Quality Guideline

Training Program

Six Sigma plus LEAN Black Belt
Training

European
Six Sigma Club Deutschland e.V.
www.sixsigmaclub.de

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Contents

Foreword

Background

This guideline places the current discussion about standards in Six Sigma expert training in the historical context of the training discourse of the last 20 years, in which the content, duration and depth of training were increasingly determined by the training companies. It was not uncommon for training development to focus exclusively on the economic interests of the training companies, rather than on the final qualification of the trainees.

The unintended side-effects of this training approach are a significant reduction in the number of training hours, resulting in insufficient depth of knowledge at the end of the training.

This results in insufficient expertise in project work and a lack of comparability of expertise in the market. This makes it almost impossible for a client to correctly assess the different qualifications.

In practice, the expertise required of a Six Sigma Black Belt has also changed considerably.

For many years, Black Belts were seen as "the" Six Sigma project managers. With their extensive training, and often in an exempt project manager role, they represent the implementation expertise of the Six Sigma initiative.

In this role, he or she leads the team in terms of organisation and methodology, prepares the necessary analyses with the support of a coach if required, and reports on the progress of the project to the customer/process owner(s) or the responsible committee.

In addition, Six Sigma has been successively supplemented and extended to include LEAN tools. Today, this has resulted in a separate training program for the Six Sigma plus LEAN expert, which covers the requirements of a modern improvement expert.

Origin

In the run-up to the conference in March 2008, the board of the European Six Sigma Club - Deutschland e.V. (ESSC-D) drew up a list of training contents describing the minimum requirements for Six Sigma Black Belt training.

On this basis, a quality standard was subsequently developed together with the members of the association and finalised at a retreat in Kassel in November 2008. At the same retreat, the minimum requirements were approved and made binding as the quality guideline of the European Six Sigma Club - Deutschland e.V..

A special working group made up of specialists from the ranks of the association's membership has drawn up and described the requirements for the Six Sigma plus LEAN expert.

Changes

The following changes have been made compared to version 1.2 from July 19th 2017:

a) Adaptation of the document layout to the new design
b) Supplementary data mining advanced course (recommended additional training)

Previous issues

Version 1.2

Version 1.1

Version 1.0

Abbreviations

5S	Sort, Set in order, Shine, Standardize, Sustain
5W	Ask 5 times why
6S	Six Sigma
7 AdV	Seven types of waste
ANOVA	Analysis of Variance
BB	Black Belt
C&E	Cause and Effect
DMAIC	Define - Measure - Analyze - Improve - Control
ESSC-D	European Six Sigma Club Germany e.V.
GB	Green Belt
FIFO	First In First Out
FMEA	Failure Mode and Effects Analysis
K	Kick-off
MBB	Master Black Belt
OEE	Overall Equipment Effectiveness
PDCA	Plan Do Check Act
SIPOC	Supplier - Input - Process - Output - Control
SMBB	Senior Master Black Belt
SMED	Single Minute Exchange of Dies
TOC	Theory of Constraints
TPM	Total Productive Maintenance
VAG	Waste-free workplace design
VOC	Voice of Customer
VSD	Value Stream Design
VSM	Value Stream Mapping
WIP	Work In Progress or Work In Process

Terms

Quality Guideline	Guideline for ensuring the desired quality in the result
Sponsor	Usually a member of middle management. Supports the project manager and team in completing the tasks.

1 Area of application

The guideline describes the minimum requirements for Six Sigma plus LEAN Black Belt training. The nature, scope and depth of the training are described in classified form and are used for comparison with existing or newly developed training courses.

If the training to be assessed meets the criteria described below, this is the basic requirement for certification as a Six Sigma plus LEAN Black Belt according to the guidelines of the European Six Sigma Club Deutschland e.V.

2 Introduction

The following guide is divided into project phases and a general section, but this does not mean that the tools must be trained in the specified phase.

As many tools can be used in more than one phase, it is the responsibility of the trainer to deliver the content at the appropriate time according to the didactics used.

Six Sigma plus LEAN BB training can be delivered by one or more trainers. At least one trainer must be a certified Master Black Belt.

3 Training duration

For the Six Sigma plus LEAN Black Belt training program, a minimum of 20 days of instruction with a minimum of 200 teaching units of 45 minutes each plus breaks must be completed to teach the content described below and to achieve the required level of instruction.

Typically, trainings consist of 25 teaching days with a total of 250 teaching units of 45 minutes each plus breaks.

Universities may achieve the required level of instruction by dividing the teaching units between attendance (lecture) and a proportion of self-study. The maximum proportion of self-study allowed is 25% of the total number of teaching units, based on the minimum scope of the standard course described above (200 units). Self-study units will be multiplied by a factor of three. For the Six Sigma plus LEAN Black Belt training, with a maximum use of self-study of 25% and a minimum number of teaching units, this results in 150 teaching units of classroom time and an additional 150 teaching units (50x3) of self-study.

