Design for Lean & Six Sigma (DFLSS)

Lean and Six Sigma (LSS) methodologies combined have achieved great quality improvements, process optimizations and waste reduction in today's businesses. Aggressive companies also focus on making their product designs so optimized that quality troubleshooting and lean optimization after production launch is minimal. This can be happen when Lean manufacturing and Six Sigma Quality considerations are aggressively implemented up front in the design, manufacturing and quality planning phases.

Participants will gain knowledge in how to apply DFLSS concepts and how to carry out Minitab software data analysis through practice with data files. Students will learn how to apply DFLSS tools and techniques at the earliest stages of a design concept to get a new product on the right track from day 1.

➢ First, the concepts of DFLSS are discussed in detail and how that the DMADV problem solving technique is applied to DFLSS projects (Define, Measure, Analyze, Design & Verify). Alignment of the DFLSS tools to the DMADV phases will be covered. Early supplier involvement in these efforts is also crucial.

➢ Next, participants will learn the sequence in which the various DFLSS tools should be applied for maximum impact. Six Sigma data analysis is used to ensure that the root causes for issues that can plague the new design are uncovered and addressed. Quality Function Deployment (QFD) will be practiced in detail.

➢ Lastly, participants will learn the benefits of error-proofing, DOE-driven verification testing, and Statistical Process Controls (SPC). Other tools will be covered that can ensure that high product reliability and production quality control.

Course Syllabus

I   IDENTIFYING INFORMATION

Course: Design for Lean & Six Sigma
Prerequisite: None
Time Frame: 40 total contact hours
Instructor: David Patrishkoff
                     Bachelors and Masters Degrees in Mechanical Engineering
                     30 years in the product engineering profession
                     20 years in executive management
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II   REFERENCE MATERIALS

1. Lean Thinking by James Womack
2. Statistical Techniques in Business and Economics by Mason, Lind & Marchal
3. The Machine that changed the World by Womack
4. Good to Great by Jim Collins
5. The Logic of Failure by Dorner

III   COURSE GOALS AND OBJECTIVES

1. Understand the DFLSS Methodology and benefits
2. Understand different Voices of the Customer
3. Understand how to identify and pursue customer Wows
4. Understand Spider charting and design innovation tools
5. Understand how to use waterfall charts as gap-to-target closure tools
6. Understand the different forms of waste to eliminate
7. Understand how to address the Cost of Poor Quality in the Design Phase
8. Understand how to make various Houses of Quality (aka: QFDs)
9. Understand how to pursue and Achieve Breakthrough Designs
10. Understand the value of Design of Experiments (DOEs)
11. Understand the Strategy of Data Collection & Stratification
12. Understand the Strategy of Data Analysis and its sequence of events
13. Understand how to identify the root causes of old design issues you do not want to repeat on new designs
14. Understand the basics of data analysis using Minitab Software

IV   METHODOLOGY

This course is a Green Design for Lean and Six Sigma class to train students how to achieve breakthrough improvements in new product design, quality, reliability and total cost reduction. Each module will introduce new material that will prepare the student for the projects to be completed. Students must take and pass an open book exam at the end of the class to qualify for a certificate of successful completion.

Lectures
Each detailed subject will be presented in a lecture format outlining the theory and standardized accepted methodology. A PDF file of the lecture material will be provided for the student's personal use as reference material. Lecture note outlines will be distributed to the students for each lecture to help the student capture personal notes.

Specific Industry Examples
Real life industry examples will be covered that detail out the application of the theory to demonstrate how different companies apply these tools and techniques. This will give the students a clear understanding of how and why these techniques are utilized at different companies and industries in different manners.

In-Class Assignments
Many DFLSS techniques will be practiced in group exercises in the class. Real industry projects will be chosen as DFLSS practice projects. Data analysis exercises will be practiced in class to gain a basic understanding in the use of Minitab Data Analysis Software.

Specific Company Application
When possible, we will apply these tools and techniques on a specific company project that is currently in development by the students. Specific changes to the student's company product development process will be identified so DFLSS can be successfully implemented.

