LEAN SIX SIGMA
ORANGE BELT SKILL SET

A GUIDELINE FOR LEAN SIX SIGMA
ORANGE BELT TRAINING AND CERTIFICATION

H.C. Theisens; A. Meek; D. Harborne

VERSION 2.2

Lean Six Sigma Academy®

© Copyright LSSA BV, October 2015
Amstelveen
Title: Skill set for Lean Six Sigma Orange Belt training and examination

Authors: H.C. Theisens; A. Meek; D. Harborne

Publisher: Lean Six Sigma Academy
© Copyright LSSA BV, 2015
Amstelveen
www.lssa.eu
info@lssa.eu

Version 2.2, October 2015

NUR 100

All rights reserved. The LSSA syllabus is a public document and can be distributed in its original and complete version. Partly republication or redistribution is prohibited without the prior written consent from LSSA. LSSA shall not be liable for any errors in the content, or for any actions taken in reliance thereon.

The structure of this books is based on the ‘Continuous Improvement Maturity Model’ - CIMM™. You have the permission to share and distribute this model in its original form by referencing the publisher and author, (LSSA®, Theisens et. al., 2014).

Printed in the Netherlands.
# CONTENT

## INTRODUCTION

### ASSESSMENT CRITERIA

<table>
<thead>
<tr>
<th>U1.</th>
<th>WORLD CLASS PERFORMANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.</td>
<td>Competitive strategies</td>
</tr>
<tr>
<td>E2.</td>
<td>History of Continuous Improvement</td>
</tr>
<tr>
<td>E3.</td>
<td>Philosophy &amp; Principles</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U2.</th>
<th>PROCESS IMPROVEMENT DEPLOYMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.</td>
<td>Management of Change</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U3.</th>
<th>PROJECT MANAGEMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.</td>
<td>Team Formation</td>
</tr>
<tr>
<td>E2.</td>
<td>Process Improvement Roadmaps</td>
</tr>
<tr>
<td>E3.</td>
<td>Voice of the Customer (VOC)</td>
</tr>
<tr>
<td>E4.</td>
<td>Project Charter</td>
</tr>
<tr>
<td>E5.</td>
<td>Project Management Techniques</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U4.</th>
<th>LEVEL I – CREATING A SOLID FOUNDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.</td>
<td>Organized Work Environment</td>
</tr>
<tr>
<td>E2.</td>
<td>Standardized work</td>
</tr>
<tr>
<td>E3.</td>
<td>Quality Management</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U5.</th>
<th>LEVEL II – CREATING A CONTINUOUS IMPROVEMENT CULTURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>E1.</td>
<td>Kaizen</td>
</tr>
<tr>
<td>E2.</td>
<td>Basic Quality Tools</td>
</tr>
<tr>
<td>E3.</td>
<td>Basic Management Tools</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>U6.</th>
<th>LEVEL III – CREATING STABLE AND EFFICIENT PROCESSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINE</td>
<td></td>
</tr>
<tr>
<td>E1.</td>
<td>Process Mapping</td>
</tr>
</tbody>
</table>

| MEASURE | |
| E2. | Lean Performance Metrics |

| ANALYZE | |
| E3. | Value Stream Analysis |
INTRODUCTION

Within the domain of ‘Continuous Improvement’ individuals can be trained at four different levels. These levels are called Yellow Belt, Orange Belt, Green Belt and Black Belt.

**Table 1. Overview of Belt levels**

<table>
<thead>
<tr>
<th>Belt level</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Belt</td>
<td>Awareness</td>
</tr>
<tr>
<td>Orange Belt</td>
<td>Foundation</td>
</tr>
<tr>
<td>Green Belt</td>
<td>Practitioner</td>
</tr>
<tr>
<td>Black Belt</td>
<td>Expert</td>
</tr>
</tbody>
</table>

The LSSA - Lean Six Sigma Academy® was established in September 2009 with the objective to develop an international recognized certification scheme for all Lean Six Sigma Belt levels. The LSSA Exam Board has developed four syllabi with clear criteria for skills and competences. These syllabi specify which of the overall Lean Six Sigma tools and techniques are expected to be included within certain Belt level competencies. Lean Six Sigma training is provided by a global network of ‘Accredited Training Organizations’ (ATOs). These ATOs provide training programs that are aligned to the LSSA syllabi.

