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Quantitative methods in process improvement — Six Sigma — Competencies for key personnel and their organizations in relation to Six Sigma and Lean implementation

Méthodes quantitatives pour l'amélioration des processus — Six Sigma — Compétences pour le personnel clé et leur organisation en relation avec la mise en œuvre du Six Sigma et du Lean

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 69, *Applications of statistical methods*, Subcommittee SC 7, *Applications of statistical and related techniques for the implementation of Six Sigma.*

Introduction

This International Standard sets out to clarify the required competencies for personnel and organizations in Six Sigma[1)], Lean and "Lean & Six Sigma". Because of the ambiguity of the many combinations of Lean and Six Sigma, currently termed "Lean Six Sigma", this International Standard will use the term "Lean & Six Sigma". Before this, there had been no universal standard on what constitutes a Black Belt or what is required in an organization which deploys these approaches.

For example, if an organization advertises for a Six Sigma Black Belt, how can they be sure of the level of ability of a "Black Belt"? If a supplier says it is deploying Six Sigma or perhaps Lean, how can a customer be sure of their real abilities? A fundamental purpose of this International Standard is to assist in the answer of such questions.

Much debate has been had on the nature of Six Sigma and Lean, their commonality and their differences. Protagonists have argued over the content, overlap, application, supremacy and purpose of the two approaches. Various combinations of the two approaches exist, many under the umbrella title of "Lean Six Sigma". Six Sigma and Lean have a commonality of field of application, i.e. process improvement. Lean focuses on reducing 'chronic' waste and Six Sigma focuses on reducing the variation and thereby its adverse effects.

This International Standard therefore sets out the separate competency requirements for Six Sigma and Lean implementation; it also sets out a combined competency framework for "Lean & Six Sigma". In so doing, it focuses on the competencies (skills and abilities) to deliver benefits to an organization rather than defining the specific educational level required for each role.

Candidates will be expected to demonstrate that they have an adequate level of competence, an amalgamation of education, training, skills and experience necessary to fulfil their roles.

In its preparation, it has been seen to be helpful to prepare this International Standard by focusing on Six Sigma, Lean implementation and "Lean & Six Sigma" separately and the user will come across different tables dealing with these subjects.

1) Six Sigma is a trade mark of Motorola, Inc.

Quantitative methods in process improvement — Six Sigma — Competencies for key personnel and their organizations in relation to Six Sigma and Lean implementation

1 Scope

This International Standard defines the competencies for the attainment of specific levels of competency with regards to Six Sigma, Lean, and "Lean & Six Sigma" in individuals, e.g. Black Belt, Green Belt and Lean practitioners and their organizations. Yellow Belt is not included in this International Standard. This International Standard excludes Design for Six Sigma.

NOTE This International Standard sets out the required competencies for individual certification and/or an organization's certificate.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 13053-1, *Quantitative methods in process improvement — Six Sigma — Part 1: DMAIC methodology*

ISO 13053-2, *Quantitative methods in process improvement — Six Sigma — Part 2: Tools and techniques*

3 Terms, definitions, and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1
appropriate authority
authority identified and justified by an organization

Note 1 to entry: This authority can be either internal or external to the organization.

3.2 Abbreviated terms

5S	sort, set, shine, standardize, sustain
CT	critical to
DOWNTIME	defects, overproduction, waiting, non-utilization of talent, transport, inventory, motion, extra-processing
EDA	exploratory data analysis
HOQ	house of quality
OEE	overall equipment effectiveness
PDCA	plan, do, check, act

PDM	policy deployment matrix
SIPOC	supplier-input-process-output-customer
SMED	single-minute exchange of die
TIM WOOD	transport, inventory, motion, waiting, over-processing, overproduction, defects
VOC	voice of the customer
VSM	value-stream map
WIP	work in progress
WORMPIT	waiting, overproduction, rework, motion, processing, inventory, transport

4 Competency of key personnel in relation to Six Sigma, Lean, and "Lean & Six Sigma"

4.1 Education and training

Six Sigma, Lean, and "Lean & Six Sigma" personnel shall be competent on the basis of adequate and appropriate education, training, skills, competencies and experience.

4.2 Skills and competency

4.2.1 Six Sigma

See Annex A.

4.2.2 Lean

See Annex B.

4.2.3 "Lean & Six Sigma"

See Annex C.

4.3 Experience

Appropriate evidence of relevant experience of an individual shall be recorded, validated, controlled and maintained. Records shall be legible, readily identifiable and retrievable.

EXAMPLE A successfully completed Six Sigma project or parts of projects, Lean activities.

5 Adequacy of an organization with regards to its Six Sigma, Lean or "Lean & Six Sigma" approach and deployment

5.1 General

Within an organization, it will be important to have the role of a champion well-defined as per ISO 13053-1. A champion facilitates improvement activities and removes "road blocks" in the path of project completion.

The organization shall, at regular defined, justified intervals and in alignment with business objectives, review and adjust the Six Sigma, Lean or "Lean & Six Sigma" strategy by an appropriate authority.

It is expected that any audit will respect the confidentiality of the organization in all respects (to include, but not limited to, intellectual property, security and commercial issues).

5.2 Adequacy of the organization's Six Sigma, Lean or "Lean & Six Sigma" strategy

The organization shall

a) define, maintain and control an appropriate, documented Six Sigma, Lean or "Lean & Six Sigma" strategy. This International Standard shall define the objectives of the approach and deployment. This will be part of the organization's overall strategy and can be a separate document, and

b) define, maintain and control appropriate approaches and/or plans of action to achieve these objectives.

5.3 Adequacy of the organization's Six Sigma, Lean or "Lean & Six Sigma" architecture

The organization shall

a) define, maintain and control Six Sigma, Lean or "Lean & Six Sigma" architecture appropriate to the organizational culture, to include infrastructure, steering committees, reporting structures, responsibilities/accountabilities, support,

b) define, maintain and control appropriate numbers and disposition of Six Sigma, Lean or "Lean & Six Sigma" personnel, at appropriate competence levels (see ISO 13053-1), and

c) define, maintain and control appropriate decision-making processes for the Six Sigma, Lean or "Lean & Six Sigma" approach and deployment.

5.4 Adequacy of the skills and competencies of the key personnel

The organization shall

a) determine the necessary competencies for Six Sigma, Lean or "Lean & Six Sigma" personnel subject to the minimum competencies contained in this International Standard,

b) where applicable, provide training or take other actions to achieve the necessary competence,

c) maintain the competencies of its personnel at appropriate levels,

d) evaluate the effectiveness of the actions taken,

e) ensure that its personnel are aware of the relevance and importance of their activities and how they contribute to the achievement of their objectives, and

f) maintain appropriate records of education, training, skills, competencies and experience.

5.5 Adequacy and continual improvement of organizational deployment

The organization shall

a) define, maintain and control appropriate deployment metrics to ascertain the adequacy, or otherwise, of Six Sigma, Lean or "Lean & Six Sigma" deployment and its continual improvement,

b) determine the required targets for these metrics,

c) review the achievement against these targets, and

d) review the continued relevance of the metrics and targets and update as appropriate.

6 Resource management

6.1 General

The organization shall define and identify key personnel.

