

Oregon Bio Virtual Classroom

BioPro Advanced Manufacturing

Lean Six Sigma Green Belt

CURRICULUM MODULES

- LSS-101: Introduction to Lean Six Sigma
- LSS-102: Measuring Process Performance-I
- LSS-103: Measuring Process Performance-II
- LSS-104: Root Cause Analysis and Improving the Process
- LSS-105: Sustaining Improvement Efforts

SELECTING YOUR LEAN SIX SIGMA IMPROVEMENT PROJECT(S)

EXCEL PREREQUISITES

EXCEL ANALYSIS TOOLPAK SETUP

Course Information

20 Half-day online modules from 8 a.m. – 12:30 p.m.

Location: Virtual classroom

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LSS-101: INTRODUCTION TO LEAN SIX SIGMA (16 hours)

Combining Lean and Six Sigma into a single improvement initiative eliminates redundant infrastructure and provides the ultimate in world-class performance: Six Sigma quality combined with Lean speed! This module will get you up to speed on Lean Six Sigma principles and methods.

You will learn:

- *How integrating Lean and Six Sigma can dramatically improve your business results*
- *How the DMAIC (Define-Measure-Analyze-Improve-Control) project roadmap can improve LSS project results, including greater reductions in lead time and cost of waste*
- *How to identify and prioritize LSS projects for maximum impact*
- *How to deploy Lean Six Sigma projects*
- *How to charter LSS projects*
- *Create accurate current state process maps*
- *How to select and launch teams for effectiveness*
- *Understand leadership responsibilities*

Tools you will learn:

- DMAIC project roadmap
- Identifying and prioritizing improvement projects
- Improvement project reporting
- Chartering improvement projects
- Process mapping

LSS-102: MEASURING PROCESS PERFORMANCE-I (16 hours)

Reliable data is required for Lean Six Sigma Improvement projects. This module explains how to collect data to quantify the current state and establish desired improvement goals.

You will learn how to:

- *Conduct process walks, apply good interviewing and listening techniques, and identify "low hanging fruit" opportunities for improvement*
- *Create accurate value stream maps*
- *Recognize basic data types: quantitative and categorical*
- *Identify X and Y variables for your LSS project*
- *Perform sample size calculations for data collection*
- *Collect data that is representative of the current state*
- *Calculate project benefit metrics based on quantitative and categorical data*

Tools you will learn:

- Observing the current state
- Value stream mapping
- Sample size calculation
- Basic statistics and normal distribution

PREREQUISITE: LSS-101: Introduction to Lean Six Sigma

LSS-103: MEASURING PROCESS PERFORMANCE-II (2 DAYS)

Reliable data is required for Lean Six Sigma Improvement projects. This module explains how to collect data to quantify the current state and establish desired improvement goals.

You will learn how to:

- *Conduct measurement system analyses*
- *Apply Pareto analysis to categories of defects, errors, failures, cost, non-value adding time, or other types of waste*
- *Calculate and interpret process capability indices*

Tools you will learn:

- Measurement system analysis
- Statistical graphics
- Pareto analysis
- Process capability indices

PREREQUISITE: LSS-102: Measuring Process Performance-I

LSS-104: ROOT CAUSE ANALYSIS AND IMPROVING THE PROCESS (16 hours)

ROOT CAUSE ANALYSIS

One of the most important and challenging steps in a Lean Six Sigma improvement project is to determine the root cause(s) of problems within the project scope. Possible causes must be confirmed or debunked by data analysis. If there are multiple root causes, these should be prioritized.

You will learn how to:

- *Describe the population associated with a process*
- *Classify significance testing into two basic types: comparing populations, correlating variables*
- *Explain P values and how they relate to standards of evidence*
- *Test for differences between or among population*
- *Test for correlations between variables and interpret the results*
- *Perform root cause analysis*

Tools you will learn:

- Significance testing
- Interpreting P values
- Five whys
- Affinity analysis
- Fishbone diagram

IMPROVING THE PROCESS

Once root causes have been identified, the next step is to develop and prioritize solutions. The best solution(s) are identified, tested, and then assessed to make sure that the intended outcome is achieved.

You will learn how to:

- *Use common solution categories to assist in developing solutions for your project*
- *Use the results of root cause analysis to develop solutions for your project*
- *Apply Lean solutions*
- *Use benefit/feasibility analysis to evaluate proposed solutions*
- *Apply FMEA to your proposed future state*
- *Plan and conduct a pilot study of your future state process*
- *Establish statistical baselines for your future state process*
- *Test for significant improvements of the future state over the current state*

Tools you will learn:

- Developing solutions
- Lean solutions
- Theory of Constraints
- Failure Modes & Effects Analysis (FMEA)

PREREQUISITE: LSS-103: Measuring Process Performance-II

LSS-105: SUSTAINING IMPROVEMENT EFFORTS (16 hours)

Developing and implementing a control plan is necessary to sustain the gains achieved by the project.

