



# **Lean Six Sigma Yellow Belt Skill Set Healthcare**





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**LSSH Yellow Belt Skill Card v1.2**

**ECQA - European Certification and Qualification Association**

**LSSA – Lean Six Sigma Academy.**

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## Introduction

### 1.1 LSSA - Lean Six Sigma Academy

It is important for healthcare providers to continuously focus on customer satisfaction by supplying a level of care provision 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 thinking' and Six Sigma approaches. Both management strategies are well established with proven success and are among the most applied process improvement methods in the world. Lean Six Sigma is a clear, practical and structured method to reduce waiting times, inefficiencies, quality issues and operational expenses.

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.

Belt level	Vocational Education Training	Adult Education – Job roles
Yellow Belt	Initial VET secondary level	Direct patient care providers
Orange Belt	-	Direct Care providers, Health Care assistants (HCA's), Nurses, Lean Facilitators, Supervisors
Green Belt	Higher Education	Clinical Nurse Manager, ward and unit managers, Clinicians
Black Belt	-	Clinicians, Unit Managers, Project Managers, Management, Consultants

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.

### 1.2 ECQA – European Certification and Qualification Association

A European certificate is also available for the above mentioned levels with the exam portal managed by the ECQA - European Certification and Qualification Association. The ECQA is a not-for-profit association which was created as a result of a number of EU-supported initiatives over the past ten years within which educational establishments decided to follow a joint process for the certification of individuals working within industry as part of the European Union's Lifelong Learning Program.

The ECQA/LSSA exam guide can be downloaded at [www.ecqa.org](http://www.ecqa.org) and at [www.lssa.eu](http://www.lssa.eu)

## Skill Definition Model

### 1.3 Skill Set Strategy

A skill set is a group of specific Learning Element that one should be able to apply within a certain job role. A standard group of skill sets within Europe is necessary due to the free mobility of workers. European countries such as the UK, The Netherlands, and France already have well-established open learning courses which support APL (Accreditation of Prior Learning). Within APL the skills of students are assessed, existing skills are recognised, and a learning plan is developed to cover any skill gaps. The skill assessment is based on defined skill units and a skill profile which indicates how many skill units have been covered.

LSSA has developed four skill sets that specify which of the overall Lean Six Sigma tools are expected to be included within a certain Belt level. A skill set is a group of 'Learning Elements' within eight 'Skill Units'. ASQ (American Society for Quality) Body of Knowledge [5], [6] documents were used as a baseline, and have been updated according the latest insights. Each of the 'Learning Elements' contains several 'Performance Criteria'. Each 'Performance Criteria' has an explanation and a cognitive level according to Bloom [8] which should be applied. The skill sets are used by the Examination Development Committee and to help candidates prepare for the exam.