Examinations are provided through a number of ‘Examination Institutes’ (EIs), which use the syllabi to develop exams. The exams are open to all. Individuals can apply directly to the EIs or sign up via one of the ATOs. It is recommended that candidates receive training through an ATO to prepare for certification. Alternatively, candidates who wish to self-study have the option to apply directly to an EI for certification.

Examinations are provided through the following three Examination Institutes (EIs):

- **APMG** APM Group Limited  
  [www.apmg-international.com](http://www.apmg-international.com)
- **iSQI** International Software Quality Institute  
  [www.isqi.org](http://www.isqi.org)
- **ECQA** European Certification and Qualification Ass.  
  [www.ecqa.org](http://www.ecqa.org)

The LSSA Orange Belt syllabus describes the assessment criteria for the exam. The Orange Belt certification can be achieved independently. There are no pre-requisites for Orange Belt certification and therefore does not require any prior completion of any other Belt(s).
ASSESSMENT CRITERIA

The following chapters describe the assessment criteria for the Lean Six Sigma Orange Belt certification. The structure consists of a number of ‘Units’, ‘Elements’ and ‘Performance Criteria’.

- **Unit**: The syllabus is presented by syllabus areas; each called a ‘Unit’. The chapters in the book ‘Climbing the Mountain’ reflect the ‘Units’ described in this syllabus.
- **Element**: Each ‘Unit’ consists of a number of ‘Elements’. The paragraphs in each chapter of the book ‘Climbing the Mountain’ reflect the ‘Elements’ in this syllabus.
- **Performance Criteria**: Each ‘Element’ consists of a number of ‘Performance Criteria’ and each ‘Performance Criteria’ has an explanation. These describe the tools, techniques and competencies that are required to be achieved by the Orange Belt.
- **Level of Cognition**: A ‘Cognitive Level’ has been assigned to each ‘Performance Criteria’-description according to Bloom’s Taxonomy [5.]. This defines at which level the Orange Belt is expected to apply the respective tool, technique or skill. This is the minimum level the Orange Belt must be able to demonstrate in order to be assessed as competent.

The Orange Belt assessment criteria are as follows:

- The theoretical exam consists of 50 multiple choice questions.
- The pass mark for this exam is set at 64% (32 marks or more required to pass).
- The duration of the exam is 60 minutes.
- This is a closed book exam.
- A calculator is allowed.
- You must be able to identify yourself with photographic ID.
- A practical assessment is not part of the Orange Belt exam.

If you pass you will receive a certificate from your EI that states you passed the Orange Belt exam.
CONTINUOUS IMPROVEMENT MATURITY MODEL (CIMM)

The LSSA syllabi are based on the ‘Continuous Improvement Maturity Model’ (CIMM). This is a framework that guides an evolutionary staged approach for process improvement from a very early stage till delivering world class products. CIMM incorporates the best practice methods and techniques of process improvement, quality management and new product development. It includes best practices from TQM, Kaizen, TPM, Lean, Six Sigma and Design for Six Sigma.

The ‘Continuous Improvement Maturity Model’ can support other maturity models or act as a stand-alone framework to guide the process of continuous improvement from a very early stage to the level of World class. The model describes five maturity levels. The levels will be identified as ‘Level-I’ to ‘Level-V’.

![Continuous Improvement Maturity Model (CIMM)](image)

Figure 1 – Continuous Improvement Maturity Model (CIMM™).

*CIMM™ is a registered trademark of the LSSA BV. You have the permission to share and distribute this model in its original form by referencing the publisher and author, (LSSA®, Theisens et. al., 2014).
U1. WORLD CLASS PERFORMANCE

The Unit ‘World Class Performance’ reviews the general philosophy of Process Improvement. It discusses the overview of different process improvement methods and the history of the most important methods. It also explains why process improvement is needed.

