DRIVES

Development and Research on Innovative Vocational Education Skills

Working in Automotive

Job Role Skill Set

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SKILLS SET WORKING IN AUTOMOTIVE

Report Title:	Skills set Working in Automotive (Automotive Engineer)		
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www.project-drives.eu

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1 INTRODUCTION

1.1 OBJECTIVE

The objective of this deliverable is to provide an introduction to described Job Role within the applied skills definition model.

1.2 PURPOSE OF THE DELIVERABLE

The purpose of this deliverable is to define skills definitions of the Working in Automotive (Automotive Engineer) job role within the ECQA/LSSA skills definition model.

1.3 SCOPE OF THE DELIVERABLE

The deliverable contains

- Description of the content of the Job Role
- Description of used Skill Sets and skills definitions, coverage of Qualification Schemas

The deliverable does not cover:

- Course development, as this will be done after the skill definitions clearly outlined the set of required courses.

2 ECQA SKILLS DEFINITION MODEL

A skills definition contains the following items:

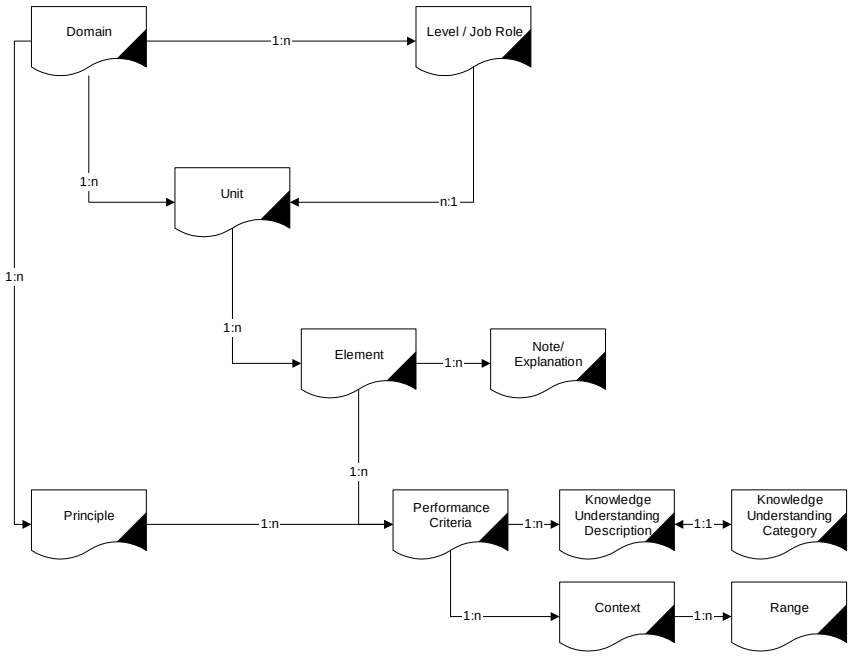


Figure 1 The Skill Definition Model (1:n = one to many relationship)

Context: A category of ranges; it represents some terminology used in a performance criterion that consists of different context, conditions or circumstances. A participant must be able to prove competence in all the different circumstances covered by the context.

Domain: An occupational category, e.g. childcare, first level management or software engineering.

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.

Evidence: Proof of competence.

Knowledge and understanding category: A category of knowledge and understanding descriptions.

Knowledge and understanding description: A description of certain knowledge and understanding. To be judged competent in a unit a participant must prove to have and to be able to apply all the knowledge and understanding attached to it.

NVQ (UK based): The National Vocational Qualification standard of England, Wales and N. Ireland.

Performance criterion: Description of the minimum level of performance a participant must demonstrate in order to be assessed as competent. A performance criterion may have relevant contexts.

Principle: A statement of good intentions; it underpins all competent domain practice.

Range: Description of a specific circumstance and condition of a performance criterion statement.

Qualification: The requirements for an individual to enter, or progress within a certain occupation.

Job Role: A certain profession that covers part of the domain knowledge. E.g. domain = Automotive engineering, Job role = Working in automotive.

Unit: A list of certain activities that have to be carried out in the workplace. It is the top-level skill in the UK qualification standard hierarchy and each unit consists of a number of elements.

The rationales for developing the ECQA skills definition model is based on the skills definition proposed by the DTI (Department of Trade and Industry) in the UK for the NVQ (National Vocational Qualification) standards. These models have been re-used and slightly modified by other countries when they started employing skill cards [1], [2].