### 1.4 Definitions

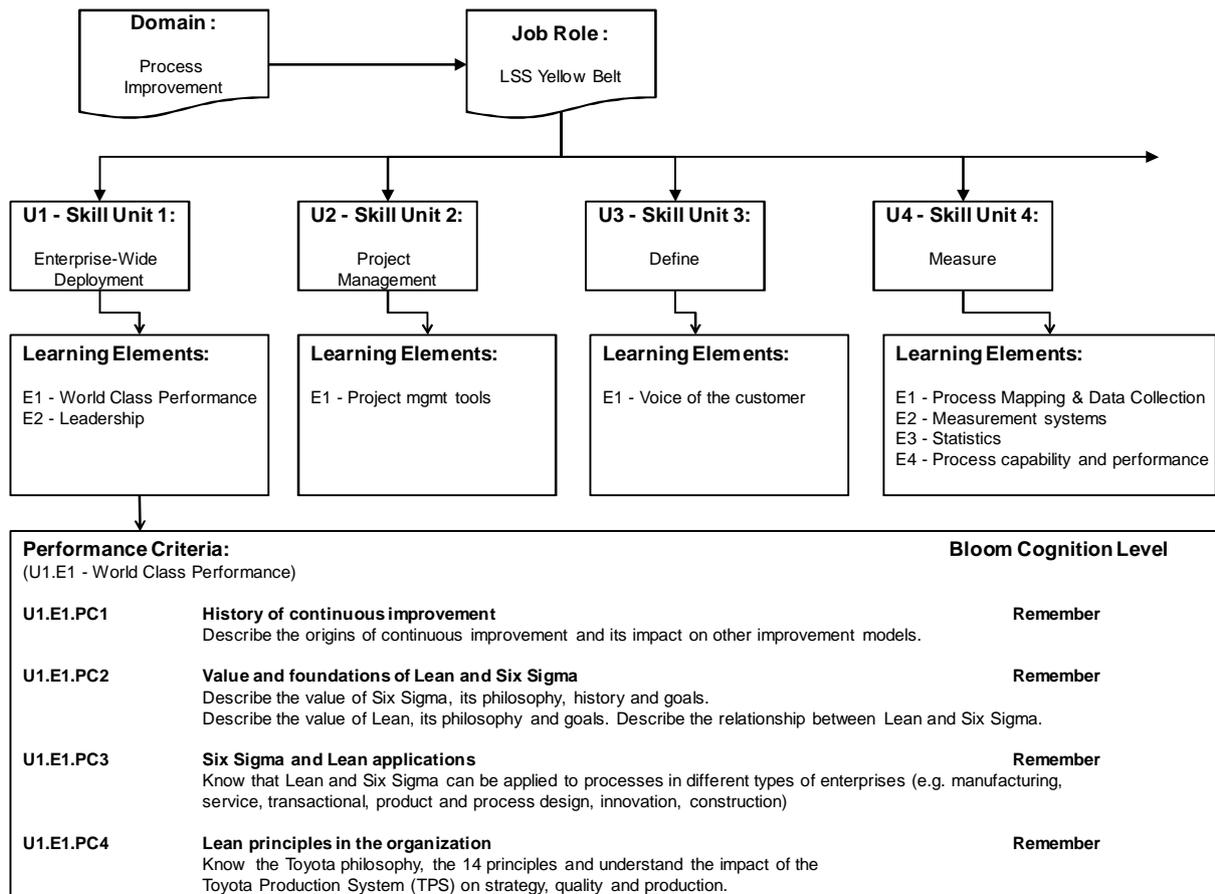
The skill sets are based on the skills definition proposed by the DTI (Department of Trade and Industry) in the UK for NVQ (National Vocational Qualification) standards [2] and revised skill cards from other countries. It contains the following items:

- **Domain:** An occupational category. E.g. Domain = Process Improvement.
- **Job role:** A certain profession that covers part of the domain knowledge. E.g. Job role = Yellow Belt, Orange Belt, Green Belt or Black Belt.
- **Unit:** A list of certain activities that have to be carried out in the workplace. It is the top-level skill in the qualification standard hierarchy. Each unit consists of a number of elements.
- **Learning element:** Description of one distinct aspect of the work performed by a worker, either a specific task that the worker has to do or a specific way of working. Each element consists of a number of performance criteria.
- **Performance criteria:** Description of the minimum level of performance a participant must demonstrate in order to be assessed as competent.
- **Level of cognition:** For each performance criteria there is an intended level of cognition. At the same time this describes the complexity level of the test questions for each performance criteria, according Bloom's Taxonomy – Rev. 2001.

## 1.5 Skill Set Structure

A skills hierarchy for the job role 'Lean Six Sigma Green Belt' has been designed using the terminology outlined in the skills definition model and includes the skills identified during the demand analysis performed at the beginning of the project.

In the graph below you will find an example for the first four Skill Units and their Learning elements. The first Learning Element of the first Skill Unit has three Performance Criteria, which are listed in the lower box. In total the Lean Six Sigma skill set for the 'Yellow Belt' job role is composed of 7 units; 17 learning elements and 50 performance criteria.



## Yellow Belt Skill Set

### 1.6 U1 – Enterprise-Wide Deployment

The Unit ‘Enterprise Wide Deployment’ discusses the general philosophy of Process Improvement. It handles the overview of different process improvement methods and the history of the most important methods: Lean and Six Sigma. It also explains why process improvement is needed, how it is organised and the different roles and responsibilities involved.