E1. COMPETITIVE STRATEGIES

The Learning Element ‘Competitive strategies’ explains Operational Excellence, Customer Intimacy and Product Leadership. It also explains how Operational Excellence can be applied to processes in different types of enterprises.

U1.E1.PC1 Operational Excellence
Remember
Recall that Operational Excellence can be applied to processes in different types of enterprises.

U1.E1.PC2 Physical vs. Transactional processes
Remember
Recall the similarities and differences between physical processes and transactional processes.

E2. HISTORY OF CONTINUOUS IMPROVEMENT

The Learning Element ‘History of Continuous Improvement’ explains the history of process improvement and quality management.

U1.E2.PC1 History of TQM, Lean and Six Sigma
Remember
Recall the origins of TQM, Lean and Six Sigma.

E3. PHILOSOPHY & PRINCIPLES

The Learning Element ‘Philosophy & Principles’ explains the values and principles of Lean and Six Sigma. Similarities and differences to other improvement methods are also reviewed.

U1.E3.PC1 Value and foundations of Lean and Six Sigma
Understand
Understand the value of Lean and Six Sigma, its philosophy and goals. Understand the relationship between Lean and Six Sigma.

U1.E3.PC2 Lean principles
Understand
Understand that Lean philosophy and principles realize improvements in process lead times and efficiencies.

U1.E3.PC3 Six Sigma principles
Understand
Understand that Six Sigma philosophy and principles realize breakthroughs in quality performance.
U2. PROCESS IMPROVEMENT DEPLOYMENT

The Unit ‘Process Improvement Deployment’ reviews how process improvement programs should be deployed across the organization. It explains the role and responsibilities of Leadership in its efforts to coach and inspire improvement teams. Also team development and change management aspects will be reviewed.

E1. MANAGEMENT OF CHANGE

The Learning Element ‘Management of Change’ reviews the dynamics that can occur during a project such as cooperation, resistance, escalation of problems and solving roadblocks.

**U2.E1.PC1 Organizational culture**  
Understand that an organization's culture can influence the success of Lean Six Sigma deployment.

**U2.E1.PC2 Change Management approaches**  
Understand the difference between Top-Down and Bottom-Up approach.  
Understand the power of the Bottom-Up approach.
U3. PROJECT MANAGEMENT

The Unit ‘Project Management’ outlines the way improvement projects should be executed. It starts with the identification of customers and its requirements. The Unit also covers a number of project management roadmaps, team formation, the project charter and a number of project management tools.

E1. TEAM FORMATION

The Learning Element ‘Team Formation’ reviews the different role and responsibilities within and around an improvement team. It also reviews how a team is formed.

**U3.E1.FC1 Roles and Responsibilities**
Understand Lean Six Sigma levels of expertise: Master Black Belt, Black Belt, Green Belt, Orange Belt and Yellow Belt. Understand various team roles and responsibilities.

**U3.E1.FC2 Team member selection**
Understand the basic principles of team formation and team member selection.

E2. PROCESS IMPROVEMENT ROADMAPS

The Learning Element ‘Process Improvement Roadmaps’ reviews a number of roadmaps, including Plan-Do-Check-Act (PDCA) and Define, Measure, Analyze, Improve and Control (DMAIC).

**U3.E2.FC1 Kaizen Roadmap**
Understand project management methods that are used at the shop floor for Kaizen initiatives e.g. PDCA, A3-report.

**U3.E2.FC2 Problem Solving Process (8D)**
Understand and be familiar with the 'Eight Disciplines Problem Solving Method' which is used to approach and resolve problems.

**U3.E2.FC3 DMAIC Roadmap**
Understand and follow the Process Improvement DMAIC roadmap.
E3. **VOICE OF THE CUSTOMER (VOC)**

The Learning Element ‘Voice of the Customer’ reviews customer identification (internal/external) and customer requirements.

- **U3.E3.PC1** Customer identification
  - **Understand**
  - Understand how the project will impact customers. Identify internal and external customers.

- **U3.E3.PC2** Customer requirements
  - **Understand**
  - Understand different customers have different needs, expectations, requirements and desires.

E4. **PROJECT CHARTER**

The Element ‘Project Charter’ covers the description of the project such as problem description, objectives, scope, timing and benefits.