ECQA standards are used to describe the skills sets delivered within the DRIVES project (www.project-drives.eu). Further description and rationales are attached in annexes of this document. The ECQA structure was mapped in DRIVES project to DRIVES Reference and Recognition Framework with the links to ESCO[7], EQF[8], ECTS[9] and ECVET[10]. See more in deliverable DRIVES-D4.1.1 Reference and Recognition Framework – Analysis.pdf (www.project-drives.eu).

3 INTRODUCTION

Acronym: AE.U1
Title: Introduction
Description: The Unit 'Introduction' is an introduction to the automotive sector in terms of its history, evolution and future, as well as key terms and key challenges. Characteristics of the sector are discussed, in particular the supplier structure, product and releases, and the importance of customer focus. Typical automotive engineering job roles are introduced to help learners orient themselves towards specific fields of interest. This unit provides an overview of a small selection of the most important legal documents, regulations and standards relevant for the sector. The importance and essence of processes and process thinking in the automotive sector is also elaborated in this introductory module. The increasing dominance of mechatronic subsystems in modern vehicles implies an outstanding of the role of multidisciplinary challenges in engineering organizations and processes. This is also discussed in this introductory module, as is the important concept of simultaneous engineering.

3.1 AUTOMOTIVE INDUSTGRY

Acronym: AE.U1.E1
Element Title: Automotive Industry
Element Note: The Learning Element 'Automotive industry' explains the most important moments in the history and evolution of the automotive as well as the future and key challenges. Also the structure of the supply chain and the most important differences to other branches will be discussed.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U1.E1.PC1	Recall the history and developments within the automotive industry. Bloom: Remember
AE.U1.E1.PC2	Recall automotive definitions, terms, and abbreviations.Bloom: Remember
AE.U1.E1.PC3	Describe the supplier structure of the automotive industry. Bloom: Understand.
AE.U1.E1.PC4	Understand the key challenges of the automotive industry. Bloom: Understand.
AE.U1.E1.PC5	Understand the differences with others branches (e.g. aerospace, medical, defense, consumer electronics, etc.). Bloom: Understand.

Tabel 1 - Performance Criterias for the Element AE.U1.E1

3.2 CHARACTERISTICS IN THE AUTOMOTIVE

Acronym: AE.U1.E2
Element Title: Characteristics in the automotive
Element Note: The Learning Element 'Characteristics in the Automotive' explains the customer focus and the formal procedures like product and process releases and change notifications.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U1.E1.PC1	Understand the product and process release and change notifications within the automotive industry. Bloom: Understand
AE.U1.E1.PC2	Recall the role of customers' expectations and specifications. Bloom: Understand
AE.U1.E1.PC3	Understand the engineering job roles in the automotive industry and their differences. Bloom: Understand
AE.U1.E1.PC4	Identify specification documents (e.g. customers' specifications, software requirements, etc.). Bloom: Understand

Tabel 2 - Performance Criterias for the Element AE.U1.E2

3.3 LEGISLATION, REGULATIONS AND STANDARDS

Acronym: AE.U1.E3
Element Title: Legislations, regulations and standards
Element Note: The Learning Element 'legislation, regulations, and standards' introduces the most relevant regulations, laws and directives for the automotive industry. It introduces the product liability and safety law and the homologation process and continues with the description of several international standards, starting with the most well-known and widely recognized ISO/TS 16949.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U1.E1.PC1	Identify and apply the legislation and regulations there are in the automotive industry. Bloom: Apply
AE.U1.E1.PC2	Identify and apply the existing norms and standards (e.g. ISO/TS 16949, ISO 26262, APQP, VDA, ISO/IEC 15504, etc.). Understand the key objectives and concepts underlying the several norms and standards, its complexity, and the relations between them. Bloom: Apply

Tabel 3 - Performance Criterias for the Element AE.U1.E3

3.4 PROCESS THINKING

Acronym: AE.U1.E4
Element Title: Process thinking
Element Note: The Learning Element 'Process Thinking' explains the different processes within automotive companies and the multidisciplinary approach.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U1.E1.PC1	Understand the primary process of a company. Bloom: Understand
AE.U1.E1.PC2	Understand the automotive process landscape. Bloom: Understand
AE.U1.E1.PC3	Understand the consequence(s) of changes on product and process. Bloom: Understand
AE.U1.E1.PC4	Understand the multidisciplinary and simultaneous engineering approaches. Bloom: Understand

Tabel 4 - Performance Criterias for the Element AE.U1.E4

4 PRODUCT AND PROCESS DEVELOPMENT

Acronym: AE.U2
Title: Product and process development
Description: The Unit 'Product and process development' focusses on selected engineering aspects of product and process development in the automotive sector. Departing from the explanation of the notion of the product life cycle and sustainability, a closer look is taken at the development phase of the product life cycle by discussing the development process, as well as the typical activities carried out in the context of this process. The notion of systems engineering is explained, as it is of particular importance in modern vehicles where system-level functions are implemented by numerous cooperating subsystems. The explanation of the V-cycle establishes the link between system-level and component-level development activities. Functional safety, i.e., the safe behavior of subsystems in case of failure, is discussed in the context of a module on risk management. This module also contains an introduction to FMEA, i.e., Failure Mode and Effect Analysis, which is one of the most important methods of risk management on both product and process levels in automotive.