To receive a certificate of attendance, the student must have attended at least 85% of the total number of hours scheduled for this course.

4 Training content, project phase-orientated

4.1 Kick-off (K)

- Six Sigma background and basics
- DMAIC phase structure
- LEAN basics (origin Toyota, 5 principles, TPM house)
- Basics of PDCA as a KAIZEN model
- Project management basics

In some areas of application, it can be difficult to decide if a specific process needs improvement. This is the case, for example, when not enough information is available. In these cases, it is helpful to use other tools beforehand:

- Chalk circle
- Value stream mapping
- Makigami (administrative processes).

4.2 DEFINE (D)

- Task sheet (also called project order, team charter, project charter)
- SIPOC
- VOC (Voice of Customer)

4.3 MEASURE (M)

- Basic statistics (mean value, median, range, standard deviation, variance, determination of proportions)
- Histogram
- Boxplot
- Time series diagram (progression diagram)
- Control chart
- Pareto diagram
- Multivariate chart (main effect and interaction)
- Scatterplot (also called XY diagram or scatterplot)
- Matrix plot
- Flowchart
- Output/input collection
- Ishikawa diagram (fishbone diagram, cause and effect diagram, C&E diagram)
- Cause and effect matrix (also known as C&E matrix)
- Data collection plan
- Measurement system analysis (for measured values and attributes)
- Distribution test (e.g. normal distribution test)
- Box-Cox transformation and or others (for non-normally distributed data)
- Process capability analysis (for continuous data)
- Sigma level calculation (Sigma Level)
- Confidence interval determination (e.g. of the mean value with 1-sample t-test) incl. sample determination
- 5S
- LEAN metrics (OEE: Overall Equipment Effectiveness, delivery reliability, cycle time, throughput time, number of employees, ...)
- Little's Law (throughput per time unit = WIP / cycle time)
- Flow and pull principle
- Makigami
- Spaghetti diagram

4.4 ANALYZE (A)

- Two sample t-test
- Simple analysis of variance (one-way ANOVA)
- Analysis of variance with several input variables
- Test for equal variance (2 or more samples)
- Chi-square test
- Sample planning
- Correlation analysis
- Simple linear and non-linear regression
- Multiple linear regression
- Full factorial design of experiments
- 2k full and partial factorial experimental designs
- Centre point and block strategies in trials
- 5W questions
- 7 types of waste
- Theory of Constraints (TOC); bottleneck analysis
- KAIZEN Event

4.5 IMPROVE (I)

- Experiments for non-linear systems (RSM)
- Brainstorming
- Decision matrix
- Basics of tolerance/vector analysis and Monte Carlo simulation
- FMEA for solution risks
- Action plan
- Data analysis of the solution pilot
- Process capability of the solution pilot
- Poka Yoke
- Set-up time reduction (SMED: Single Minute Exchange of Dies)
- FIFO
- KANBAN
- Utilization levelling (line balancing)
- Value stream design (VSD)
- Waste-free workplace design (VAG)
- Total Productive Maintenance (TPM)
- Visual Management

4.6 CONTROL (C)

- Data analysis of the solution (before/after)
- Hypothesis tests of the solution (before/after)
- Process capability of the solution (before/after)
- Individual control chart
- Moving Range control chart (MR)
- Two-track average/scatter map (xquer/R or xquer/s)
- Control plan
- Final project report incl. standardization
- Field report

5 Scope and objectives of the individual topics

The topics, methods and tools defined above describe the minimum content required for training. This section specifies the scope and objectives of these topics based on classifications. The outcome of the training shall be at or above the specified level to comply with the guideline.

5.1 Classification legend

5.1.1 Classification for the scope (delivery)

Class	Meaning
A	Method was explained
B	Method was shared
C	Method was practised alone or in a group
D	Method was practised including feedback on the exercise

5.1.2 Classification of goals

Class	Meaning
1	The participant has understood the principle of the application
2	"1" and participant can select & use tool
3	"2" and participant can interpret important results
4	"3" and participant knows the calculation background in detail
5	"4" and participant can also calculate the result manually