- **U3.E4.PC1** Problem statement
  - **Apply**
  - Prepare problem statements in relation to customer requirements.

- **U3.E4.PC2** Project scope and goal
  - **Understand**
  - Understand and review project boundaries of the project (scope). Understand the objectives and measurable targets for the project based on the problem statement and scope (goal).

- **U3.E4.PC3** Project performance measures
  - **Understand**
  - Understand performance measurements Cost, Quality and Delivery.

- **U3.E4.PC4** Project benefits calculation
  - **Understand**
  - Understand the hard benefits and the soft benefits of the project.
E5. PROJECT MANAGEMENT TECHNIQUES
The Element ‘Project Management Techniques’ reviews a number of tools that are used during execution of the project.

U3.E5.PC1 Time management Understand
Understand the importance and basic disciplines of time management.

U3.E5.PC2 Project progress Understand
Understand the importance of presenting project progress and results.

U3.E5.PC3 Project risk management Understand
Understand risk management and contribute by attending risk assessment meetings. Assure useful contribution by identifying risks.
U4. LEVEL I – CREATING A SOLID FOUNDATION

The Unit ‘Creating a solid foundation’ reviews how to achieve a solid foundation for further process improvement programs. This foundation consists of a proper and organized work environment, reliable equipment and standardized work.

E1. ORGANIZED WORK ENVIRONMENT

The Learning Element ‘Organized work environment’ is about good housekeeping and how to set up a proper and safe work environment in a structured manner.

U4.E1.PC1  Organized work environment (5S)  
Apply
Organize the work environment by applying 5S (Sort, Straighten, Shine, Standardize, Sustain). Understand that an organized environment will improve safety and moral.

E2. STANDARDIZED WORK

The Learning Element ‘Standardized work’ is about implementing and improving standards.

U4.E2.PC1  Standardized work and Documentation  
Understand
Understand that standardized tasks are the foundation for continuous improvement. Interpret standard operating procedures (SOPs) and one-point-lessons.

E3. QUALITY MANAGEMENT

The Learning Element ‘Quality Management’ is about developing procedures to identify and detect defects. Also preventing mistakes and avoiding problems will be discussed.

U4.E3.PC1  Quality Management System  
Understand
Understand quality procedures, the need to be disciplined and to work according procedures.

U4.E3.P2  Ongoing evaluation and auditing  
Understand
Understand and participate in (internal / external) audits.
U5. LEVEL II – CREATING A CONTINUOUS IMPROVEMENT CULTURE

The Unit ‘Creating a continuous improvement culture’ reviews how to create a continuous improvement culture at the shop floor. This Unit reviews setting up and facilitate Kaizen teams. It also reviews a number of problem solving techniques and tools.

E1. KAIZEN

The Learning Element ‘Kaizen’ reviews how to organize and facilitate improvement teams at the shop floor that work on Kaizen improvement initiatives.

U5.E1.PC1 Short Interval Management
Apply
Implement and support Short Interval Management, Stand Up meetings and corrective actions.

U5.E1.PC2 Visual Workplace
Apply
Apply elements of Visual Workplace and understand how these can help to control the improved process.

U5.E1.PC3 Root Cause Analysis
Apply
Apply root cause analysis and understand the issues involved in identifying a root cause.

U5.E1.PC4 Kaizen events
Apply
Setup and lead Kaizen events.

E2. BASIC QUALITY TOOLS

The Learning Element ‘Basic Quality Tools’ reviews a number of basic quality tools.

U5.E2.PC1 Visualization of data
Understand
Understand the purpose and use of data visualization, analysis and communication.

U5.E2.PC2 Basic Quality Tools
Apply
Apply basic quality tools: Check sheet; Pareto chart; Scatter plot; Bar chart; Pie chart; Time Series Plot, Histogram and Box plot.

E3. BASIC MANAGEMENT TOOLS

The Learning Element ‘Basic Management tools’ reviews a number of tools that are very powerful in the problem solving process.

U5.E3.PC1 Brainstorm Techniques
Apply
Apply brainstorm techniques: affinity diagram, 5-Why's and Ishikawa.