6.2 Provision of resources

The organization shall determine, provide and effectively use the resources needed to

a) support the Six Sigma, Lean or "Lean & Six Sigma" implementation, i.e. sponsor(s) and/or champion(s),

b) deploy and maintain the Six Sigma, Lean or "Lean & Six Sigma" implementation and continually improve its effectiveness, and

c) achieve their defined objectives.

NOTE These resources can be internal or external to the organization.

6.3 Ongoing monitoring of requirements

The organization shall, at regular defined intervals, review and adjust appropriate resources for the Six Sigma, Lean or "Lean & Six Sigma" measurement, analysis and improvement.

6.4 Key personnel

Key personnel shall

a) demonstrate attainment against defined competencies and objectives,

b) actively maintain and enhance their skills and competencies, and

c) actively maintain personal records of their training, skills, competencies and experience.

6.5 Maintaining competence of key personnel

6.5.1 Green Belts and Lean practitioners

Green Belts and Lean practitioners shall prepare and produce a portfolio of evidence of work experience. These portfolios form the basis of status review and will usually be reviewed internally every year by a Black Belt or Master Black Belt.

Status will be renewed subject to satisfactory evidence.

6.5.2 Black Belts and Lean leaders

Black Belts and Lean leaders shall prepare and produce a portfolio of evidence of work experience. These portfolios form the basis of status review and will normally be

a) reviewed internally every year, and

b) reviewed every three years by an appropriate authority.

Status will be renewed subject to satisfactory evidence.

6.5.3 Master Black Belt and Lean expert

Master Black Belts and Lean experts shall prepare a portfolio of evidence of work experience. These portfolios form the basis of status review and will normally be reviewed every three years by an appropriate authority.

Status will be renewed subject to satisfactory evidence.

6.6 Organization

The organization shall plan and implement the monitoring, measurement, analysis and improvement processes needed to

a) demonstrate attainment of defined objectives and deployment metrics,

b) ensure continued applicability of the approaches and/or plans of action, and

c) enable organizational learning and continually improve the effectiveness of the implementation.

This shall include determination of applicable methods and justification of these methods to the appropriate authority, to include statistical techniques as appropriate and the extent of their use.

6.7 Maintaining competence of the organization

The competence of an organization is to be reviewed every three years by an appropriate authority.

More frequent internal reviews are recommended.

Annex A
(normative)

Six Sigma

A.1 Green Belt

The Green Belt is expected to deliver the agreed benefits of a Six Sigma project to the organization. These improvement activities will often be within the Green Belt's usual field of employment and operation. In so doing, the Green Belt will

a) work with the local 'line management' to identify and quantify opportunities for improvement within the local environment,

b) be required to

   1) work, possibly under the direction of a Black Belt or Master Black Belt or as a member of a larger Six Sigma project led, for example, by a Black Belt, and/or

   2) be required to lead a smaller Six Sigma project under the direction of a Black Belt, and

c) possibly coach process operators (Yellow Belts) on process improvement methods and activities.

Table A.1 — Six Sigma — Green Belt competencies

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
1	Organizational benefits identification and prioritization.	Understands the importance of using quantified local organizational benefits or goals to guide project selection.	Describes the appropriate identification of the organization's opportunities, the benefits of removing concerns and the relationship to an organization's local business goals and how project/problem selection relates to these goals.	Demonstrates the identification of benefits on Green Belt projects.	Not applicable	Not applicable
2	Business process improvement.	Understands the use of Six Sigma to support organizational strategy.	Describes when and where Six Sigma would be an appropriate approach for process improvement in the organization.	Demonstrates the impact that Six Sigma has had on local organization.	Not applicable	Not applicable
3	Change management.	Understands the role of a Green Belt in change management and the importance of using a coherent approach to manage change.	Describes interaction between stakeholders and the change process in the Green Belt's project and the mutual impact of one on the other.	Demonstrates participation in and communication of change.	Not applicable	Not applicable

Table A.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
4	Data acquisition for analysis.	Identifying and actively seeking appropriate information in various forms, ensuring the validity of such information and transforming into data which can be analysed in Competency 22.	Describes the difference between qualitative and quantitative information and the benefits of quantifying performance. Describe where data might be found, how it is gathered and what analysis techniques might be used in the Green Belt's project. Describe where or how validity might be compromised and what actions might be needed.	Evidence of implementation of a plan to acquire appropriate data.	Not applicable	Not applicable
5	Leadership development in self.	Importance of developing leadership skills in self.	Describes leadership development including the following, as appropriate: self-assessment, importance of coaching, importance of mentoring, personal development plans.	Not applicable	Not applicable	Not applicable
6	Leadership development in others.	Importance of leadership development in others. (See also Competency 20).	Not applicable	Not applicable	Not applicable	Not applicable
7	Creativity thinking.	Understands the need to apply creative thinking approaches to pursue project objectives.	Describes the different thinking modes (e.g. creative and analytical).	Evidence of use of this approach during a project.	Not applicable	Not applicable
8	Customer focus.	To understand how and why to listen to the 'voice of the customer' (VOC).	Describes the different types of customers as applied to the Green Belt project.	Demonstrates the application of 'customer focus' approaches. For example, through the correct use of a 'house of quality' and/or 'critical to' (CT) matrix.	Not applicable	Not applicable
9	Decision making and taking.	To recognize the importance of decision-taking and identify the decision-takers.	Describes circumstances where decision-taking is required in a Green Belt project and the responsibility for these decisions.	Not applicable	Not applicable	Not applicable
10	Interpersonal and team leadership skills.	To support effective interaction with others including stake holders. To work effectively with others to achieve objectives.	To know the factors affecting team effectiveness, including factors such as leadership style, team roles, personality types.	Demonstrates the effective use of communication techniques in a Green Belt project.	Not applicable	Not applicable

Table A.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
11	Motivating others.	Understands why it is important to motivate individuals and teams to progress towards objectives.	Knows possible motivations such as identifying individual drivers, creating a shared vision, shared goals, understanding appropriate incentives and consequences.	Demonstrates that such approaches have been deployed.	Not applicable	Not applicable
12	Numeracy.	To be proficient in the interpretation of numbers in the Green Belt project.	Describes the necessity to have proficiency with numerical information to undertake a Green Belt project.	Demonstrates a sense of the size of order of magnitude and the sound basis of these. To calculate accurately a range of calculations. To recognize when it is appropriate to use a computer, and be able to do so effectively. To demonstrate that calculated results are reasonable. To demonstrate interpolations and predictions from the data in projects, e.g. graphs, diagrams, charts and tables.	Not applicable	Not applicable
13	Practical problem solving (opportunity realization).	The ability to differentiate between different types of problems/opportunities and choose appropriate approaches to address them. For example, acute/chronic or special cause/common cause. To understand how to apply root cause analysis techniques to identify causal factors for process improvement.	To describe appropriate processes used to address different types of problems. Describes where this is appropriate.	To demonstrate the appropriate use of DMAIC and other problem solving methods, qualifying the selection. To participate in process improvements having found the principal root cause. To demonstrate the successful application of a variety of practical root-cause identification and sorting techniques (e.g. the five 'whys', Pareto charts, fault tree analysis, cause and effect diagrams).	Not applicable	Not applicable
		The ability to put forward potential solutions and select and verify the most appropriate.	Describes solution generation process used and how proposals address the root causes identified. Describes process used to establish the criteria for selection. Describes the verification process for the chosen solution(s).	Demonstrates use of appropriate techniques to generate solution(s) to identified root cause(s), then sort, select and verify.	Not applicable	Not applicable