You will learn how to:

- *Develop a control plan for the future state*
- *Explain the difference between common causes and assignable causes*
- *Calculate control limits for some commonly used control charts*
- *Explain the purpose and nature of a response plan*
- *Describe a scenario where a process outcome fails to meet a customer expectation, but it is not appropriate to initiate a response plan*
- *Understand the principle of a visual factory*

Tools you will learn:

- Control Plan
- Statistical Process Control (SPC)
- Response Plan

LSS GB TEST FOR SUCCESSFUL COMPLETION OF COURSE

PREREQUISITE: LSS-104: Root Cause Analysis and Improving the Process

SELECTING YOUR LEAN SIX SIGMA IMPROVEMENT PROJECT(S)

Your organization should assign a high-priority improvement project to work on during the training program. Selecting the right project can have a tremendous effect on your organization's business results. If project selection is done well, processes will function more efficiently in 3 to 6 months, employees will feel satisfied and appreciated for making business improvements and ultimately all stakeholders will see the benefit. If project selection is done poorly, it may not have the support of senior management and roadblocks may not be removed due to other business priorities.

Here are some guidelines to help you and your organization identify and prioritize potential improvement projects:

- Every business is different. You should make every effort to ensure your company's specific priorities are taken into account when evaluating potential improvement projects.
- Ask your business leader for the three greatest issues facing the business. Make sure the project is one of the issues or is directly related. This will ensure that your management team is giving the project the proper attention and support and is willing to quickly remove roadblocks.
- What are the greatest issues as seen from the eyes of your customers? Look through customer complaint logs, listen to call center telephone conversations and call customers that have stopped your company service. Create a Pareto Chart to prioritize issues. This will help with project prioritization and project selection.
- Is the project manageable? Can the project be completed within six months? If longer, you may lose members as they move to other jobs or the team may feel frustrated that they're not making a difference.
- Will the completed project have a measurable impact on the business processes or financial bottom line? Don't embark on a project without knowing what the benefits are to the business. This will keep your team motivated along the way.
- What is your process capability? If you haven't been measuring your process, how do you know it needs improvement? Make sure you know what amount of defects the process is currently producing and define your project desired outcome.

GENERAL GUIDELINES FOR PROJECT SELECTION

- Any project should have identifiable process inputs and outputs.
- A good Lean Six Sigma project should never have a pre-determined solution.
- If you already know the answer, then just go fix it! (For example, Lean projects)
- For projects that have operator or operator training as an input, focus on ways to reduce operator variation, making your process more robust to different or untrained operators.
- All projects need to be approached from the perspective of understanding the variation in process inputs, controlling them, and eliminating the defects.

Lean Six Sigma is project-intensive. Organizations such as General Electric complete as many as 7,000 Lean Six Sigma projects in a single year. Smaller companies can complete several hundred projects per year. Typically, Lean Six Sigma projects address three different areas of potential improvement: quality, cost and schedule. Critical-to-quality characteristics are designated CTQ; critical-to-cost, CTC; and critical-to-schedule, CTS. This classification can help focus Lean Six Sigma projects by defining project deliverables in terms of their impact on one or more characteristics.

Spreadsheets can provide an objective means of prioritizing potential improvement projects. First, your "Council of Champions" decides on a "Balanced Scorecard" of *project benefit metrics*, for example: Customer Satisfaction (Quality, Delivery, Service...), Sales, Profit, Cash Flow, New Business Generation, Safety, Employee Satisfaction, etc. Projects under consideration are rated with respect to each benefit metric, and then overall ratings are computed and used to rank the projects by overall benefit. A hypothetical example of this process is shown in **Figure 1**.

		Benefit metrics →									
		Customer satisfaction	Sales	Cost	Cash flow						
Relative weight →		2	1	1	1						
Projects	Reduce defects per unit for process A	3	3	9							18.0
	Improve call-center performance	9	3	1							22.0
	Reduce days in Accounts Receivable				9						9.0
	Reduce lead time for product family B	9	3								21.0
	Reduce WIP on production line C				9						9.0
	Find and qualify cheaper raw material			9							9.0
	Increase reliability of product D	9	3								21.0
											0.0
											0.0
											0.0
Total metric impact →		30	12	19	18	0	0	0	0	0	0

Total project benefit

Rate each project for impact on each metric: 0 = none 1 = weak 3 = moderate 9 = strong

Figure 1. Example of project benefits prioritization

Potential projects should also be rated with respect to *project feasibility metrics* like Ease of Implementation, Likelihood of Success, Rapidity of ROI, Availability of Data, etc. The overall ratings are then computed and used to rank the projects by overall benefit. A hypothetical example of this process is shown in **Figure 2**.