U5.E3.PC2 Decision making
Understand
Participate in decision making techniques e.g. Cause & Effect Matrix.
U6. LEVEL III – CREATING STABLE AND EFFICIENT PROCESSES

The Unit ‘Creating stable and efficient processes’ reviews how the logistical flow of processes can be improved and made more stable, predictable and efficient. This Unit also reviews tools which can be used to visualize and analyze the process flow. This unit also reviews a number of tools and techniques that can be used to improve efficiency, effectiveness, productivity and agility of processes. All Level III Learning Elements and Performance Criteria follow the DMAIC structure.

DEFINE

E1. PROCESS MAPPING

The Learning Element ‘Process Mapping’ reviews a number of tools to map the process flow that can be used in both Lean and Six Sigma projects.

U6.E1.PC1 Process Flow diagram
Understand
Participate in process mapping initiatives to visualize the flow of activities and decisions within a process.

U6.E1.PC2 High level process description
Understand
Participate by identifying input and output process variables and be familiar with SIPOC technique.

MEASURE

E2. LEAN PERFORMANCE METRICS

The Learning Element ‘Lean Performance Metrics’ reviews different types of data, measurement scales and Lean performance metrics. This Element also reviews process flow analysis.

U6.E2.PC1 Process Flow analysis
Apply
Apply Little’s Law.

U6.E2.PC2 Lean Performance metrics
Understand
Understand Lean performance metrics e.g. takt time, cycle time, lead time, queue time, WIP, yield and OEE.

U6.E2.PC3 Data types
Understand
Understand the difference between quantitative and qualitative data. Understand the difference between continuous (variables) and discrete (attributes) data.

U6.E2.PC4 Measurement scales
Understand
Distinguish between nominal, ordinal, interval and ratio measurement scales.
ANALYZE

E3. VALUE STREAM ANALYSIS
The Learning Element ‘Value Stream Analysis’ reviews how to create a Value Stream Map of the current situation.

U6.E3.PC1 Value Adding versus Non Value Adding Understand
Understand the difference between value added and non-value added activities.

Understand that Value Stream Mapping is a technique for identifying waste and non-value added activities.

IMPROVE

E4. REDUCING MUDA (WASTE)
The Learning Element ‘Reducing Muda’ reviews how to identify Waste in the organization and in the processes.

U6.E4.PC1 Waste identification (for the Operation) Apply
Identify and eliminate the 8 types of waste (Muda); Overproduction, Waiting, Transport, Overprocessing, Inventory, Movement, Defects, Unused expertise.

U6.E4.PC2 Waste identification (for the Customer) Apply
Identify and eliminate the 7 types of customer waste (Muda); Opportunity Loss, Delay, Unnecessary Movement, Duplication, Incorrect inventory, Unclear Communication and Errors.

E5. REDUCING MURI (OVERBURDEN)
The Learning Element ‘Reducing Muri’ reviews how to identify overburdening the organization and how to implement flow and work balancing to reduce overburden. This element also reviews the relations between Lean with TPM and TOC.

U6.E5.PC1 Flow Understand
Understand the meaning of Flow.

U6.E5.PC2 Work balancing Understand
Understand the meaning of Work balancing.

U6.E5.PC3 Total Productive Maintenance (TPM) Understand
Understand the eight pillars of TPM and understand how it can be used for process improvement.
E6. REDUCING MURA (UNEVENNESS)
The Learning Element ‘Reducing Mura’ reviews how to identify unevenness in the organization and in the processes. This element also reviews a number of techniques to reduce unevenness.

**U6.E6.PC1** Pull
Understand the meaning of Pull.

**U6.E6.PC2** Volume and Type leveling
Understand basic principles of volume leveling, type leveling and one piece flow.

**U6.E6.PC3** Quick Change Over (SMED)
Apply
Reduce change over times by implementing Single Minute Exchange of Die (SMED).

E7. VALUE STREAM IMPROVEMENT
The Learning Element ‘Value Stream Improvement’ reviews how the techniques and tools that reduce Muda, Muri and Mura can be applied in constructing a Future State Value Stream Map.