4.1 PRODUCT LIFECYCLE MANAGEMENT

Acronym: AE.U2.E1
Element Title: Product lifecycle management
Element Note: The Learning Element 'Product Lifecycle Management' explains the significance of the product life cycle and its management for the product creation and support process. The relationship between product life cycle management and environmental sustainability is pointed out. A particular focus is directed on the engineering for the end-of-life as a key lever to increase sustainability.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U2.E1.PC1	Understand the life cycle at different levels (e.g. software, hardware, system, product, service, infrastructure, safety, security). Bloom: Understand
AE.U2.E1.PC2	Understand the complexity from designing until End-of-Life (EOL) of a vehicle. Bloom: Understand

Tabel 5 - Performance Criterias for the Element AE.U2.E1

4.2 ADVANCED PRODUCT AND QUALITY PLANNING

Acronym: AE.U2.E2
Element Title: Advanced product and quality planning
Element Note: The Learning Element 'Advanced Product Quality Planning' (APQP) explains the different phases within product and process development and their most important activities and tools used in these phases.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U2.E2.PC1	Understand the objectives of APQP, why and when it's used. Bloom: Understand

AE.U2.E2.PC2	Identify the different phases of APQP. Bloom: Understand

Tabel 6 - Performance Criterias for the Element AE.U2.E2

4.3 SYSTEMS ENGINEERING

Acronym: AE.U2.E3
Element Title: Systems engineering
Element Note: The Learning Element 'Systems Engineering' explains the essential automotive engineering principles, starting from a system level down to component level. It introduces the automotive development process and the most important related activities and concepts. A particular focus is made on the development of automotive subsystems containing electrics/electronics and software.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U2.E3.PC1	Understand the complexity of a vehicle and its systems. Bloom: Understand
AE.U2.E3.PC2	Understand Product Development Process, and V-Model. Bloom: Understand
AE.U2.E3.PC3	Understand the development lifecycle. Bloom: Understand

Tabel 7 - Performance Criterias for the Element AE.U2.E3

4.4 RISK MANAGEMENT

Acronym: AE.U2.E4
Element Title: Risk management
Element Note: The Learning Element 'Risk Management' describes risk management and risk management tools like functional safety hazard and risk analysis and FMEA. The element describes how to apply the FMEA and how to perform a functional safety hazard and risk analysis.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U2.E4.PC1	Understand the purpose of risk management. Bloom: Understand
AE.U2.E4.PC2	Motivate the risks and safety issues, taking in consideration the several systems in a vehicle and their interference. Understand the process FMEA and recall the process risks. Bloom: Apply
AE.U2.E4.PC3	Review Failure Mode Effects Analyses and diagnostic analysis. Understand functional safety principles. Understand the hazard and risk analyses based on ISO 26262 and IEC 61508. Bloom: Apply

Tabel 8 - Performance Criterias for the Element AE.U2.E4

5 PRODUCTION

Acronym: AE.U3
Title: Production
Description: The Unit 'Production' deals with the automotive production process, with a particular focus on the quality assurance measures based on Six Sigma principles. The key topics here include the Process Capability (a measure for the variation in the process) and Process Control, mainly based on statistical tools applied to data measured in the process. Since the suppliers have a key role in the automotive development and production process, the assurance of the quality they deliver is essential to the total quality management of the product creation process. This training element therefore discusses supplier control and assessment schemes, in particular Automotive SPICE ®, which is used by automotive OEMs to assess their suppliers' mechatronics development process quality worldwide. Change management is an important activity throughout the entire product creation process, because changes can happen at every moment.