V   COURSE OUTLINE & ASSIGNMENTS

Module 1

Introduction to DFLSS	PowerPoint lecture
The History of DFSS & DFLSS	PowerPoint lecture
The Quest to do things right the first time	PowerPoint lecture
Soliciting the Voices of Internal & External Customers	PowerPoint lecture
Attacking the Cost of Poor Quality (COPQ)	PowerPoint lecture
The need for early Supplier selection & involvement	PowerPoint lecture
The need for Cross-Functional Involvement	PowerPoint lecture
The Trap with Benchmark-Driven Goal Setting	PowerPoint lecture
Creating Customer Needs, Wish & Wow Lists	PowerPoint lecture
Using Waterfall Charts to track Gap-to-Goal Progress	PowerPoint lecture
VOC, Voc, VOP, DFM, DFA, DFSC Considerations	PowerPoint lecture
First-Time Yield (FTY)	PowerPoint lecture
Rolled Throughput Yield (RTY)	PowerPoint lecture
Getting Lean: The 34 Forms of Waste to Eliminate	PowerPoint lecture
In-Class exercise, Designing to achieve Lean	Complete & present
How Six Sigma applies to new Designs	PowerPoint lecture
The Define Phase of DMADV and its Strategy	PowerPoint lecture
In-Class Assignment, SWOT Analysis	Complete & present
Identifying and avoiding Issues from older Designs	PowerPoint lecture
In-Class Assignment, Create a Risk Mitigation Plan	Complete & present
In-Class Assignment, The Design Project Charter	Complete & present

Module 2

The Measure Phase of DMADV and its tools	PowerPoint lecture
In-Class Assignment, Create Needs, Wish & Wow Lists	Complete & present
Creating a Design Process that enforces the VOCs	PowerPoint lecture
In-Class Assignment, Create a VOC Enforcement Plan	Complete & present
The Analyze Phase of DMADV and its LSS tools	PowerPoint lecture
Structured Innovation to create unique design concepts	PowerPoint lecture
In-Class Assignment, Create Rooms 1-7 for QFD #1	Complete & present
Know or determine the old Root Causes to avoid	PowerPoint lecture
In-Class Assignment, The Strategy of Data Collection	Complete & present
Follow along, Minitab Software Basics	PowerPoint lecture
Introduction to the Strategy of Data Analysis	PowerPoint lecture
In-Class Assignment, Pareto Charting in Minitab	Complete & present
In-Class Assignment, 4W Data stratification techniques	Complete & present
In-Class Assignment, 6M and other Fishbone Diagrams	Complete & present
In-Class Assignment, 5Why Root Cause Brainstorming	Complete & present

Module 3

In-Class Assignment, Time & Trend Plots in Minitab	Complete & present
In-Class Assignment, Histograms & misc. stats in Minitab	Complete & present
In-Class Assignment, Process Capability in Minitab	Complete & present
In-Class Assignment, Advanced data charting in Minitab	Complete & present
In-Class Assignment, Data normality tests in Minitab	Complete & present
In-Class Assignment, Non-normal data distributions	Complete & present
In-Class Assignment, Matrix Plots in Minitab	Complete & present
In-Class Assignment, Simple Regression Analysis	Complete & present
In-Class Assignment, Multiple variable Regression analysis	Complete & present
Non-Linear multiple variable Regression Analysis	PowerPoint lecture
In-Class Assignment, Contour & 3D Plots in Minitab	Complete & present
In-Class Assignment, Confidence Intervals in Minitab	Complete & present
In-Class Assignment, Hypothesis Testing in Minitab	Complete & present
Risk Mitigation Plan updates after Root Causes are known	PowerPoint lecture

Module 4

In-Class Assignment, Create Rooms 1-7 for QFD #2	Complete & present
Use of concept review criteria to choose the best designs	PowerPoint lecture
The Design Phase of DMADV and its LSS tools	PowerPoint lecture
In-Class Assignment, Create Rooms 1-7 for QFD #3, 4 & 5	Complete & present

Module 5

Design & Process Failure Modes and effects Analysis	PowerPoint lecture
Using Waterfall Charts for gap-to-target tracking	PowerPoint lecture
In-Class Assignment, Error-Proofing Techniques	Complete & present
In-Class Assignment, Creating 5 How improvement plans	Complete & present
In-Class Assignment, Creating detailed project trackers	Complete & present
In-Class Assignment, Create a Spider Chart for the Design	PowerPoint lecture
In-Class Assignment, Calculate the I-Ratio for the Design	PowerPoint lecture
In-Class Assignment, Updating the Risk Mitigation Plan	Complete & present
The Verify Phase of DMADV and its LSS tools	PowerPoint lecture
Using Design of Experiments (DOEs) and Test Planning	PowerPoint lecture
Create internal and supplier SOPs & Quality Control Plans	PowerPoint lecture
Prepare to monitor your new production process	PowerPoint lecture
In-Class Assignment, Common Cause & Special Causes	Complete & present
In-Class Assignment, Interpreting Time Plots & Trends	Complete & present
In-Class Assignment, SPC charting & Analysis in Minitab	Complete & present
The VOC specs vs. the actual VOP	PowerPoint lecture
In-Class Assignment, Visual Controls & SOPs	Complete & present
Creating a DFLSS Final Report and Storyboard	PowerPoint lecture