#### 1.6.1 E1 – World Class Performance

The Learning Element ‘World Class Performance’ explains the history, value and principles of Lean and Six Sigma. Similarities and differences to other improvement methods are also reviewed.

- |                  |   |                 |
|------------------|---|-----------------|
| <b>U1.E1.PC1</b> | <b>History of continuous improvement</b><br>Describe the origins of continuous improvement and its impact on other improvement models.  | <b>Remember</b> |
| <b>U1.E1.PC2</b> | <b>Value and foundations of Lean and Six Sigma</b><br>Describe the philosophy of Lean and Six Sigma, Describe the relationship and difference between Lean and Six Sigma.                   | <b>Remember</b> |
| <b>U1.E1.PC3</b> | <b>Six Sigma and Lean applications</b><br>Know that Lean and Six Sigma can be applied to processes in different types of enterprises.   | <b>Remember</b> |
| <b>U1.E1.PC4</b> | <b>Lean principles in the organization</b><br>Know the Toyota philosophy and principles and understand how these directly apply to provision of timely, patient focused quality healthcare. | <b>Remember</b> |

#### 1.6.2 E2 – Leadership

The Learning Element ‘Leadership’ explains the roles and responsibilities of the people involved in process improvement. The different Belt-levels and roles of management, team leaders and team members are also reviewed.

- |                  |  |                 |
|------------------|--|-----------------|
| <b>U1.E2.PC1</b> | <b>Roles and responsibilities</b><br>Know Six Sigma levels of expertise: Master Black Belt, Black Belt, Green Belt, Orange Belt and Yellow Belt. Know various team roles and responsibilities: Champion, Project leader and Team member. | <b>Remember</b> |
|------------------|--|-----------------|

## 1.7 U2 – Project Management

The Unit ‘Project Management’ outlines the way improvement projects should be executed. It covers the most common project management tools, the DMAIC improvement roadmap and team facilitation.

### 1.7.1 E1 – Project Management Tools

The Learning Element ‘Project Management Tools’ sets out the main elements that have to be taken into account during project execution, such as differing interests of stake holders and project execution within time and budget.

<b>U2.E1.PC1</b>	<b>Stakeholder analysis</b> Know there are different stakeholders in a project.	<b>Remember</b>
<b>U2.E1.PC2</b>	<b>DMAIC roadmap</b> Know the Process Improvement DMAIC roadmap.	<b>Remember</b>
<b>U2.E1.PC3</b>	<b>Time management</b> Attending meetings, arrive on-time, coming prepared. Be punctual and to the point. Understand that the contribution of the work floor is important for process improvement.	<b>Understand</b>

### 1.7.2 E3 – Team Formation

The Learning Element ‘Team Formation’ discusses the various types of teams and the process for selecting team members.

<b>U2.E3.PC1</b>	<b>Team dynamics and performance</b> Be constructive and pro-active. Looking for solutions rather than roadblocks.	<b>Understand</b>
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## 1.8 U3 – Define

Define is the first phase within the DMAIC roadmap. The Unit ‘Define’ discusses the elements that have to be taken into account during the first phase of a process improvement project such as the project charter and patient? requirement.

### 1.8.1 E1 – Voice of the Customer (VOC)

The Learning Element ‘Voice of the Customer’ reviews customer requirements (internal/external) and the flow down of these requirements to measurable criteria for the product and/or process.

<b>U3.E1.PC1</b>	<b>Customer identification</b> Know that a project will impact both internal and external customers.	<b>Remember</b>
<b>U3.E1.PC2</b>	<b>Customer requirements</b> Understand different customers have different needs, expectations, requirements and desires.	<b>Remember</b>
<b>U3.E1.PC3</b>	<b>Customer demand</b> Know that there is a difference between takt time and cycle time.	<b>Remember</b>
<b>U3.E1.PC4</b>	<b>Critical requirements (CTx)</b> Know critical characteristics are called CTQ and have to be translated to internal process targets.	<b>Remember</b>

## 1.9 U4 – Measure

Measure is the second phase within the DMAIC roadmap. The Unit ‘Measure’ describes the measurability of the process/product responses and factors of influence. The Unit also reviews several process mapping methods, types of data and the reliability of the measurement method. This Unit also discusses statistics and visualisation of data.