5.1 PROCESS CAPABILITY

Acronym: AE.U3.E1
Element Title: Process capability
Element Note: The Learning Element 'Process capability' describes how to calculate the process capability and performance in relation to specification limits.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U3.E1.PC1	Understand the difference between special cause and common cause variation. Bloom: Understand
AE.U3.E1.PC2	Calculate and interpret process capability indices,: Cp and Cpk, to assess process capability. Bloom: Apply
AE.U3.E1.PC3	Calculate and interpret process performance indices,: Pp and Ppk., to assess process performance. Interpret the relationship between capability and performance indices. Bloom: Apply

Tabel 9 - Performance Criterias for the Element AE.U3.E1

5.2 PROCESS CONTROL

Acronym: AE.U3.E2
Element Title: Process control
Element Note: The Learning Element 'Process Control' describes different tools used for controlling processes, it explains how to perform measurement systems analyses and their control methods in order to identify out of-control situations and deviations over time.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to

AE.U3.E2.PC1	Apply measurement system analyses. Basics of Measurement System Analysis: calculate and interpret measurements and analyses (e.g. Gage R&R, Attribute Agreement Analysis report). Bloom: Apply
AE.U3.E2.PC2	Describe how and why processes are controlled during production. Bloom: Understand
AE.U3.E2.PC3	Describe the objectives of SPC, including monitoring and controlling process performance and tracking trends. Apply SPC for reducing variation in a process. Bloom: Apply
AE.U3.E2.PC4	Prepare a control plan to document and hold gains. Define controls and monitoring systems. Transfer of responsibility from the project team to the process owner. Bloom: Apply
AE.U3.E2.PC5	Understand the difference between repeatability and reproducibility (R&R) and the meaning of the number of distinct categories. Bloom: Understand

Tabel 10 - Performance Criterias for the Element AE.U3.E2

5.3 SUPPLIER QUALITY ASSURANCE

Acronym: AE.U3.E3
Element Title: Supplier Quality Assurance
Element Note: The Learning Element 'Supplier Quality Assurance' describes the significance of supplier quality assurance process and their tools to evaluate and control the suppliers. The element describes how to collect and analyze documents for the PPAP and EMPB and perform supplier audits according to the VDA 6.3 standard.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U3.E3.PC1	Identify the risks of a supplier and can take the needed action by using PPAP, EMPB, and VDA 6.3. Bloom: Apply
AE.U3.E3.PC2	Use PPAP and EMPB when releasing changes and new products. Bloom: Apply
AE.U3.E3.PC3	Prepare a supplier audit (VDA 6.3). Bloom: Apply
AE.U3.E3.PC4	Understand Automotive SPICE® and why and how Automotive SPICE® Assessments are performed. Bloom: Understand

Tabel 11 - Performance Criterias for the Element AE.U3.E3

5.4 MANAGEMENT OF CHANGE

Acronym: AE.U3.E4
Element Title: Management of change
Element Note: The Element 'Management of Change' explains the importance of a change management process in product and process development as well as in released processes with the focus on evaluating the impact of the risk in terms of costs, timing, quality and prepare a change notification to the customer.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to

AE.U3.E4.PC1	Calculate and review the risks when changes are being proposed/made. Is able to fill out a Change notification. Bloom: Apply
AE.U3.E4.PC2	Define change notification, PPAP, and EMPB. Bloom: Apply
AE.U3.E4.PC3	Understand the interface with change management in design and development. Bloom: Understand

Tabel 12 - Performance Criterias for the Element AE.U3.E4

6 CONTINUOUS IMPROVEMENT

Acronym: AE.U4
Title: Continuous Improvement
Description: The Unit 'Continuous Improvement' deals with continuous improvement as an intrinsic element of successful automotive development and production processes. The key elements are tools and methods for problem finding, analyzing, and solving, lean manufacturing (i.e., the minimization of non-value-adding activities in the manufacturing process), quality awareness, as well as approaches to sustaining improvements.

6.1 PROBLEM SOLVING

Acronym: AE.U4.E1
Element Title: Problem solving
Element Note: The Learning Element 'Problem Solving' describes how to apply the 'Eight Steps Problem Solving Method' used to approach and resolve problems.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U4.E1.PC1	Apply and prepare 8D (reports) including containment actions, root cause analysis and corrective/preventive actions. Bloom: Apply
AE.U4.E1.PC2	Organize containment actions (e.g. recall, corrective actions during service, etc.). Bloom: Apply
AE.U4.E1.PC3	Apply tools that are used for root cause analyses (e.g. Ishikawa, 5Why, etc.). Bloom: Apply
AE.U4.E1.PC4	Define the relations between problems, FMEA, and control plan. Bloom: Apply

Tabel 13 - Performance Criterias for the Element AE.U4.E1

6.2 LEAN MANUFACTURING

Acronym: AE.U4.E2
Element Title: Lean manufacturing
Element Note: The Learning Element 'Lean Manufacturing' describes the values and principles of Lean Manufacturing and its role in the automotive industry. The element describes also how the most common tools are applied.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U4.E2.PC1	Describe Lean Manufacturing and interpret Lean Manufacturing in the automotive chain. Bloom: Understand
AE.U4.E2.PC2	Apply Lean Manufacturing tools such as process mapping, value stream mapping, 5S, Kanban, flow, and pull. Bloom: Apply