5.2 Classification for Six Sigma plus LEAN Black Belt Training

Topic	Phase	Scope	Goal
Six Sigma background and basics	K	B	1
DMAIC phase structure	K	B	1
Project management basics	K	B	2
Lean basics (origin Toyota, 5 principles, TPM house)	K	A	1
Basics of PDCA as a KAIZEN model	K	A	1
Chalk circle	K	A	3
Value stream mapping (VSM)	K	D	4
Task sheet (also called project order, team charter, project charter)	D	B	2
SIPOC	D	D	2
VOC (Voice of Customer)	D	B	2
Basic statistics (mean value, median, range, standard deviation, variance, determination of proportions)	M	D	5
5S	M	B	3
Lean metrics (OEE: Overall Equipment Effectiveness, inventories, delivery reliability, cycle time, number of employees, ...)	M	B	5
Little's Law (throughput per time unit = WIP/cycle time) => Leads to the flow principle & pull principle)	M	B	5
Histogram	M	C	4
Boxplot	M	C	4
Time series diagram (progression diagram)	M	C	4
Control chart	M	C	4
Pareto diagram	M	C	5
Multivariate chart (main effect and interaction)	M	C	5
Scatterplot (also called XY diagram or scatterplot)	M	C	4
Matrix plot	M	C	3

Flowchart	M	D	3
Makigami	M	A	5
Spaghetti diagram	M	A	3
Output/input collection	M	D	3
Ishikawa diagram (fishbone diagram, cause and effect diagram, C&E diagram)	M	B	3
Cause and effect matrix (also known as C&E matrix)	M	D	5
Data collection plan	M	C	3
Measurement system analysis (for measured values and attributes)	M	D	3
Distribution test (e.g. normal distribution test)	M	D	3
Box-Cox transformation and or others (for non-normally distributed data)	M	B	4
Process capability analysis (for continuous data)	M	C	4
Sigma level calculation (Sigma Level)	M	C	4
Confidence interval determination (e.g. of the mean value with 1-sample t-test) incl. sample determination	M	C	4
5W-Questions (5Why)	A	B	3
7 types of waste	A	B	3
Theory of Constraints (TOC); bottleneck analysis	A	B	3
Kaizen Event	A	A	2
Confidence interval	A	C	3
Test for equality of variance (two or more samples)	A	D	4
Two sample t-test	A	C	4
Simple analysis of variance (one-way ANOVA)	A	D	4
Analysis of variance with several input variables	A	D	4
Chi-square test	A	C	4
Sample planning	A	C	3
Correlation analysis	A	C	3
Simple linear and non-linear regression	A	C	4
Multiple linear regression	A		
Full factorial design of experiments	A	C	3
2k full and partial factorial experimental designs	A	D	3

Centre point and block strategies in trials	A	C	3
Experiments for non-linear systems (RSM)	I	C	3
Brainstorming	I	B	2
Decision matrix	I	A	3
Basics of tolerance/vector analysis and Monte Carlo simulation	I	B	3
FMEA for solution risks	I	B	2
Action plan	I	A	2
Data analysis of the solution pilot	I	C	3
Process capability of the solution pilot	I	C	4
Poka Yoke	I	A	2
Set-up time reduction (SMED: Single Minute Exchange of Dies)	I	A	2
FIFO	I	B	3
Kanban	I	B	3
Utilization levelling (line balancing)	I	A	2
Value stream design (VSD)	I	B	2
Waste-free workplace design (VAG)	I	A	1
TPM: Total Productive Maintenance (servicing, maintenance)	I	A	1
Visual Management	I	A	2
Data analysis of the solution (before/after)	C	D	3
Hypothesis tests of the solution (before/after)	C	D	4
Process capability of the solution (before/after)	C	C	4
Individual control chart	C	B	3
Moving range control chart (MR)	C	C	3
Two-track average/scatter map (Xquer/R or Xquer/s)	C	C	3
Control plan	C	A	2
Final project report (incl. standardisation)	C	C	2
Field report	C	A	2

6 Recommended additional qualification

In addition to our social environment, digitalisation is also changing the way we communicate and work. The decisive value of digitalisation does not lie in the increase in convenience and efficiency, the improved use of resources, environmental protection or process optimisation. Rather, it lies in the enormous gain in transparency and data, which makes it possible to initiate and automate the process of learning and continuous improvement and take it to a new level.

The opportunities and challenges arising from digitalisation have long since found their way into Six Sigma. Not only is more data from an increasing number of sources of varying quality available in an ever-shorter time, but the possibilities for process optimisation and control have also expanded. The ESSC-D working group "Six Sigma Thinking Ahead" has gathered well-founded cross-industry experience, put the Six Sigma toolbox to the test and added essential tools for the future-proof belt and all those interested in quality management in the age of digitalisation and big data.

These include, among others:

- Different project management methods
- Preparation of structured and unstructured data as well as large amounts of data
- Visualisation options for complex data structures
- Common methods of data science (or data mining)
- Possibilities and limits of artificial intelligence (AI) and machine learning (ML)
- Application and utilisation of developed correlation models.

Further information and recommended training depths can be found in detail here:
https://www.sixsigmaclub.de/download/ESSCD_QualityGuideLine_DM_Aufbaukurs_DE.pdf

"Learning is like rowing against the current. If you stop, you drift backwards."
(Laozi, Chinese philosopher, 6th century BC)