**U6.E7.PC1** Value Stream Mapping (Future State)
Understand
Understand the difference between current state and future state Value Stream Mapping.

CONTROL

E8. FIRST TIME RIGHT
The Learning Element ‘First Time Right’ looks at how results that have been achieved in process improvement projects can be sustained. This element reviews the following techniques and principles: Process FMEA, Control plan, Jidoka and Poka Yoke.

**U6.E8.PC1** Process FMEA (pFMEA)
Understand
Understand the purpose and elements of Process FMEA, including the risk priority number (RPN) and describe FMEA results for processes.

**U6.E8.PC2** Control plan
Understand
Participate in developing a control plan to document and hold gains and assist in implementing controls and monitoring systems.

**U6.E8.PC3** Jidoka & Poka Yoke
Understand
Understand the work has to be stopped when there is a quality problem. Identify opportunities to apply Poka Yoke to avoid quality problems.
U7. LEVEL IV – CREATING CAPABLE PROCESSES

The Unit 'Creating Capable Processes' focuses on reducing variation in a stable process with the objective to create a process capable of meeting customer requirements. This Unit reviews the application of Six Sigma and statistical tools used to assure a valid and reliable performance measurement system, to collect data and to analyze the performance of processes. Six Sigma focuses on quality breakthrough improvement projects. All Level IV Learning Elements and Performance Criteria follow the DMAIC structure.

DEFINE

E1. CRITICAL TO QUALITY

The Learning Element 'Critical to Quality' reviews how to translate the Voice of Customer (VOC) into a CTQ flowdown that represents the key measurable characteristics of the product or process.

U7.E1.PC1 Critical requirements Understand
Understand the various CTx requirements (critical to quality (CTQ), cost (CTC), process (CTP), safety (CTS) and delivery (CTD)).

U7.E1.PC2 CTQ Flowdown Understand
Understand that Voice of the customer (VOC) requirements need to be translated into CTQ targets and specifications.

MEASURE

E2. SIX SIGMA PERFORMANCE METRICS

The Learning Element 'Six Sigma Performance Metrics' reviews a number of metrics that are often used in Six Sigma projects. The element also reviews a number of sampling methods for assuring data accuracy and integrity.

U7.E2.PC1 Defects and Defectives Understand
Understand the Six Sigma process performance metrics (e.g. PPM, DPMO, DPU and RTY). Understand the difference between a defect and a defective.

U7.E2.PC2 Sampling methods Understand
Understand it is important to follow systematic data collection.

U7.E2.PC3 Data collection tools Apply
Apply tools for collecting data such as data sheets and check sheets.
E3. STATISTICS
The Learning Element ‘Statistics’ reviews the basic terms of sample and descriptive statistics.

- **U7.E3.PC1** Descriptive statistics
  Understand the basic terms of statistics e.g. proportion, mean, standard deviation and range.

- **U7.E3.PC2** Variation
  Understand the difference between special cause and common cause variation.

E4. DISTRIBUTIONS
The Learning Element ‘Distributions’ reviews a number of continuous and discrete distributions.

- **U7.E4.PC1** Common continuous distributions
  Understand and interpret Normal distribution.

- **U7.E4.PC2** Common discrete distributions
  Understand Poisson and Binomial distributions.

E5. MEASUREMENT SYSTEMS
The Learning Element ‘Measurement Systems’ reviews how to evaluate measurement systems.

- **U7.E5.PC1** Measurement methods
  Understand the different measurement methods for continuous and discrete data.

- **U7.E5.PC2** Measurement Systems Analysis
  Understand the basic principles of performing a Measurement System analysis. Understand the difference between repeatability and reproducibility (R&R) and the meaning of the number of distinct categories.
ANALYZE

E6. HYPOTHESIS TESTING & CONFIDENCE INTERVALS
The Learning Element ‘Hypothesis Testing & Confidence Intervals’ reviews test methods that are used to test a hypothesis. This Learning Element also discusses Confidence Intervals that indicate the reliability of test conclusions.

U7.E6.PC1  Hypothesis testing  Understand
Understand the basic principles of hypothesis testing.

