPN.

3.12 FISHBONE DIAGRAM

A fishbone diagram, also called a cause-and-effect diagram or Ishikawa diagram, is a visualization tool for categorizing the potential causes of a problem in order to identify its root causes. This Excel template will help you in the creation of a Fishbone Diagram.

3.13 5-WHYS

This simple template helps the team to perform a 5-Whys assessment. Five-whys (or 5 whys) is an iterative interrogative technique used to explore the cause-and-effect relationships underlying a particular problem. The primary goal of the technique is to determine the root cause of a defect or problem by repeating the question "Why?". Each answer forms the basis of the next question. The "five" in the name derives from an anecdotal observation on the number of iterations needed to resolve the problem.

3.14 MULTI-VARI CHART

This file can be used to create simple multi-vari charts. Multi-vari charts are a visual way of presenting variability through a series of charts. A multi-vari chart is a graphical representation of the relationships between factors and a response. Use a multi-vari chart to present analysis of variance data in a graphical form especially in the preliminary stages of data analysis to view data, possible relationships, and root causes for variation. Multi-vari charts are especially useful in understanding interactions.

4. IMPROVE

4.1 3-FACTOR DOE

Design of experiments (DOE) is a systematic method to determine the relationship between factors affecting a process and the output of that process. In other words, it is used to find cause-and-effect relationships. This information is needed to manage process inputs in order to optimize the output. An understanding of DOE first requires knowledge of some statistical tools and experimentation concepts. The excel file you find here is provided by The American Society of Quality (ASQ) and helps you to run a 3-factor DOE. For more complex experimental design, we recommend to use specific software (such as Minitab)

4.2 5S MANUFACTURING ASSESSMENT

The 5S Manufacturing Assessment is a tool to determine whether or not the standards of 5S (Sort, Set-in-Order, Shine, Standardize and Sustain) are being met in a physical manufacturing environment. The types of conditions being monitored would include whether there were unused parts in the work space or whether or not people knew where tools and equipment belonged, etc. Once conditions are assessed, the areas that miss the 5S standards would be addressed.

4.3 REGRESSION ANALYSIS

Regression analysis is a set of statistical processes for estimating the relationships between a dependent variable and one or more independent variables. The most common form of regression analysis is linear regression, in which one finds the line (or a more complex linear combination) that most closely fits the data according to a specific mathematical criterion. This file helps to perform a regression analysis using the basic Excel functionalities.

4.4 VISUAL MANAGEMENT CHECKLIST

The Visual Management Checklist is a guide to your visual management efforts. The Checklist helps you determine if you've paid attention to the Four Basic Principles; Make it Simple, Big, Visible and Changeable. And it ensures you've applied all the standard tips and tricks to create a truly visual process.

5. CONTROL

5.1 RUN CHART

A run chart is a graph that displays observed data in a time sequence. Often, the data displayed represent some aspect of the output or performance of a manufacturing or other business process.

Use this template to perform a run chart in Excel.

5.2 I-MR CHART

An Individual moving range (I-MR) chart is used when data is continuous and not collected in subgroups. In other words, collect the single observation at a time. An I-MR chart provides process variation over time in graphical method. Graphical I-MR chart helps to identify the when the process goes out of control and also indicates where to focus for source of assignable cause.

Use this template provided by the American Society of Quality (ASQ) to create a I-MR chart in Excel.

5.3 XBAR-R CHART

Use Xbar-R Chart to monitor the mean and variation of a process when you have continuous data and subgroup sizes of 8 or less. Use this control chart to monitor process stability over time so that you can identify and correct instabilities in a process.

Use this template provided by the American Society of Quality (ASQ) to create Xbar-R charts in Excel.

5.4 XBAR-S CHART

Use Xbar-S Chart to monitor the mean and variation of a process when you have continuous data and subgroup sizes of 9 or more. Use this control chart to monitor process stability over time so that you can identify and correct instabilities in a process.

Use this template to create Xbar-S charts in Excel.

5.5 P-NP CHARTS

P and NP control charts are used with yes/no type attributes data. These two charts are commonly used to monitor the fraction (p chart) or number (np chart) of defective items in a subgroup of items.

Use this template to create p-np chart in Excel.

5.6 C-U CHARTS

The u-chart is a quality control chart used to monitor the total count of defects per unit in different samples of size n ; it assumes that units can have more than a single defect. The c-chart is a quality control chart used to monitor the total count of defects in fixed samples of size n .

Use this template to create c-u charts in Excel.

5.7 CONTROL PLAN

A control plan is a living document that outlines the methods taken for quality control of critical inputs to deliver outputs that meet customer requirements. It also provides a written description of the measurements, inspections, and checks put in place to control production parts and processes.

5.8 PROCESS SURVEILLANCE

This worksheet supports the team to implement process surveillance effectively. Process Surveillance helps the team to monitor a process in order to reduce the risk that variation happens by eliminate the sources since the beginning.

5.9 LESSONS LEARNT

Lesson Learnt are experiences distilled from a project that should be actively taken into account in future projects. Use this Excel template to record Lessons Learnt throughout the project lifecycle.