### 1.9.1 E1 – Process Mapping & Data Collection

The Learning Element ‘Process Mapping & Data Collection’ sets out the different ways of process mapping to visualise the process. This Element also covers types of data and the accuracy and integrity of data.

<b>U4.E1.PC1</b>	<b>Input and output variables (SIPOC)</b> Assist in identifying input and output process variables that are used to construct PFM (Process Flow Mapping), SIPOC or Cause and Effect Matrix.	<b>Understand</b>
<b>U4.E1.PC2</b>	<b>Process flow modelling and metrics</b> Assist in developing process maps and flowcharts.	<b>Understand</b>
<b>U4.E1.PC3</b>	<b>Types of data</b> Know there are different types of data. Know there is a difference between counting and measuring.	<b>Remember</b>
<b>U4.E1.PC4</b>	<b>Sampling methods for assuring data accuracy and integrity</b> Know methods for collecting data such as check sheets. Know it is important to follow systematic data collection.	<b>Understand</b>

### 1.9.2 E2 – Statistics

The Learning Element ‘Statistics’ reviews the basics of statistics such as mean, deviation and probability. This Learning Element reviews a range of graphs that can be used to visualise data as well.

<b>U4.E2.PC1</b>	<b>Basic terms</b> Understand basic terms of statistics (e.g. mean, median, standard deviation and range).	<b>Understand</b>
<b>U4.E2.PC2</b>	<b>Visualization of data</b> Know there are different diagrams and charts, including Bar Chart, Pie Chart, Pareto, Time Series Plot and Scatter Plot).	<b>Understand</b>

### 1.9.3 E3 – Measurement Systems

The Learning Element ‘Measurement Systems’ examines the reliability of the measurement system.

<b>U4.E3.PC1</b>	<b>Measurement methods</b> Know measurement methods for both continuous and discrete data.	<b>Remember</b>
<b>U4.E3.PC2</b>	<b>Measurement systems analysis</b> Know that the measurement procedure has variation. Know the importance of randomizing samples.	<b>Understand</b>

### 1.9.4 E4 – Process Capability and Performance

The Learning Element ‘Process Capability and Performance’ explains process capability and performance in relation to specification limits.

<b>U4.E4.PC1</b>	<b>Process performance metrics</b> Understand process performance metrics such as percent defective, parts per million (PPM), defects per million opportunities (DPMO), defects per unit (DPU) and rolled throughput yield (RTY). Know the difference between a defect and a defective.	<b>Understand</b>
<b>U4.E4.PC2</b>	<b>Process capability studies</b> Know basic principles of process capability studies. Collecting data.	<b>Understand</b>
<b>U4.E4.PC3</b>	<b>Short-term and long-term capability</b> Know there is a difference between long-term and short-term capability.	<b>Remember</b>
<b>U4.E4.PC4</b>	<b>Process capability indices</b> Know basic process capability indices such as Cp and Cpk.	<b>Remember</b>
<b>U4.E4.PC5</b>	<b>Process performance indices</b> Know basic process performance indices such as Pp and Ppk.	<b>Remember</b>

## 1.10 U5 – Analyse

Analyse is the third phase within the DMAIC roadmap. The Unit ‘Analyse’ reviews the analysis of current process performance. The different elements will review Risk Analysis, Root Cause Analysis, Waste Identification, Regression Analysis and Analysis of Variance.

### 1.10.1 E1 – Exploratory Data Analysis

The Learning Element ‘Exploratory Data Analysis’ describes the predictive models using regression techniques to determine the relation between factors on a response. This Learning Element also covers process performance metrics and the method for determining the capability of a process to meet specifications.

<b>U5.E1.PC1</b>	<b>Regression analysis</b> Know basics of linear regression.	<b>Remember</b>
<b>U5.E1.PC2</b>	<b>Correlation Coefficient</b> Know basics of correlation coefficient.	<b>Remember</b>

### 1.10.2 E2 – Hypothesis Testing

The Learning Element ‘Hypothesis testing’ reviews test methods that are used to test a hypothesis. This Learning Element also discusses Confidence Intervals that indicate the reliability of test conclusions.