Table A.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
		To be able to implement solution(s) and verify benefit(s) delivered.	Describes how to check that the chosen solution will work in practice (e.g. trials, pilot, experimentation etc.). Describes how to implement the chosen solution in practice. Describes how to check implementation has addressed the root cause and delivered benefit.	Demonstrates use of appropriate techniques to check solution(s) will work in practice, then implement and verify benefit achieved.	Not applicable	Not applicable
14	Presentation and reporting skills.	Understands the importance of communicating effectively.	Describes effective ways to structure presentations and reports.	Demonstrates the planning and delivery of presentations, formal or informal, and preparation of reports.	Not applicable	Not applicable
15	Process thinking skills.	Understands the processes and/or systems in which the Green Belt project operates and the impacts the project may have.	To describe the processes and/or systems in which the Green Belt project operates and the impacts the project may have.	Demonstrates the application of appropriate process tools/techniques such as SIPOC, flow charts.	Not applicable	Not applicable
16	Project management.	Managing a finite-time improvement activity with a defined group of people.	Describes what constitutes good project management skills.	To have demonstrated the effective management of a Six Sigma Green Belt project.	Not applicable	Not applicable
17	Risk analysis.	To understand the concept of risk in a Six Sigma project.	Describes what is meant by risk and how risks are evaluated and prioritized in a Green Belt project.	To have demonstrated the identification of risk. To have demonstrated how to quantify and prioritize risk.	Not applicable	Not applicable
18	Self-review and development.	To be able to understand own strengths and areas requiring development.	To describe own strengths and plans for self-development.	To have demonstrated self-review and suitable actions taken.	Not applicable	Not applicable
19	Six Sigma tools.	To understand the application of Six Sigma tools and techniques (refer to ISO 13053-1 for appropriate Green Belt level).	Describes the use and application of these techniques.	To have demonstrated the correct selection and application of appropriate Six Sigma tools and techniques in a Green Belt project.	Not applicable	Not applicable
20	Stakeholder management.	To have knowledge of stakeholder management.	Describes types of stakeholder and appropriate techniques for stakeholder management.	Not applicable	Not applicable	Not applicable

Table A.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
21	Statistical concepts.	To understand statistical concepts and methods and use appropriately (refer to ISO 13053-1 for appropriate Green Belt level).	Describes the appropriate application of statistical concepts in a Green Belt project.	To demonstrate the appropriate application of statistical concepts in a Green Belt project, for example, sample selection, sample size determination, confidence level.	Not applicable	Not applicable
22	Statistical software use.	To have knowledge of the application, capabilities and limitations of at least one statistical software tool and situations when it is appropriate to use it.	Describes the use and strengths of one software package which runs statistical analysis, including any limitations.	To demonstrate proficiency in at least one currently-available software package which runs statistical analysis, including the sense-checking and presentation of analysis results.	Not applicable	Not applicable
23	Sustainability and control.	To understand the concept of control in a Six Sigma project.	Describes the importance of sustainability of implemented solution.	To demonstrate steps taken to ensure performance of improved process is sustained over time.	Not applicable	Not applicable

A.2 Black Belt

The Black Belt is expected to deliver the agreed benefits of a Six Sigma project to the organization. In so doing, the Black Belt will

a) work with others to identify and quantify opportunities for improvement,

b) organize multi-disciplinary teams (process organization), where necessary, and manage improvement projects,

c) lead improvement projects or facilitate Green Belt projects using the DMAIC methodology,

d) train, coach and mentor Green Belts on DMAIC methodology and associated process improvement techniques, and

e) to participate in all 'gate' reviews directly through prepared presentations of the work accomplished to-date with an emphasis on the accomplishments in the phase being reviewed.

Table A.2 — Six Sigma - Black Belt competencies

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
1	Organizational benefits identification and prioritization.	Identification of the importance of using quantified organizational benefits or goals to guide project selection. Selection and use of an appropriate prioritization approach.	Describes the appropriate identification of the organization's opportunities, the benefits of removing concerns and the relationship to an organization's business goals and how project/problem selection relates to these goals. Describes appropriate prioritization approaches and techniques and their use.	Demonstrates that the selection of each project is in agreement with these goals and objectives. Demonstration of correct selection and use of prioritization techniques such as the following: prioritization matrices, multi-voting techniques, strategy grids.	Evidence of review of Green Belt project benefits and linkages to organizational goals as appropriate.	Not applicable
2	Business process improvement.	Appropriate use of Six Sigma to support organizational strategy.	Describes the origins of Six Sigma. Describes when and where Six Sigma would be an appropriate approach for process improvement.	Demonstration of the impact that Six Sigma has had on organization.	Not applicable	Not applicable
3	Change management.	Importance of using a coherent approach to change management.	Describes interaction between stakeholders and change process and the mutual impact of one on the other.	Demonstration of the identification of key stakeholders and the use of coherent approach to progress change.	Evidence of review of Green Belt change effectiveness.	Not applicable
4	Leadership development in self.	Importance of developing leadership skills in self.	Describes leadership development including the following, as appropriate: self-assessment, importance of coaching, importance of mentoring, personal development plans.	Demonstrates identification of any gaps in required own competencies to progress change and suggestions made for appropriate action.	Not applicable	Not applicable
5	Leadership development in others.	Importance of leadership development in others. (See also Competency 20).	Describes leadership development in others including as appropriate: assessment, coaching, mentoring, development plans.	Demonstrates identification of any gaps in required competencies to progress change, in individuals, teams or in organization, and suggestions made for appropriate action.	Not applicable	Not applicable
6	Data acquisition for analysis.	Identifying and actively seeking appropriate information in various forms, ensuring the validity of such information and transforming into data which can be analysed in Competency 22.	Describes where data might be found and possible formats (structured and unstructured). Describes how to verify and validate information and manipulate data into appropriate formats.	The demonstration of a plan to acquire appropriate data, the verification and validation of such data, the manipulation of data into the appropriate format to satisfy project objectives.	Critical analysis of existing data streams and suggestions of possible improvements.	Not applicable
7	Creativity thinking.	To apply creative thinking approaches to define and pursue project objectives.	Describes the different thinking modes (e.g. creative and analytical, divergent/convergent) and suggest appropriate techniques to support creative thinking.	Evidence of use of this approach during the project.	Critical analysis of suitability of chosen approach.	Not applicable