Tabel 14 - Performance Criterias for the Element AE.U4.E2

6.3 QUALITY AWARENESS

Acronym: AE.U4.E3
Element Title: Quality awareness
Element Note: The Learning Element 'Quality Awareness' is about the most important factors influencing the quality awareness in the organizational culture. It investigates leadership and commitment, team formation and teamwork, as well as cultural diversity and their influences on quality culture. A quality culture in automotive organizations is the necessary requirement for providing a high-quality product to customers.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U4.E3.PC1	Describe the type of leadership needed in the automotive industry. Describe what commitment is and its importance. Bloom: Understand
AE.U4.E3.PC2	Understand that the interdisciplinary expertise is fundamental for tackling complexity in innovation cycles. Bloom: Understand

Tabel 15 - Performance Criterias for the Element AE.U4.E3

6.4 SUSTAIN IMPROVEMENT

Acronym: AE.U4.E4
Element Title: Sustain improvement
Element Note: The Learning Element 'Sustain Improvements' describes the methods for sustaining improvements and how to apply them in order to prevent mistake, avoiding problems in the future and optimize processes.

Performance Criteria: The student must be able to show evidence of competencies for the following performance criteria (PC):

Performance Criterion	Evidence Check: The student is able to
AE.U4.E4.PC1	Define and apply methods for maintaining improvements to become a learning organization (standardization and documentation). Standardize and review lessons learned. Bloom: Apply
AE.U4.E4.PC2	Propagate the quality management system and procedures. Identify opportunities for improvement. Bloom: Apply
AE.U4.E4.PC3	Standardize tasks and processes to establish the foundation for continuous improvement and employee empowerment. Prepare documents, standard operating procedures (SOPs) and one-point-lessons to ensure that the improvements are sustained over time. Bloom: Apply
AE.U4.E4.PC4	Identify and document lessons learned from all phases of a project. Identify possible improvements and ownership. Bloom: Apply
AE.U4.E4.PC5	Apply tools for the ongoing evaluation of the improved process, including auditing (internal / external), monitoring for new constraints and identification of additional opportunities for improvement. Bloom: Apply

Tabel 16 - Performance Criterias for the Element AE.U4.E4

APPENDIX A – BLOOM'S TAXONOMY

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.

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. Bloom's Taxonomy divides educational objectives into three 'domains': Affective, Psychomotor and Cognitive. This Skill set only notices the Cognitive domain. The 'Levels of Cognition' are in rank order - from least complex to most complex.

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

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

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

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

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

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

ANNEXES

The annex provides overview of used skills set, coverage of Qualification Schemas and Legal background for Certification

ANNEX A ECQA DESCRIPTION

ECQA – EUROPEAN CERTIFICATION AND QUALIFICATION ASSOCIATION

ECQA standards are used to describe the skills sets delivered within the DRIVES project (www.project-drives.eu). ECQA is the pilot Certification body, which structure is mapped to DRIVES Reference and Recognition Framework providing the EU-wide overview of training courses and possible certifications, and micro-credentials. DRIVES Reference and Recognition Framework provides links to ESCO[7], EQF[8], ECTS[9] and ECVET[10]. See more in deliverable DRIVES-D4.1.1 Reference and Recognition Framework – Analysis.pdf (www.project-drives.eu).

Europe Wide Certification

The ECQA is the result of a number of EU supported initiatives in the last ten years where in the European Union Life Long Learning Programme different educational developments decided to follow a joint process for the certification of persons in the industry.

Through the ECQA it becomes possible that you attend courses for a specific profession in e.g. Spain and perform a Europe wide agreed test at the end of the course.

Access to a Vast Pool of Knowledge

ECQA currently supports 27 professions in Europe and with the continuous support until 2012 by the European Commission the pool is growing to 30 certified professions in Europe. ECQA offers certification for professions like IT Security Manager, Innovation Manager, EU project manager, E-security Manager, E-Business Manager, E-Strategy Manager, SW Architect, SW Project Manager, IT Consultant for COTS selection, Internal Financial Control Assessor (COSO/COBIT based), Interpersonal Skills, Scope Manager (Estimation Processes), Configuration Manager, Safety Manager, and so forth.

The ECQA guide can be downloaded at www.ecqa.org -> Guidelines.