<b>U5.E2.PC1</b>	<b>Terminology</b> Understand basics principles of hypothesis testing.	<b>Remember</b>
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### 1.10.3 E3 – Analytical Methods

The Learning Element ‘Analytical Methods’ describes the tools that can be used for risk analysis, root cause analysis and waste identification.

<b>U5.E3.PC1</b>	<b>Failure mode and effects analysis (FMEA)</b> Understand the purpose and elements of FMEA, including risk priority number (RPN)	<b>Understand</b>
<b>U5.E3.PC2</b>	<b>Root cause analysis</b> Understand the issues involved in identifying a root cause. Apply problem solving tools (5-Why and Cause and Effect diagrams / Ishikawa) for analyzing problems.	<b>Understand</b>
<b>U5.E3.PC3</b>	<b>Waste identification</b> Identify and interpret the 8 types of waste (Overproduction, Waiting, Transport, Overprocessing, Inventory, Movement, Defects, Unused expertise).	<b>Understand</b>

**U5.E3.PC4**

**Value Stream Mapping (Current State)**

**Understand**

Distinguish value added from non value added activities. Know Value Stream Mapping is a technique for identify waste and non value added activities.

## 1.11 U6 – Improve

Improve is the fourth phase within the DMAIC roadmap. The Unit ‘Improve’ discusses the identification, implementation and verification of improvements that solve a problem, eliminate waste or improve quality or process performance.

### 1.11.1 E1 – Process Improvement Methods

The Learning Element ‘Process Improvement Methods’ sets out a series of methods and tools that can be used for process improvement, such as 5S, Kaizen, 8D, Theory of Constraints and Total Productive Maintenance.

<b>U6.E1.PC1</b>	<b>Organized work environment (5S)</b> Organizing the clinical environment by applying 5S (Sort, Straighten, Shine, Standardize, Sustain). Understand an organized environment will improve safety and morale.	<b>Understand</b>
<b>U6.E1.PC2</b>	<b>Improvement teams (Kaizen)</b> Setup and lead improvement teams such as Kaizen or Small Group Activities.	<b>Understand</b>
<b>U6.E1.PC3</b>	<b>Basic Problem Solving (8D)</b> Familiar with the eight disciplines problem solving process which is used to approach and resolve problems.	<b>Understand</b>
<b>U6.E1.PC4</b>	<b>Theory of constraints (TOC)</b> Know why it is important to identify the bottle necks in a process.	<b>Remember</b>
<b>U6.E1.PC5</b>	<b>Total Productive Maintenance (TPM)</b> Understand the eight pillars of TPM and know how it can be used for process improvement.	<b>Understand</b>

### 1.11.2 E2 – Waste Elimination

The Learning Element ‘Waste Elimination’ discusses improving the organisation of a production line or process. This Learning Element also explains line balancing, Flow, Pull, quick change-overs and doing things right the first time.

<b>U6.E2.PC1</b>	<b>Value Stream Mapping (Future State)</b> Know there is a difference between current state and future state Value Stream Mapping	<b>Remember</b>
<b>U6.E2.PC2</b>	<b>Work and Line Balancing (Flow and Pull)</b> Know basic principles of line balancing, Flow and Pull.	<b>Remember</b>

- U6.E2.PC3      Quick Change Over (SMED)      Understand**  
Support work and line balancing by reducing change over times by applying Single Minute Exchange of Die (SMED). Reduce materials, skilled resources and time necessary to equipment setup and product change over.
- U6.E2.PC4      First Time Right (FTR)      Understand**  
Understand a process has to be stopped when there is a quality problem. Identify opportunities to apply Poka Yoke to avoid quality problems.

## 1.12 U7 – Control

Control is the fifth phase within the DMAIC roadmap. The Unit ‘Control’ is about sustaining achievements and discusses the tools and procedures that ensure good quality. The elements that are reviewed include Statistical Process Control, Visual Management, Standardisation and Documentation.