Table A.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
8	Customer focus.	To understand how and why to listen to and capture the 'voice of the customer' (VOC).	Describes the different types of customers. To understand the link between the VOC and the requirements of other stakeholders, e.g. operations and management.	Demonstration of the application of 'customer focus' approaches. For example, through the correct use of the Kano model and 'house of quality' and/or 'critical to' (CT) matrices.	Reviews effectiveness of solutions to address customer's needs.	Not applicable
9	Decision making and taking.	To recognize the importance of decision-taking and identify the decision-takers.	Describes circumstances where decision-taking is required and the responsibility for these decisions.	Demonstration of the appropriate usage of the key elements of decision-taking (individual or group).	Review of effectiveness of decision making processes.	Not applicable
10	Interpersonal and team leadership skills.	To support effective interaction with others including stake holders. To work effectively with others to achieve objectives.	To describe the factors affecting team effectiveness, including factors such as leadership style, team roles, personality types.	Demonstration that the Black Belt has studied their team from the viewpoint of the interpersonal skills deployed, taken appropriate action and demonstrated a positive effect.	Review of effectiveness of actions.	Not applicable
11	Motivating others.	Understands how to motivate individuals and teams to progress towards objectives.	Describes possible approaches such as identifying individual drivers, creating shared vision, shared goals, understanding appropriate incentives and consequences.	Demonstration of how such approaches have been deployed and the outcomes.	Review of success of motivation approaches.	Not applicable
12	Numeracy.	To be proficient in interpretation and manipulation of numbers.	Describes the necessity to have proficiency with numerical information to undertake a Six Sigma project.	A demonstration of the sense of the size of order of magnitude and the sound basis of these. To calculate accurately a range of calculations. To recognize when it is appropriate to use a computer and be able to do so effectively. To demonstrate that calculated results are reasonable. To demonstrate interpolations and predictions from the data in projects, e.g. graphs, diagrams, charts and tables.	To demonstrate that they have assessed numeracy skills in Six Sigma projects, identified gaps and ensured these are addressed appropriately.	Not applicable

Table A.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
13	Practical problem solving (opportunity realization).	The ability to differentiate between different types of problems/opportunities and choose appropriate approaches to address them. For example, acute/chronic, or special cause/common cause. To understand how and when to apply root cause analysis techniques to identify causal factors for process improvement.	To describe appropriate processes used to address different types of problems. Describes where this is appropriate.	To demonstrate the appropriate use of DMAIC and other problem solving methods, qualifying the selection. To complete process improvements having found the principal root cause and evaluated the costs associated with implementation compared to the costs of the problem itself. To demonstrate the successful choice and application of various practical root-cause identification and sorting techniques (e.g. the five 'whys', Pareto charts, fault tree analysis, cause and effect diagrams).	To review effectiveness of problem-solving within project team(s).	Not applicable
		The ability to put forward potential solutions and select and verify the most appropriate.	Describes solution generation process used and how proposals address the root causes identified. Describes process used to establish the criteria for selection. Describes the verification process for the chosen solution(s).	Demonstrates use of appropriate techniques to generate solution(s) to identified root cause(s), then sort, select and verify.	Demonstration of review and check of solution generation and selection process.	Not applicable
		To be able to implement solution(s) and verify benefit(s) delivered.	Describes how to check that the chosen solution will work in practice (e.g. trials, pilot, experimentation, etc.). Describes how to implement the chosen solution in practice. Describes how to check that the implementation has addressed the root cause and delivered benefit.	Demonstrates use of appropriate techniques to check that the solution(s) will work in practice, then implement and verify benefit achieved.	Demonstration of review and check of solution implementation and verification process.	Not applicable
14	Presentation and reporting skills.	The importance of communicating effectively to stakeholders through presentations and reports in order to drive the achievement of project objectives.	Describes effective ways to structure presentations and reports to meet required purposes with the expected audience.	To have demonstrated the planning and delivery of presentations and reports to different audiences.	To have measured the effectiveness of these presentations and reports.	Not applicable

Table A.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
15	Process thinking skills.	The need to define the scope and ownership of a process. Planning and managing available resources and process activity in support of objectives using measurement to achieve outcomes.	To describe the processes and/or systems in which the Black Belt and/or Black Belt project operates. To describe what constitutes good process management skills.	Evidence of using process thinking techniques such as SIPOC.	Evidence of reviewing use of process analysis techniques. To describe how skills gaps in process management may impact process performance.	Not applicable
16	Project management.	Managing a finite-time improvement activity with a defined group of people. Coordinating their activities to meet the phase and overall requirements.	Describes what constitutes good project management skills.	To have demonstrated the effective management of a Six Sigma project.	To have reviewed and managed delivery of key project metrics such as time cost and resource.	Not applicable
17	Risk analysis and management.	To understand the concept of risk and how to manage it in relationship to a Six Sigma project.	Describes what is meant by risk and how risks are evaluated and prioritized. Explains how risks should be proactively managed in pursuit of project objectives.	To have demonstrated the identification of risk. To have demonstrated how to quantify and prioritize risk, e.g. through use of FMEA.	To have demonstrated how risk has been managed.	Not applicable
18	Self-review and development.	To be able to understand own strengths and areas requiring development.	To describe own strengths and plans for self-development.	To have demonstrated self-review and suitable actions taken.	Not applicable	Not applicable
19	Six Sigma tools.	To understand the application of Six Sigma tools and techniques (refer to ISO 13053-2).	Describes the use and application of these techniques.	To have demonstrated the correct selection and application of appropriate Six Sigma tools and techniques in previous projects.	To review the use of suitable techniques.	Not applicable
20	Stakeholder management.	To have knowledge of stakeholder management techniques in pursuit of operational goals.	Describes types of stakeholder and appropriate techniques for stakeholder management.	To have demonstrated proactive and continual assessment of stakeholders' status in pursuit of operational goals.	Not applicable	Not applicable
21	Statistical techniques.	To understand statistical techniques and methods and use appropriately.	Describes categories of statistical techniques for process improvement such as the following: descriptive statistics, inferential statistics, exploratory data analysis (EDA).	To demonstrate the appropriate application of statistical techniques and methods in process improvement.	Review the use of statistical techniques in process improvement.	Not applicable

Table A.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
22	Statistical software use.	To have knowledge of the application and capabilities of their statistical software tool and situations when it is appropriate to use it.	Describes the use and capabilities of one statistical software package.	To demonstrate proficiency in at least one statistical software package currently available, including the sense-checking and presentation of analysis results.	Not applicable	Not applicable
23	Sustainability and control.	To understand the concept of control in a Six Sigma project.	Describes the importance of sustainability of implemented solution.	Demonstrates effectiveness of steps taken to ensure performance of improved process is sustained over time.	Reviews the control phase of DMAIC projects.	Not applicable

A.3 Master Black Belt

The role of the Master Black Belt is to support the Black Belts in the application of the DMAIC methodology and the selection and use of the tools and techniques required. In particular, the Master Black Belt will

a) lead improvement projects as required,

b) determine if any training activities are appropriate and effective,

c) provide training in a number of the tools and techniques (described in Table A.3 and in ISO 13053-2) associated with Six Sigma to Black Belts and Green Belts as required,

d) assist in the identification of suitable improvement projects,

e) assist in the determination of the scope of the selected improvement project,

f) assist in periodic reviews of the improvement projects,

g) provide 'internal' consultancy in advanced statistics,

h) provide support so that improvements identified within the nominated projects are realized and maintained, and

i) coach and mentor the Black Belts in the application of the DMAIC methodology and the selection and use of the tools and techniques required.