Defined procedures are applied for:

- Self assessment and learning
- http://www.ecqa.org/fileadmin/documents/Self_Assessment/eucert-users-self-assessment-learning-guide-v5-doc.pdf
- Exam performance
- http://www.ecqa.org/fileadmin/documents/ECQA_Exam_Guide_Participant_v2.pdf

ECQA SKILLS DEFINITION MODEL

The ECQA skills definition model, used for Job Role definition, is described in section 2 of this document.

ECQA SKILL SET STRATEGY

Imagine that in the future Europeans will have a skill set like a card with a chip which stores your skill profile to fulfil specific professions, job roles, and tasks. It's working like an ID card. This future scenario requires -

- A standard way to describe a skill set for a profession, job, or specific task.
- A standard procedure to assess the skill and to calculate and display skill profiles.

Such a common set of skill sets in Europe is needed due to the free mobility of workers. European countries such as UK, The Netherlands, and France already have well established open universities which support APL (Accreditation of Prior Learning). In APL the skills of students are assessed, already gained skills are recognised, and only for the skill gaps a learning plan is established. The skill assessment bases on defined skill units and a skill profile displaying how much of the skill units are covered.

In a previous project CREDIT (Accreditation of Skills via the Internet) [1] in which some of the project partners were involved such an Internet based skills assessment system has been built. Therefore another possible scenario of the future is that representative educational bodies per country in Europe maintain skill profiles in databases which can be accessed via defined ID codes for people.

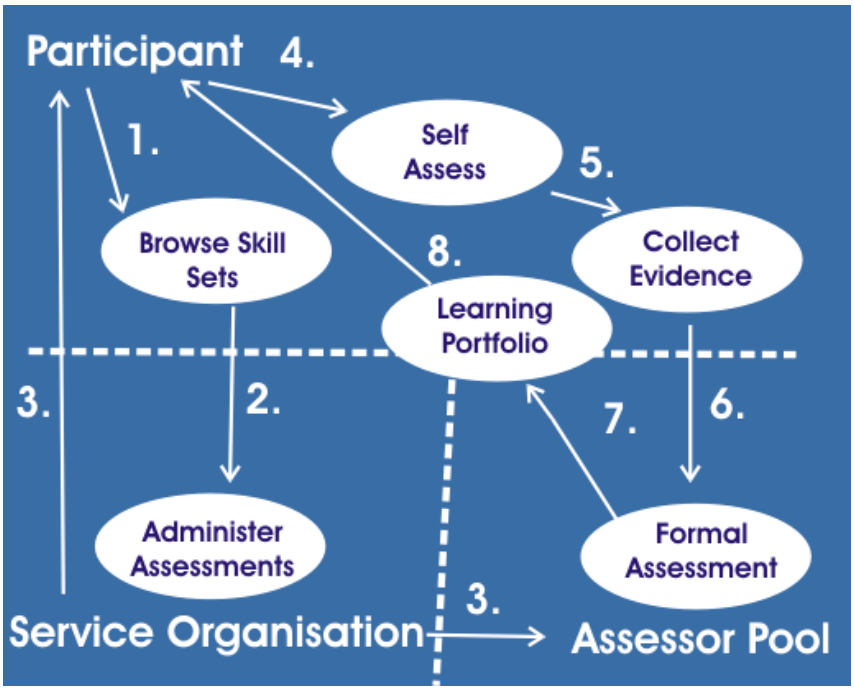
ECQA SKILLS ASSESSMENT MODEL

Step 1 – Browse a Skills Set: You select a set of skills or competencies, which are required by your profession or job using national standards or your company standards. You browse different skills cards and select a job role you would like to achieve.

Step 2 – Register for Self Assessment with a Service Unit : This can be a service unit inside your own company (e.g. a personnel development department) or a skills card and assessment provider outside your company which offers skills assessment services. In case of the Safety Manager Project the registration will automatically assign a predefined service unit.

Step 3 – Receive an Account for Self-Assessment and Evidence Collection : With the registration you automatically received an account to login to the working space in which you can go through the steps

of online self assessment and the collection of evidences to prove that you are capable of certain performance criteria.



Picture 1: Basic steps of the skills assessment model

Step 4 – Perform Self Assessment: You log into the system , browse through the skills required and self assess performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. A skills gaps profile can be generated and printed illustrating in which areas your self assessment shows improvement potentials.

Testing of Skills (Addition to Step 4) – The system provides a multiple-choice test for each performance criteria so that you can check your capabilities as realistically as possible.