### 1.12.1 E1 – 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.

<b>U7.E1.PC1</b>	<b>Objectives and benefits</b> Understand the objectives and benefits of SPC.	<b>Understand</b>
<b>U7.E1.PC2</b>	<b>Selection and application of control charts</b> Know there are different types of control charts such as Xbar-R.	<b>Remember</b>
<b>U7.E1.PC3</b>	<b>Control chart analysis</b> Know there is a difference between special cause and common cause variation.	<b>Remember</b>

### 1.12.2 E2 – Quality Assurance

The Learning Element ‘Quality Assurance’ establishes a series of tools and procedures that can be used to measure, communicate and ensure quality such as visual management and controls.

<b>U7.E2.PC1</b>	<b>Visual Management</b> Describe elements of Visual Management and know how these can help to control the improved process.	<b>Understand</b>
<b>U7.E2.PC2</b>	<b>Control plan</b> Know a control plan contains elements to verify the process to assure product quality.	<b>Remember</b>

### 1.12.3 E3 – Sustain Improvements

The ‘Sustain Improvements’ Learning Element discusses methods for maintaining achievements, how to apply standardisation and how to become a learning organisation.

<b>U7.E3.PC1</b>	<b>Lessons learned</b> Identify learning opportunities and hand over to superior.	<b>Understand</b>
<b>U7.E3.PC2</b>	<b>Standardized work and Documentation</b> Understand standardized tasks are the foundation for continuous improvement. Support in modifying standard operating procedures (SOPs) and work instructions.	<b>Understand</b>

## 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 [7].

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 [8]. Bloom's Taxonomy divides educational objectives into three "domains": Affective, Psychomotor and Cognitive. This Skill only notice the Cognitive domain.

The ‘Levels of Cognition’ are in rank order - from least complex to most complex.

### **Remember**

Recall or recognise terms, definitions, facts, ideas, materials, patterns, sequences, methods, principles, etc.

### **Understand**

Read and understand descriptions, communications, reports, tables, diagrams, directions, regulations, etc.

### **Apply**

Know when and how to use ideas, procedures, methods, formulas, principles, theories, etc.

### **Analyse**

Break down information into its constituent parts and recognise their relationship to one another and how they are organised; identify sublevel factors or salient data from a complex scenario.

### **Evaluate**

Make judgments about the value of proposed ideas, solutions, etc., by comparing the proposal to specific criteria or standards.

### **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

## Appendix B – European Qualifications Framework (EQF) for Job roles

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. [8]

Level	Knowledge	Belt level
<b>Level 1</b>	Basic general knowledge	-
<b>Level 2</b>	Basic factual knowledge of a field of work or study	-
<b>Level 3</b>	Knowledge of facts, principles, processes and general concepts, in a field of work or study	-
<b>Level 4</b>	Factual and theoretical knowledge in broad contexts within a field of work or study	Lean Six Sigma Yellow Belt
<b>Level 5</b>	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	Lean Six Sigma Orange Belt
<b>Level 6</b>	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Lean Six Sigma Green Belt
<b>Level 7</b>	<ul style="list-style-type: none"> <li>Highly specialised 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</li> <li>Critical awareness of knowledge issues in a field and at the interface between different fields</li> </ul>	Lean Six Sigma Black Belt
<b>Level 8</b>	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

Acronym	Description
APL	Accreditation of Prior Learning
ASQ	American Society of Quality
CREDIT	Accreditation of Skills via the Internet
YB	Lean Six Sigma Yellow Belt
OB	Lean Six Sigma Orange Belt
GB	Lean Six Sigma Green Belt
BB	Lean Six Sigma Black Belt
LSSA	Lean Six Sigma Academy, <a href="http://www.lssa.eu">www.lssa.eu</a>
NVQ	National Vocational Qualification standard of England, Wales and N. Ireland
EQF	European Qualifications Framework
ECQA	European Certification and Qualification Association, <a href="http://www.ecqa.org">www.ecqa.org</a>

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

## Appendix C – References

- [1] *CREDIT Project, Accreditation Model Definition, MM 1032 Project CREDIT, Version 2.0, University of Amsterdam, 15.2.99*
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