Table A.3 — Six Sigma — Master Black Belt competencies

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
1	Organizational benefits identification and prioritization.	Identification of the importance of using quantified organizational benefits or goals to guide project selection.	The appropriate identification of the organization's opportunities, the benefits of removing concerns and the relationship to an organization's organizational goals and how project/problem selection relates to these goals.	Demonstrates that the selection of each project is in agreement with these goals and objectives.	Demonstrates the appropriate quantification and monitoring of the alignment between the benefits from projects and organizational goals.	Demonstrates delivery of training on benefits identification, quantification and management which meet the organizational needs.

Table A.3 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
		Selection and use of an appropriate prioritization approach.	Describes appropriate prioritization approaches and techniques and their use.	Demonstrates correct selection and use of prioritization techniques such as the following: prioritization matrices; multi-voting techniques; strategy grids.	Demonstrates monitoring and maintenance of project priorities and their alignment with organizational priorities.	Demonstrates delivery of training on prioritization methods and techniques which meet the organizational needs.
2	Organizational process improvement.	Appropriate use of Six Sigma to support organizational strategy.	Describes the origins of Six Sigma. Describes when and where Six Sigma would be an appropriate approach for process improvement.	Demonstrates the impact that Six Sigma has had on the organization.	Demonstrates the deployment of Six Sigma process improvement programme to improve performance.	Demonstrates training sessions on organizational process improvement methodologies and their integration and relationship with Six Sigma.
		Knowledge of different approaches and their expected effects to enable appropriate selection and application of an integrated approach.	Describes other applicable process improvement methodologies and how they could be used together.	Demonstration of the appropriate selection use of other approaches.	Demonstration of the integration between various organizational process improvement methodologies as appropriate.	Not applicable
		Extension of strategic view of process improvement into the value chain beyond the organization's boundaries (customers/suppliers/partners).	Describes how the whole value chain will benefit from holistic approach to process improvement.	Demonstrates consideration of opportunities in the extended value chain for holistic improvement.	Evidence of structured approach to process improvement in the extended value chain (customers/suppliers/partners).	Evidence of training others in the application of process improvement methods in the value chain (customers/suppliers/partners).
3	Change management.	Importance of using a coherent approach to change management.	Describes interaction between stakeholders and change process and the mutual impact of one on the other.	Demonstration of the identification of key stakeholders and the use of coherent approach to progress change.	Demonstration of contribution to the initiation, execution and embedding of change in the organization. Development and maintenance of an action plan to progress change.	Delivery of training on change management approaches including stakeholder management.
4	Leadership development in self.	Importance of developing leadership skills in self.	Describes leadership development including the following, as appropriate: self-assessment, importance of coaching, importance of mentoring, personal development plans.	Demonstrates identification of any gaps in required own competencies to progress change and suggestions made for appropriate action.	Not applicable	Not applicable

Table A.3 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
5	Leadership development in others.	Importance of leadership development in others. (See also Competency 20).	Describes leadership development including the following, as appropriate: assessment, coaching, mentoring, personal development plans.	Demonstrates identification of any gaps in required competencies to progress change, in individuals, teams or in organization, and suggestions made for appropriate action. Demonstrates coaching and mentoring of other belts. Demonstrates the development of other coaches ('coach' coaches).	Demonstration of the management of leadership programme to progress on filling competencies gap.	Delivery of training on leadership development.
6	Data acquisition for analysis.	Identifying and actively seeking appropriate information in various forms, ensuring the validity of such information and transforming into data which can be analysed in Competency 22.	Describes where data might be found and possible formats (structured and unstructured). Describes how to verify and validate information and manipulate data into appropriate formats.	The demonstration of a plan to acquire appropriate data, the verification and validation of such data, the manipulation of data into the appropriate format to satisfy project objectives. Critical analysis of existing data streams and suggestions of possible improvements.	Demonstration of the management of entire process for data acquisition process, verification and validation and the manipulation of the data.	Delivery of training session on data acquisition, creation, verification and validation and manipulation methods and techniques.
7	Creativity thinking.	To apply creative thinking approaches to define and pursue project objectives.	Describes the different thinking modes (e.g. creative and analytical, divergent and convergent) and suggest appropriate techniques to support creative thinking.	Evidence of use of this approach during project and critical analysis of suitability of chosen approach.	Demonstrates that creative thinking is systematically used in Six Sigma process improvement activity.	Delivery of training session on different thinking modes.
8	Customer focus.	To understand how and why to listen to and capture the 'voice of the customer' (VOC).	Describes the different types of customers. To understand the link between the VOC and the requirements of other stakeholders, e.g. operations and management.	Demonstration of the application of 'customer focus' approaches. For example, through the correct use of the Kano model, 'house of quality' and/or 'critical to' (CT) matrices.	Demonstration of the management, continuous monitoring and maintenance of the VOC.	Demonstration of training session on VOC and its relationship to requirements management.
9	Decision making and taking.	To recognize the importance of decision-taking and identify the decision-takers.	Describes circumstances where decision-taking is required and the responsibility for these decisions.	Demonstration of the correct usage of the key elements of decision-taking (individual or group).	Demonstrates that a well-structured decision-making process is systematically used in Six Sigma process improvement activity.	Demonstration of training sessions for decision making process methods and techniques (individual and group).
10	Interpersonal and team leadership skills.	To support effective interaction with others including stake holders. To work effectively with others to achieve objectives.	To describe the factors affecting team effectiveness, including factors such as leadership style, team roles, personality types.	Demonstration that the Master Black Belt has assessed Six Sigma project teams from the viewpoint of the interpersonal skills deployed, taken appropriate action and demonstrated a positive effect.	Demonstration that the MBB evaluates the need for a programme to monitor and develop team leadership skills in Six Sigma projects and, where appropriate, contributed to it.	Demonstration that such skills are part of planned training programmes.

Table A.3 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
11	Motivating others.	Understand how to motivate individuals and teams to progress towards objectives.	Describes possible approaches such as identifying individual drivers, creating shared vision, shared goals, understanding appropriate incentives and consequences.	A demonstration of how such approaches have been deployed and the outcomes.	Review of success of motivation approaches.	Not applicable
12	Numeracy.	To be proficient in interpretation and manipulation of numbers.	Describes the necessity to have proficiency with numerical information to undertake a Six Sigma project.	Demonstration of the sense of the size of order of magnitude and the sound basis of these. To calculate accurately a range of calculations. To recognize when it is appropriate to use a computer and be able to do so effectively. To demonstrate that calculated results are reasonable. To demonstrate interpolations and predictions from the data in projects, e.g. graphs, diagrams, charts and tables.	To demonstrate that they have assessed numeracy skills in Six Sigma projects across the organization, identified gaps and ensured these are addressed appropriately. If such gaps are found in the extended value chain then the MBB should have made appropriate recommendations.	Demonstration that such skills are part of planned training programmes.
13	Practical problem solving (opportunity realization).	The ability to differentiate between different types of problems/opportunities and choose appropriate approaches to address them. For example, acute/chronic, or special cause/ common cause.	To describe appropriate processes used to address different types of problems.	To demonstrate the appropriate use of DMAIC and other problem solving methods, qualifying the selection.	Demonstration of the management and monitoring of DMAIC implementations and other problem solving methods.	Delivery of training on DMAIC and other problem solving methods.
		To understand how and when to apply root cause analysis techniques to identify causal factors for process improvement.	Describes where this is appropriate.	To complete process improvements having found the principal root cause and evaluated the costs associated with implementation compared to the costs of the problem itself. To demonstrate the successful choice and application of various practical root-cause identification and sorting techniques (e.g. the five 'whys', Pareto charts, fault tree analysis, cause and effect diagrams).	Demonstrates that root cause analysis is systematically used in Six Sigma process improvement activity.	Delivery of training on root cause analysis techniques and methods.