Step 5 – Collect Evidences: Before you want to enter any formal assessment you need to prove your skills by evidences. Evidences can be any electronic files (sample documents, sample graphics, results of some analysis, etc.) or any references with details (e.g. a certificate received from a certain institution). Evidences you can then link to specific performance criteria or whole elements of skills units.

Testing of Skills (Addition to Step 5) – In traditional learning schemes people have always needed to go to a learning institution (university, accreditation body, professional body, etc.) to take exams and they received a certificate if they pass. This traditional approach however is insufficient when it comes to

measuring experience and (soft) skills learned on the job and fails to give recognition to skills gathered on the job. The APL (Accreditation of Prior Learning) approach, by contrast, collects so called evidences. Evidences can be certificates obtained in the traditional way, but also references from previous employers, materials from previous projects in which the person took ownership of results (e.g. a test plan) to prove their capability, as well as any kind of proof of competence gathered on the job. The assessors will then evaluate the evidences provided and not only rely on certificates and exams.

Step 6 – Receive Formal Assessment: Formal assessors are assigned by the service unit to the skills assessment. Once formal assessors log into the system they automatically see all assigned assessments. They select the corresponding one and can see the uploaded evidences. They then formally assess the evidences and assess the formal fulfilment of performance criteria, whole elements or whole units with a standard evaluation scale of non-applicable, not adequate, partially adequate, largely adequate, and fully adequate. In case of missing competencies they enter improvement recommendations, a well as learning options.

Step 7 – Receive Advise on Learning / Improvement Options: After the formal assessment the participants log into the system and can see the formal assessment results from the assessors, can print skills gaps profiles based on the assessor results, and can receive and print the improvement recommendations and learning options. If required, the generation of learning options can also be automated through the system (independent from assessor advises).

ECQA CERTIFICATE TYPES

In the standard test and examination procedures for levels of certificates are offered:

- Course Attendance Certificate
  - Received after course attendance
  - Modular per Element
- Course / Test Certificate
  - Test in a test system (European pool of test questions)
  - 67% satisfaction per element
- Summary Certificate
  - Overview of covered elements where the student passed the test, all elements shall be covered
  - Generation of certificate
- Professional Certificate

- Uploading applied experiences for review by assessors
- Rating by assessors
- Observation of 2 years

The certificates show credited elements in comparison to all required.

ANNEX B ECQA COVERAGE OF QUALIFICATION SCHEMAS

MAPPING BASED ON NVQ QUALIFICATION LEVELS

Qualification / training levels: Five levels of qualification / training are defined by European legislation and this structure can be used for comparability of vocational qualifications from the different European countries.

- Level 1: semi-skilled assistant performing simple work
- Level 2: basic employee performing complex routines and standard procedures
- Level 3: skilled professional with responsibility for others and performing independent implementation of procedures
- Level 4: middle management & specialist performing tactical an strategic thinking
- Level 5: professional / university level

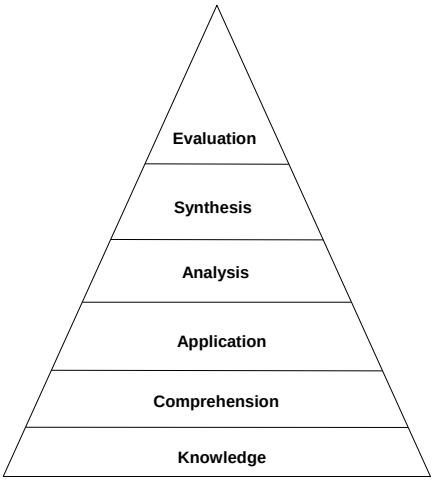
In most cases the same job role can be offered on different levels. e.g. IT Security Manager Basic Level (NVQ level 2), IT Security Manager Advanced level (NVQ Level 3), and IT Security Manager Expert Level (NVQ Levels 4 and 5).

MAPPING BASED ON EUROPEAN QUALIFICATION FRAMEWORK (EQF) LEARNING LEVELS

- Six level taxonomy:

  Level 0: I never heard of it

  1. Knowledge (I can define it):
  2. Comprehension (I can explain how it works)
  3. Application (I have limited experience using it in simple situations)
  4. Analysis (I have extensive experience using it in complex situations)
  5. Synthesis (I can adapt it to other uses)
  6. Evaluation (I am recognized as an expert by my peers)



Picture 3: Blooms Learning levels

Level	Knowledge	Example
Level 1	Basic general knowledge	
Level 2	Basic factual knowledge of a field of work or study	
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	Six Sigma Yellow Belt
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Six Sigma Green Belt
Level 7	• 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 • Critical awareness of knowledge issues in a field and at the interface between different fields	Six Sigma Black Belt

Level	Knowledge	Example
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	Six Sigma Master Black Belt

Picture 4 : EQF Learning levels

MAPPING BASED ON ECTS AND ECVET SCHEMA

ECQA has established a procedure to map ECQA skills sets onto the ECTS (European Credit Transfer System) and the ECVET framework n the European Union.