U7.E6.PC2  Confidence Intervals  Understand
Understand the basic principles of confidence intervals.

U7.E6.PC3  Sample size  Understand
Understand sample size has an influence on the confidence of statistical conclusions.

E7. CORRELATION AND REGRESSION
The Learning Element ‘Correlation and Regression’ describes the predictive models using regression techniques to determine the relation between factors on a response.

U7.E7.PC1  Correlation coefficient  Understand
Interpret the correlation coefficient.

U7.E7.PC2  Regression analysis  Apply
Apply linear regression to understand the relationship between factors and response.

E8. PROCESS CAPABILITY AND PERFORMANCE

U7.E8.PC1  Process capability studies  Understand
Understand basic principles of process capability studies. Understand the importance of stability in process capability studies.

U7.E8.PC2  Process capability indices  Understand
Interpret Cp and Cpk to assess process capability.

U7.E8.PC3  Short-term and long-term capability  Understand
Understand the difference between long-term and short-term capability.

Interpret Pp and Ppk to assess process performance.
IMPROVE

E9. DESIGN OF EXPERIMENTS (DOE)
The Learning Element ‘Design of Experiments’ reviews efficient ways of experimenting. Design of Experiments examines the influence of factors and interactions on a process.

U7.E9.PC1 Principles of experiments and terminology
Understand the importance of efficient ways of experimenting.

CONTROL

E10. STATISTICAL PROCESS CONTROL (SPC)
The Learning Element ‘Statistical Process Control’ explains the controls methods used to identify out-of-control situations and deviations over time. Different types of SPC charts are reviewed.

U7.E10.PC1 SPC Objectives and benefits
Understand the objectives and benefits of SPC.

U7.E10.PC2 Control charts
Understand the different types of control charts such as Xbar-R.
APPENDIX A – BLOOM’S TAXONOMY FOR PERFORMANCE CRITERIA

In addition to specifying content, each performance criteria in this skill set also indicates the intended complexity level of the test questions for each topic. These levels are based on ‘Levels of Cognition’ (from Bloom’s Taxonomy – Revised, 2001), and can be used to create learning outcomes for students [6].

The Taxonomy of Educational Objectives, often called Bloom’s Taxonomy, is a classification of the different objectives that educators set for students (learning objectives). The taxonomy was proposed in 1956 by Benjamin Bloom, an educational psychologist at the University of Chicago. During the nineties, Lorin Anderson a former student of Bloom revisited the cognitive domain in the learning taxonomy [5]. Bloom’s Taxonomy divides educational objectives into three ‘domains’: Affective, Psychomotor and Cognitive. This Skill set only notices the Cognitive domain. The ‘Levels of Cognition’ are in rank order - from least complex to most complex. The Orange Belt skill set only uses the levels ‘Remember’, ‘Understand’ and ‘Apply.

**Remember**
Recall or recognize terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc. The LSSA uses the following verb at this level: Recall.

**Understand**
Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc. The LSSA uses the following verbs at this level: Describe, Follow, Identify, Interpret, Participate, Understand.

**Apply**
Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc. The LSSA uses the following verbs at this level: Apply, Assure, Calculate, Define, Demonstrate, Divide, Eliminate, Empower, Facilitate, Implement, Motivate, Organize, Plan, Prepare, Present, Promote, Propagate, Review, Select, Standardize, Support, Use.

**Analyze**
Break down information into its constituent parts and recognize their relationship to one another and how they are organized; identify sublevel factors or salient data from a complex scenario. The LSSA uses the following verbs at this level: Analyze, Construct, Design, Develop, Distinguish, Evaluate, Lead, Manage, Translate.

**Evaluate**
Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards. The LSSA does not uses this level in their skill sets.

**Create**
Put parts or elements together in such a way as to reveal a pattern or structure not clearly there before; identify which data or information from a complex set is appropriate to examine further or from which supported conclusions can be drawn. The LSSA does not uses this level in their skill sets.
APPENDIX B – EUROPEAN QUALIFICATIONS FRAMEWORK (EQF)

The European Qualifications Framework (EQF) acts as a translation device to make national qualifications more readable across Europe, promoting workers' and learners' mobility between countries and facilitating their lifelong learning.