Table A.3 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
		The ability to put forward potential solutions and select and verify the most appropriate.	Describes solution generation process used and how proposals address the root causes identified. Describes process used to establish the criteria for selection. Describes the verification process for the chosen solution(s).	Demonstrates use of appropriate techniques to generate solution(s) to identified root cause(s), then sort, select and verify.	Demonstration of review and check of solution generation and selection process.	Delivery of training on ideas and solution generation and selection.
		To be able to implement solution(s) and verify benefit(s) delivered.	Describes how to check that the chosen solution will work in practice (e.g. trials, pilot, experimentation, etc.). Describes how to implement the chosen solution in practice. Describes how to check that the implementation has addressed the root cause and delivered benefit.	Demonstrates use of appropriate techniques to check that solution(s) will work in practice, then implement and verify benefit achieved.	Demonstration of review and check of solution implementation and verification process.	Delivery of training and solution implementation and verification.
14	Presentation and reporting skills.	The importance of communicating effectively to stakeholders through presentations and reports in order to drive the achievement of project objectives.	Describes effective ways to structure presentations and reports to meet required purposes with the expected audience.	To demonstrate the planning and delivery of presentations and reports to different audiences and to measure the effectiveness of these presentations and reports.	Demonstration that the MBB evaluates Six Sigma presentations and reports and, where necessary, recommends appropriate improvement activity.	Delivery of training on presentation and reporting techniques.
15	Process thinking and process analysis skills.	The need to define the scope and ownership of a process. Planning and managing available resources and process activity in support of objectives using measurement to achieve outcomes.	To describe the processes and/or systems in which the Master Black Belt operates and the impacts Six Sigma project may have. To describe what constitutes good process management skills. To describe how skills gaps in process management may impact process performance.	Demonstration of gap analysis incorporating process measurement and base lining.	Not applicable	Demonstration of training sessions for process management frameworks.
16	Project management.	Managing a finite-time improvement activity with a defined group of people. Coordinating their activities to meet the phase and overall requirements.	Describes what constitutes good project management skills.	To demonstrate the effective management of a Six Sigma project.	Demonstration of management of Six Sigma projects portfolio. Demonstration of monitoring and monitoring of progress of multiple Six Sigma projects.	Demonstration of training sessions on the management of Six Sigma projects and their particularities.

Table A.3 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency (evidence of training one or more of the following)
17	Risk analysis and management.	To understand the concept of risk and how to manage it in relationship to a Six Sigma project.	Describes what is meant by risk and how risks are evaluated and prioritized. Explains how risks should be proactively managed in pursuit of project objectives.	To have demonstrated the identification of risk. To have demonstrated how to quantify and prioritize risk. To have demonstrated how risk has been managed. To have demonstrated should be learning from past experience and building into risk management/register.	Demonstration of risk management and continuous monitoring and maintenance.	Demonstration of training sessions on risk analysis and management methods, including identification, quantification, prioritization and monitoring
18	Self-review and development.	To be able to understand own strengths and areas requiring development.	To describe own strengths and plans for self-development.	To have demonstrated self-review and suitable actions taken.	Not applicable	Not applicable
19	Six Sigma tools.	To understand the application of Six Sigma tools and techniques (refer to ISO 13053-1 and ISO 13053-2 for appropriate techniques).	Describes the use and application of these techniques.	To have demonstrated the correct selection and application of appropriate Six Sigma tools and techniques in previous projects.	Not applicable	Demonstration of training sessions for Six Sigma tools both from theory and practice perspectives.
20	Stakeholder management.	To have knowledge of stakeholder management process and techniques in pursuit of operational goals.	Describes types of stakeholder and appropriate techniques for stakeholder management.	To have demonstrated proactive and continual assessment of stakeholders' status in pursuit of operational goals.	Demonstration of continuous stakeholder management and monitoring using appropriate techniques.	Demonstration of training sessions on stakeholder's management techniques and methods.
21	Statistical techniques.	To understand statistical techniques and methods and use appropriately (refer to ISO 13053-1 and ISO 13053-2 for appropriate techniques).	Describes the differences between the following: descriptive statistics, inferential statistics, exploratory data analysis (EDA).	To have demonstrated the correct application of statistical techniques and methods in the following: descriptive statistics, inferential statistics, exploratory data analysis (EDA).	Not applicable	Demonstration of training sessions for statistical techniques both from theory and practice perspectives.
22	Statistical software use.	To have knowledge of the application, capabilities and limitations of their statistical software tool and situations when it is appropriate to use it.	Describes the use and strengths of one statistical software package, including any limitations.	To have demonstrated proficiency in at least one statistical software packages currently available, including the sense-checking and presentation of analysis results.	Not applicable	Demonstration of training sessions of at least one statistical software package in combination with statistical techniques. (see Competency 21).
23	Sustainability and control.	To understand the concept of control in a Six Sigma project.	Describes the importance of sustainability of implemented solution.	Demonstrates steps taken to ensure performance of improved process is sustained over time.	Reviews on-going monitoring of processes and implementation of control processes.	Delivers training on control and sustainability.

Annex B
(normative)

Lean

B.1 Lean practitioner

The role of the Lean practitioner is to participate in Lean improvements in the organization. These improvement activities will usually be within the Lean practitioner's usual field of employment and operation. In so doing, the Lean practitioner will

a) work to implement improvements in the local area,

b) use workplace layout techniques to improve process flow,

c) be required to lead improvement activities and quantify benefits delivered,

d) coach team members on process improvement methods and activities, and

e) run training sessions on Lean techniques.