A job role is assigned ECTS and ECVET points using a defined framework.

ECTS Mapping

Each element of the skills set is assigned hours of lecturing and exercises. These hours determine the ECTS points which are then agreed among a cluster on different universities in Europe.

Level	Knowledge	AQUA	ECTS	Safety Manager	ECTS
Level 1	Basic general knowledge	-		-	
Level 2	Basic factual knowledge of a field of work or study	-		-	
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study				
Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study				
Level 5	Comprehensive, specialized, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge				
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	AQUA - Automotive Quality Integrated Skills - presentations / theory	3	AQUA - Automotive Quality Integrated Skills - presentations / theory	3
Level 7	- Highly specialized knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research - Critical awareness of knowledge issues in a field and at the interface between different fields	AQUA - Automotive Quality Integrated Skills - with exercises to apply on nan example (e.g. ESCL)	4	AQUA - Automotive Quality Integrated Skills - with exercises to apply on nan example (e.g. ESCL)	4
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	AQUA - Automotive Quality Integrated Skills - implementation in a research at PhD level / with link to a real project	5	AQUA - Automotive Quality Integrated Skills - implementation in a research at PhD level / with link to a real project	5

Picture 5 : Example Automotive Quality Engineer and Safety Manager

The 2 job roles illustrated in the picture above have been assigned to ECTS and are taught using the same skills set at industry and also universities.

ECVET Mapping

Also ECQA provides a framework to assign ECVET points onto elements of the skills set. The ECQA guidance recommends to offer the ECQA course (which is offered as a lecture at university) as a short course (2 weeks with exercises) in industry to retrain for a job role in industry. The recommended size is 30 ECVET points in total. The lecturing time and exercise per element determine how many ECVET points ae assigned to an element of the skills set.

Automotive Quality Engineer			
			ECVET L7&8
U1	4	U1.E1: Introduction	2
		U1.E2: Organisational Readiness	2
U2	32	U2.E1 Life Cycle	8
		U2.E2 Requirements	8
		U2.E3 Design	8
		U2.E4 Test and Integration	8
U3	12	U3.E1: Capability	2
		U3.E2: Hazard and Risk Management	8
		U3.E3 Assessment and Audit	2
U4	12	U4.E1: Measurement	6
		U4.E2: Reliability	6
		ECVET Points Total	60

Picture 6 : ECVET Mapping example - Automotive Quality Engineer

Functional Safety Manager / Engineer			
			ECVET L7&8
U1	2	U1.E1 International Standards	1
		U1.E2 Product Life Cycle	1
		U1.E3 Terminology	
U2	4	Safety management on organisational	1
		Safety Case Definition	1
		Overview of Required Engineering an	1
		Establish and Maintain Safety Plannin	1
U3	16	System Hazard Analysis and Safety Co	4
		Integrating Safety in System Design &	4
		Integrating Safety in Hardware Design	4
		Integrating Safety in Software Design	4
U4	4	Integration of Reliability in Design to I	2
		Safety in the Production,Operation an	2
U5	4	Legal aspects and Liabilities	2
		Regulatory & Qualification Requireme	2
		ECVET Points Total	30

Picture 7 : ECVET Mapping example – Functional Safety Manager / Engineer

ANNEX C ECQA LEGAL BACKGROUND FOR CERTIFICATION

ISO/IEC 17024 STANDARD FOR PERSONNEL CERTIFICATION PROGRAMMES

The ISO/IEC 17024 standard describes standard processes for the examination and certification of people. Some of the basic principles described include:

- Standard exam procedure
- Standard certification procedure
- Identification of persons receiving the certificate
- Independence of examiner and trainer
- Certification system that allows to log the exam to keep a record/proof that the examinee passed the exam
- Mapping of processes towards ISO 17024

ECQA AND ISO/IEC 17024 STANDARD

- ECQA defined standard exam processes
- ECQA defined standard certification processes
- ECQA developed an exam system that generates random exams and corrects exams.
- ECQA developed a certification database to identify persons and map them to exam results
- ECQA established a mapping onto the ISO 17024 norm and published that in form of a self declaration.

LIASION WITH NATIONAL UNIVERSITIES

ECQA established cooperation with national universities who teach job roles with ECTS. The same job roles are offered with ECVET on the market by training bodies.

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