		Feasibility metrics →										Total project feasibility	
		Ease of implementation					Likelihood of success						
Projects	Relative weight →	1	2										
	Reduce defects per unit for process A	9	3										15.0
	Improve call-center performance	1	3										7.0
	Reduce days in Accounts Receivable	3	9										21.0
	Reduce lead time for product family B	9	9										27.0
	Reduce WIP on production line C	9	9										27.0
	Find and qualify cheaper raw material	9	1										11.0
	Increase reliability of product D	9	3										15.0
													0.0
													0.0
													0.0
												0.0	

Rate each project with respect to each metric: 1 = low 3 = medium 9 = high

Figure 2. Example of project feasibility prioritization

The final step in project selection should involve joint consideration of overall benefit and feasibility ratings. Projects ranking high for both benefit and feasibility are good candidates for immediate action. An example in Figures 1 and 2 is the project “Reduce lead time for product family B.”

Last but not least, considerable time during the first two-day session of the training program will be spent on the subject of project selection. If you have two or three potential improvement projects in mind before the first training session begins then information gained can be used to make a final decision regarding selection of the optimal improvement project. Your instructor will also be available to assist you in project selection if required. The project you select will form the basis for the application of the remainder of the training and will be the first outcome of your newly acquired knowledge and skills.

EXCEL PREREQUISITES

COMPUTER PLATFORM

The Lean Six Sigma Green Belt (LSS GB) program is designed around the use of Microsoft Office Excel for PC’s (2010 preferred but 2007 will also work). If a Mac is used, it must be loaded with the 2016 version of Excel for Macs to be compatible with the course materials (Mac Excel version 2011 will not be compatible for some of the statistical analyses).

RECOMMENDED EXCEL SETUP

Excel set-up needs to include the add-on “Analysis ToolPak” which will enable the “Data Analysis” function in the “Data” tab. See the “Excel Analysis Toolpak Setup” for additional instructions.

EXCEL PROFICIENCY

The Lean Six Sigma program was developed on the assumption that participants already know how to perform the Excel operations listed in the following table. Practice and proficiency with these Excel operations will allow participants to concentrate on learning the concepts and tools of LSS, without having to learn Excel at the same time. The items in bold are more advanced operations, and you’ll be instructed in these during class; learning them ahead of time is optional.

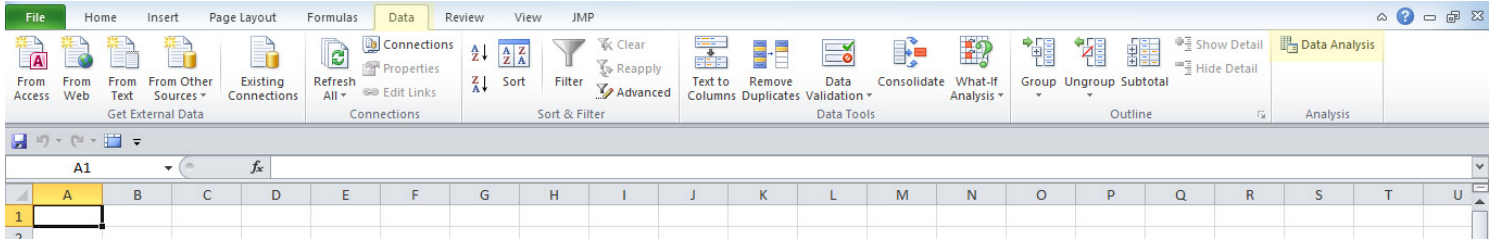
EXCEL TAB	OPERATION
<i>File</i>	Open, Close, Save As
<i>Home</i>	Cut, Copy, Paste, Paste Options (values, formulas etc.), Insert Row/Column, Delete Row/Column, Clear Contents, Format Cells (general, text, #, \$, %, etc.), Select Cell Ranges, Select Row(s), Select Column(s), Select Row Height, Set Column Width
<i>Insert</i>	Create, Format and Modify Column Charts; Create, Format and Modify Line Charts; Create and Modify Pivot Tables; Create, Format and Modify Scatter Plots
<i>Formulas</i>	Insert Function; AutoSum; Edit Cell Formulas; Copy Cell Formulas; Use basic math, stats and logic functions in formulas (SUM, SQRT, AVERAGE, STDEV, IF); Use relative and absolute cell references; use quotation marks to signify a text result in a logic formula (e.g., =IF(C2<1500, “Fail”, “Pass”)