Table B.1 — Lean — Lean practitioner competencies

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
1	Benefits of Lean.	Understand expected Lean benefits.	Can explain the benefits of Lean to a process, including such ideas as reduced lead time, cycle time, operating expense. Increased capacity, productivity, quality.	Not applicable	Not applicable	Communicates the benefits of Lean to a team working in an improvement activity, e.g. reduced lead time, cycle time, operating expense. Increased capacity, productivity, and quality.
1.1	Applying the knowledge in practice.	Can translate benefits to the situational environment. Can begin to demonstrate using data how much improvement will be achieved.	Explains how Lean can benefit the specific environment and/or sector, what will/does Lean deliver to the individual's organization and its customers/ stakeholders.	Evidence of delivering quantified benefits to the organization through Lean approaches. For instance, improved cycle times, reduced rework increased throughput, reduced WIP or defects.	Manages resource in a process to deliver the customer demand.	Not applicable
2	Lean principles.	Understands the Lean principles.	Can describe Lean principles define value, understand the value stream, flow, pull, strive for perfection.	Evidence of applying Lean principles to a specific situation.	Manages processes and/or teams using Lean principles.	Not applicable
2.1		Understanding value.	Can define value in the eyes of the customer in terms of a product or a service.	Has evidence of identifying the customer(s) of the process and their requirements (value). For example, customer interviews or surveys or house of quality.	Not applicable	Not applicable

Table B.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
2.1.1		Non-value-added (waste, Muda).	Can identify and describe value-added (VA) and non-value-added (NVA) activities, e.g. using an acronym such at TIM WOOD, WORMPIT, DOWNTIME, etc.	Evidence of identifying non-value-add activities, prioritising (for example using Pareto charts) and eliminating as appropriate, using metrics to quantify improvement.	Not applicable	Not applicable
2.2		Understanding the value stream.	Can describe the current value stream and the boundaries of implementation for a process.	Evidence of creating a value stream map (VSM) or material and information flow map from a live process, populating with appropriate stages, flows and numbers. Evidence of creating a future state VSM or material and information flow map.	Can critique a value stream map or material and information flow map of a live process. Interpret the differences between a current state and a future state VSM or material and information flow map.	Not applicable
2.3		Understanding flow.	Can describe flow and the implication of the theory of constraints.	Evidence of improving process flow, for example, identification and removal of bottlenecks or laying out the workplace to improve flow.	Not applicable	Not applicable
2.4		Understanding pull.	Can describe the concept of 'pull' (as opposed to 'push').	Evidence of creating 'pull' in a process. Uses kanban techniques to transmit the signal from a customer to the process.	Not applicable	Not applicable
2.5		Understanding what it means "to strive for perfection".	Can describe striving for perfection: continually seeking opportunities to improve, making sustained improvements, in quality, cost and delivery.	Not applicable	Not applicable	Not applicable
2.5.1		Process improvement.	Not applicable	Has evidence of process improvement.	Not applicable	Not applicable
2.5.2		Standardization of improvement into process.	Not applicable	Has evidence of standardizing improvements into the process.	Not applicable	Not applicable
2.5.3		Search for new opportunities to improve.	Not applicable	Has evidence of seeking new improvement opportunities, for example, through team suggestions or kaizen events.	Not applicable	Not applicable
3	Stakeholder management.	To have knowledge of stakeholder management techniques in pursuit of operational goals.	Describes types of stakeholder and appropriate techniques for stakeholder management.	Not applicable	Not applicable	Not applicable

Table B.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
3.1	Communication skills.	Understands importance, uses and builds skills in others.	Can describe the importance of communication skills in Lean implementations and consequences of poor communication.	Has evidence of the use of appropriate communication approaches with teams and individuals.	Not applicable	Not applicable
3.2	Change at individual level.	Can describe change curve.	Can explain change curve thinking and its effect on any change including Lean implementation.	Not applicable	Not applicable	Not applicable
3.3	Change at organizational level.	Can describe cultural change.	Can explain the impact on the organizational culture of Lean process improvement.	Not applicable	Not applicable	Not applicable
4	Measurement of process performance.	Selecting and collecting data for process improvement.	Can describe the factors which are important in data collection, for example, sample size, sample timing, sampling method,	Has evidence of selection and collection of appropriate data.	Not applicable	Not applicable
4.1		Using and communicating appropriate metrics used in Lean implementations.	Can describe the metrics used in current state diagnosis and workload planning, how to collect and analyse the required data, e.g. customer demand, cycle times, takt, resource requirements, defect rate, failures, rework.	Has evidence of calculation of appropriate metrics and their use to improve processes and quantify improvements.	Not applicable	Not applicable
5	Creativity thinking.	Understand the need to apply creative thinking approaches to pursue Lean objectives.	Describes the different thinking modes (e.g. creative and analytical).	Evidence of use of this approach.	Not applicable	Not applicable
6	Visual management and control.	To be able to use appropriate visual management techniques to improve processes and communicate information.	Can describe what is meant by visual management, and what effects can be expected.	Has evidence of implementing visual management in a process.	Not applicable	Not applicable
7	Workplace optimization.	To be able to optimize the content and physical layout of a workspace for a process.	Can describe the effect on efficiency of physical layout of a process.	Has evidence of using appropriate techniques to improve workspaces. For example, 5S, spaghetti diagrams.	Not applicable	Not applicable
8	Team based process improvement.	Maximizing the use of team skills in process improvement.	Can explain the importance of engaging all employees in improvement activity.	Evidence of analysing team dynamics (for example, Belbin role analysis) and taking appropriate action (e.g. role allocation).	Not applicable	Not applicable

Table B.1 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
9	Implementing Lean.	Implementation roadmap.	Can describe a structured approach for implementing Lean improvements in a process, for example, plan do check act (PDCA) or Scope diagnose design implement sustain.	Evidence of implementations delivered using a structured approach.	Not applicable	Not applicable
9.1		Implementation management.	Can describe the importance of adhering to a planned schedule of actions in the organization (e.g. use of a tactical implementation plan).	Has evidence of drawing up and using a plan for the implementation of changes.	Evidence of managing the activity and time frame of changes in a process.	Not applicable
10	Analysis of data.	To be able to select and apply the correct tools for analysis.	Can describe different tools and when they are used (for example, scatter plots, histograms, and run charts).	Has evidence of the correct selection and use of appropriate analysis techniques.	Not applicable	Not applicable
11	Risk analysis.	To understand the concept of risk in a Lean activity.	Describes what is meant by risk and how it applies to Lean implementations.	Demonstration of risk identification in a process change.	Not applicable	Not applicable
12	Sustainability.	To understand the concept of sustainability.	Describes the importance of sustainability of improvement.	Demonstrates appropriate approaches to ensure sustainability.	Not applicable	Not applicable
13	Motivating others.	Understands how to motivate individuals and teams to progress towards objectives.	Describes possible approaches such as identifying individual drivers, creating shared vision, shared goals, understanding appropriate incentives and consequences.	Demonstration of how such approaches have been deployed and the outcomes.	Not applicable	Not applicable

B.2 Lean leader

The role of the Lean Leader is to drive improvements in the organization. These improvement activities will often be within the Lean leader's usual field of employment and operation. In so doing, the Lean leader will

a) work with the local 'line management' to identify and drive improvement within the local environment,

b) use takt times and cycle times to identify appropriate resource requirements,

c) be required to lead improvement activities and quantify benefits delivered,

d) coach Lean practitioners on process improvement methods and activities, and

e) run training sessions on Lean techniques.