The core of the EQF are 'Learning outcomes' which are eight reference levels describing what a learner knows, understands and is able to do.

<table>
<thead>
<tr>
<th>EQF Level</th>
<th>Knowledge</th>
<th>Belt level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Basic general knowledge</td>
<td>-</td>
</tr>
<tr>
<td>Level 2</td>
<td>Basic factual knowledge of a field of work or study</td>
<td>-</td>
</tr>
<tr>
<td>Level 3</td>
<td>Knowledge of facts, principles, processes and general concepts, in a field of work or study</td>
<td>-</td>
</tr>
<tr>
<td>Level 4</td>
<td>Factual and theoretical knowledge in broad contexts within a field of work or study</td>
<td>Lean Six Sigma Yellow Belt</td>
</tr>
<tr>
<td>Level 5</td>
<td>Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge</td>
<td>Lean Six Sigma Orange Belt</td>
</tr>
<tr>
<td>Level 6</td>
<td>Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles</td>
<td>Lean Six Sigma Green Belt</td>
</tr>
</tbody>
</table>
| Level 7   | • Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research  
          • Critical awareness of knowledge issues in a field and at the interface between different fields | Lean Six Sigma Black Belt |
| Level 8   | Knowledge at the most advanced frontier of a field of work or study and at the interface between fields | Lean Six Sigma Master Black Belt |
**APPENDIX B – ACRONYMS**

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>APL</td>
<td>Accreditation of Prior Learning</td>
</tr>
<tr>
<td>APMG</td>
<td>APM Group Limited</td>
</tr>
<tr>
<td>ASQ</td>
<td>American Society of Quality</td>
</tr>
<tr>
<td>ATO</td>
<td>Accredited Training Organization</td>
</tr>
<tr>
<td>ECQA</td>
<td>European Certification and Qualification Association</td>
</tr>
<tr>
<td>EQF</td>
<td>European Qualifications Framework</td>
</tr>
<tr>
<td>LSSA</td>
<td>Lean Six Sigma Academy (LSSA BV)</td>
</tr>
<tr>
<td>LSS YB</td>
<td>Lean Six Sigma Yellow Belt</td>
</tr>
<tr>
<td>LSS OB</td>
<td>Lean Six Sigma Orange Belt</td>
</tr>
<tr>
<td>LSS GB</td>
<td>Lean Six Sigma Green Belt</td>
</tr>
<tr>
<td>LSS BB</td>
<td>Lean Six Sigma Black Belt</td>
</tr>
<tr>
<td>iSQI</td>
<td>International Software Quality Institute (iSQI GmbH)</td>
</tr>
<tr>
<td>NVQ</td>
<td>National Vocational Qualification standard of England, Wales and N. Ireland</td>
</tr>
</tbody>
</table>

The LSSA has developed an abbreviation list with over 200 Lean Six Sigma terms and abbreviations. It is available online in four different languages at [www.lssa.eu](http://www.lssa.eu).
APPENDIX C – REFERENCES

[1.] Department of Trade and Industry UK, British Standards for Occupational Qualification, National Vocational Qualification Standards and Levels.


[3.] American Society for Quality (2008), ASQ body of knowledge - Six Sigma Black Belt Certification. Milwaukee: ASQ.


It is important for businesses and organizations to continuously focus on customer satisfaction by supplying products or services with outstanding quality, cost efficiently and within the agreed lead time. Improving quality and efficiency is the domain of ‘Process Improvement’.

Realising these objectives is effectively achieved by applying Lean Six Sigma: a combination of Lean Manufacturing and Six Sigma approaches. Within Lean Six Sigma, individuals can be trained at various ‘Belt levels’. These levels are called Black Belt, Green Belt, Orange Belt and Yellow Belt.

The LSSA – Lean Six Sigma Academy – was established in September 2009, with the main objective to determine a common certification standard for Lean Six Sigma job roles. This has been realised by developing four skill sets with clear criteria and an online exam portal. This document describes the second revision of the Orange Belt skill set.

H.C. Theisens
Managing director Lean Six Sigma Academy