Data	Sort (including Add/Delete levels); Filter; Text to Columns; “Data Analysis” needs to be enabled (see notes in Excel Set-up section)
View	Options to show Gridlines, Formula Bar and Headings should be checked; New Window; Arrange All; Hide/Unhide Columns; Freeze/Unfreeze Panes
Other Excel Functions	Use of right-click mouse commands; Drag and drop; Select Worksheet; Rename Worksheet; Move Worksheet; Copy Worksheet

EXCEL ANALYSIS TOOLPAK SETUP

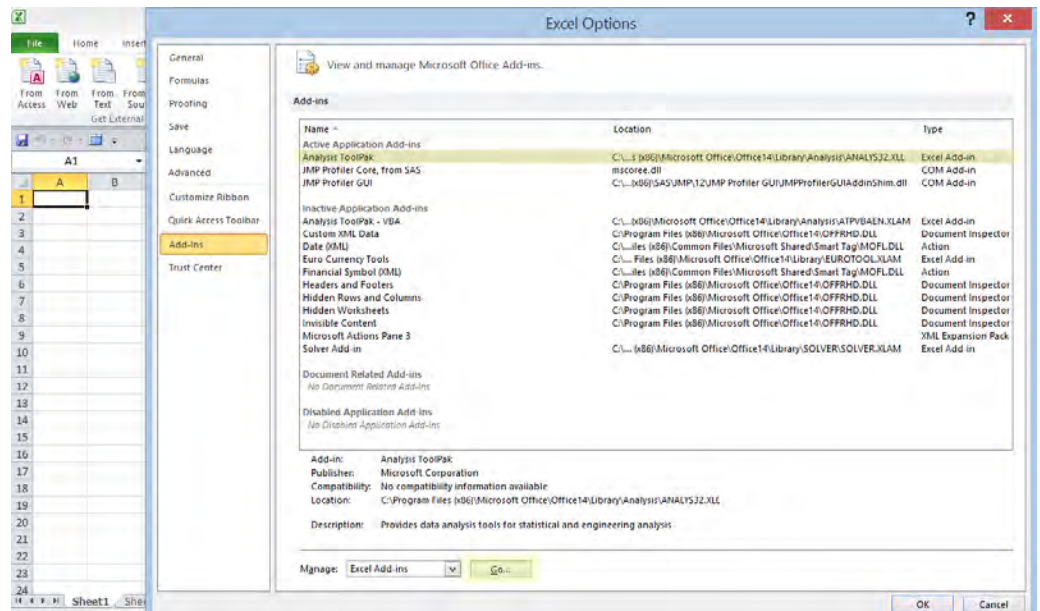
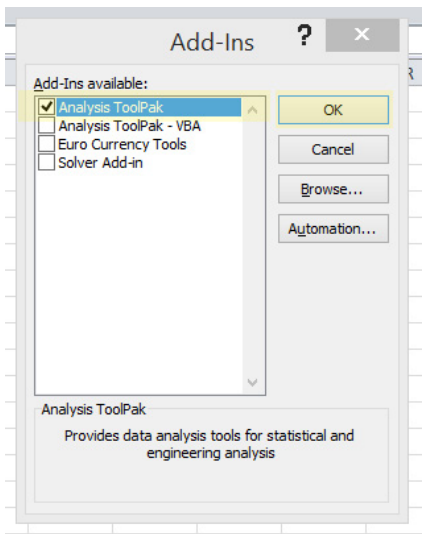
Excel setup needs to include the Add-On “Analysis ToolPak” which will enable the “Data Analysis” function in the “Data” tab.

What you should see (from Excel 2010):



If “Data Analysis” does not appear, select in the following order:

- File tab (in left hand corner)
- Options
- Add-Ins
- Select (highlight) “Analysis ToolPak”
- Click Go
- Check “Analysis ToolPak”
- Click OK



Go back to the Data tab and see if the “Data Analysis” function shows up (you can try closing and re-opening Excel). If it does not show up, try the command above again, making sure to follow each step.

If the “Analysis ToolPak” option was not included in the original installation, then the commands above will not be successful. Excel must be re-installed making sure it’s included.

The “Analysis ToolPak” can also be downloaded from the Microsoft Office web site.

At times, Excel sometimes loses the “Data Analysis” function and the “Analysis ToolPak” must be reloaded (try closing and re-opening Excel first).