Table B.2 — Lean — Lean leader competencies

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
1	Understanding and communicating expected benefits of Lean.	Able to explain the expected benefits of using Lean (overall/general terms).	Can explain the benefits of Lean for value streams and in organizations. Including such concepts as reduced lead time, cycle time, operating expense. Increased capacity, productivity, and quality.	Not applicable	Has communicated effectively to a team working in an improvement activity the benefits of Lean.	Evidence of training Lean benefits.
	History of Lean.	Has knowledge of the origins and development of Lean approaches.	Can describe the origins of Lean.	Not applicable	Not applicable	Evidence of training the history of Lean.
1.1	Applying the knowledge in practice.	Can translate benefits to the specific situational environment. Identifying the issues in real organizations which affect quality, cost and delivery, and designing improvements.	Explains how Lean can benefit the specific environment or sector, what will/does Lean deliver to the individual's organization and its customers/stakeholders.	Has evidence in a specific situation of diagnosing the areas where benefits will be delivered and to which stakeholders. Evidence of using takt times, cycle times and staffing requirements. Can identify best repeatable times for processes operations.	Evidence of managing others to apply Lean thinking. Can explain how Lean can be applied to the specific environment or sector; what will/does Lean deliver to the individual's organization and its customers. Can understand and employ takt times, cycle times and staffing requirements. Can understand best repeatable times and use to budget resource requirements.	Evidence of presenting the local application of Lean approaches in the organisation.
		Can demonstrate using data how much improvement will be achieved.	Can describe how to use data to quantify improvements.	Has used data appropriately to demonstrate improvements.	Has evidence of communicating benefits using appropriate data.	Not applicable
2		Can describe the Lean principles.	Can describe Lean principles define value, understand the value stream, create flow, create 'pull', strive for perfection.	Can apply Lean principles to a specific situation.	Can apply Lean principles to a strategic situation.	Not applicable
2.1		Value.	Defines value in the eyes of the customer, the transformation of an unsatisfied need to a satisfied need, can be a product or a service. Can identify and describe value-added activities (VA), non-value-added (NVA) process issues such as waste, unevenness, overburden (Muda, Mura, Muri) and necessary non-value-added activities (NNVA). Acronyms such as TIM WOOD, WORMPIT, DOWNTIME may be useful in waste identification.	Has evidence of identifying and eliminating waste from processes.	Can manage value in the eyes of the customer, identifying what is value add and what is non-value add.	Not applicable

Table B.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
2.2		Value stream.	Understands the value stream and the boundaries of implementation. The value stream defining the stages of transformation and the wastes along the journey, usefully described by a value stream map or material and information flow map.	Has evidence of building a current state value stream map or material and information flow map from a live process, populating with appropriate stages, flows and numbers, building a future state value stream map.	Manages the value stream and can follow and critique a value stream map or material and information flow map of a live process.	Training others in value stream thinking, including how to create a value stream map or material and information flow map.
2.3		Flow.	Creates flow, removes the barriers, identified through seven wastes (Muda), removal of work in progress between process stages.	Creates flow, can identify and remove the barriers, identified through seven wastes (Muda), removing work in progress between process stages and laying out the workplace to improve flow; uses techniques such as value stream maps/material and information flow maps, spaghetti diagrams, work combination charts, workload levelling, Ohno circles to identify and remove Muda (waste).	Flow, can identify and manage the removal of the barriers identified through seven wastes (Muda), improving flow.	Not applicable
			Can describe how to use workload levelling techniques to improve flow.	Can demonstrate use of workload levelling techniques to improve flow.	Has evidence of review of process flow to identify where workload levelling would be appropriate.	Not applicable
2.4		Pull.	Can describe 'pull', giving the customer what they need, when they need it. A familiar term would be kanban relating to a signal from a customer commencing the transformation process.	Can demonstrate creation of pull in a process, giving the customer what the need, when they need it. Uses kanban techniques to transmit the signal from a customer o the process.	Can manage 'pull', giving the customer what they need, when they need it. Deploys kanban techniques to transmit the signal from a customer to the process.	Not applicable
2.5		Can describe what it means "to strive for perfection".	Can describe the strive for perfection, starting from a standardized process, making continual improvements, in quality, cost and delivery, relentless desire to remove waste from the current state and to sustain improvements, seeking an improved next current state every day.	Has applied standard work to processes, making repeated improvements, in quality, cost and/or delivery, relentless removal of waste from the current state seeking an improved next current state every day.	Strive for perfection, demonstrates continual improvements, in quality, cost and delivery, relentless removal of waste from the current state seeking an improved next current state every day.	Not applicable
3	Stakeholder management.	To have knowledge of stakeholder management techniques in pursuit of operational goals.	Describes types of stakeholder and appropriate techniques for stakeholder management.	To have demonstrated proactive and continual assessment of stakeholders' status in pursuit of operational goals.	Demonstration of continuous stakeholder management and monitoring using appropriate techniques.	Demonstration of training sessions on stakeholder's management techniques and methods.

Table B.2 *(continued)*

Index	Competency	Performance criteria	Suggested evidence of understanding the competency	Suggested evidence of applying the competency	Suggested evidence of managing the competency	Suggested evidence of training the competency
3.1	Communication skills.	Understands importance, uses and builds skills in others.	Can describe the importance of communication skills in Lean implementations and consequences of poor communication.	Has evidence of the use of appropriate communication approaches with teams and individuals.	Has evidence of planning, initiating and progressing appropriate communications.	Trains communication approaches.
3.2	Change effects on individuals.	Can describe change curve.	Can explain change curve thinking and its effect on any change including Lean implementation.	Has evidence of analysis of situation based on understanding of change process, e.g. transition curves/change curves to help explain attitudes and/or actions of self or team.	Has evidence of analysis of situation and planning of actions based on understanding of change process, e.g. transition curves/change curves.	Trains others in the importance of the transition process.
3.3	Change at organizational level.	Importance of cultural change.	Can explain the importance of cultural change in Lean implementations, rather than individual change or process change.	Written evidence of identification of analysis of cultural state and identification of cultural issues which need to be addressed.	Written evidence of identification of possible issues, of challenges encountered in practice and any plan of action required as a result. Evidence of action taken, including monitoring of effectiveness and refinement of plans.	Trains others in the need for cultural change.
4	Measurement of process performance.	Selecting and collecting data for process improvement.	Can describe the factors which are important in data collection, for example, sample size, sample timing, sampling method.	Has evidence of selection and collection of appropriate data.	Not applicable	Trains others in the appropriate collection methods for data.
4.1		Importance of communicating appropriate metrics used in Lean implementations.	Can describe the metrics used in current state diagnosis and workload planning, e.g. customer demand, cycle times, takt, resource requirements, defect rate, failures, rework.	Has evidence of calculation of appropriate metrics and their use to improve processes and quantify improvements.	Manages processes or teams using appropriate metrics. Communicates such metrics appropriately to teams in visual manner.	Trains others in the appropriate use of Lean metrics.
5	Creativity thinking.	Understands the need to apply creative thinking approaches to pursue Lean objectives.	Describes the different thinking modes (e.g. creative and analytical).	Evidence of use of this approach.	Not applicable	Trains others in creativity thinking approaches.
6	Visual management and control.	To be able to use appropriate visual management techniques to improve processes and communicate information.	Can describe what is meant by visual management and what effects can be expected.	Has evidence of implementing visual management and/or control in a process.	Reviews effectiveness of visual management and adjusts as appropriate.	Trains others in the appropriate use of visual management and control.
7	Workplace optimization.	To be able to optimize the content and physical layout of a workspace for a process.	Can describe the effect on efficiency of physical layout of a process.	Has evidence of using appropriate techniques to improve workspaces, for example, 5S, spaghetti diagrams.	Reviews effectiveness of workplace optimization and adjusts appropriately.	Trains others in workplace optimization techniques.