DRIVES

Development and Research on Innovative Vocational Education Skills

Innovation Agent – Business Model Innovation

Job Role Skill Set

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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 Innovation Agent - Product Innovation job role within the ECQA 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 based on the defined skills which need to be covered by the course.

2 ECQA SKILLS DEFINITION MODEL

A skills definition contains the following items (see Fig. 1):

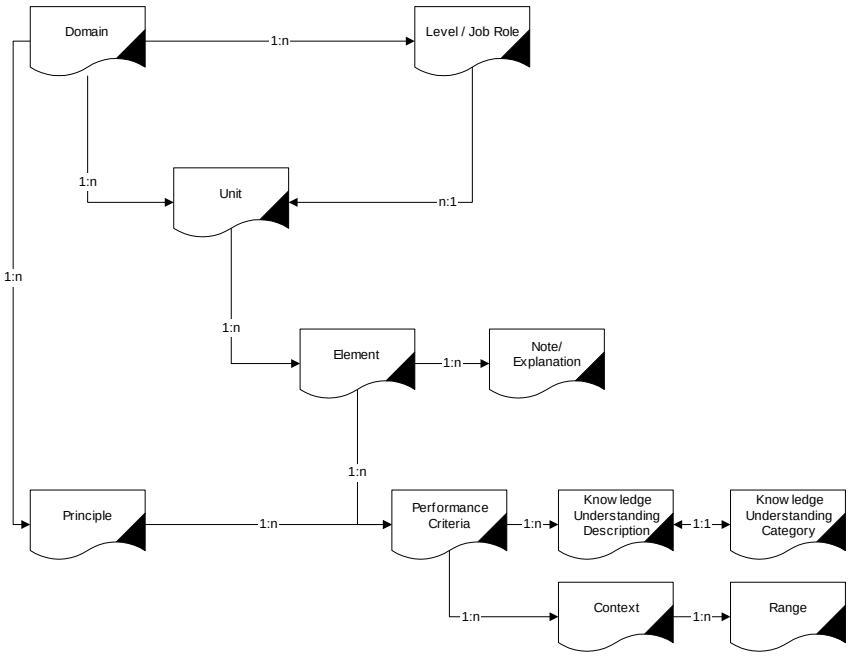

Figure 1 The Skill Definition Model (1:n = one to many relationship)

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 = Functional Safety, job role = Functional Safety Manager.

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 SKILLS DEFINITION FOR THE JOB ROLE "INNOVATION AGENT - PRODUCT INNOVATION"

3.1 THE SKILLS HIERARCHY

In the DRIVES project in cooperation with SOQRATES (www.soqrates.de) the new job roles for innovation have been defined.

1. Innovation Agent – Product Innovation
2. Innovation Agent – Organisation
3. Innovation Agent – Business Model Innovation

The overall set of units and elements for innovation agents have also been assigned to levels of skills (awareness, practitioner, expert level), see Fig. 2 below.

Units (U) and Elements (E) of the skill card	InovationAgent Product Innovation	Innovation Agent Organisation	Innovation Agent Business Model Innovation
Unit 1 Introduction			
U1.E1 Innovation Vision 2030	awareness	awareness	awareness
U1.E2 Divers of Change Analysis	awareness	awareness	awareness
Unit 2 Product Innovation			
U2.E1: identification of opportunities and problems	expert		
U2.E2: Production and Evaluation of Ideas	expert		
U2.E3: Research and Development Work and Prototyping	expert		
U2.E4 Service based innovation	expert		
Unit 3 Organisational Innovation			
U3.E1 Core Competence Analysis & First Architecture		expert	
U3.E2 Dynamic Learning Cycles Design		expert	
U3.E3 Innovation Process Design including Ideation		expert	
U3.E4 Teamwork and leadership		expert	
U3.E5 Leading innovation projects and initiatives		expert	
Unit 4 Business Model Innovation			
U4.E1 Open Network Strategies			expert
U4.E2 Service Innovation Strategies			expert
U4.E2 Big Data and Cloud and new business scenarios			expert
U4.E3 Smart Technologies and new business scenarios			expert
U4.E4 Smart production and new business senarios			expert

Figure 2 The Skills Set for Innovation Agent Roles

Innovation Agent builds on the field studies of EU Blueprint projects like DRIVES where the association of manufacturers an suppliers in Europe cooperated to identify the major drivers of change which will influence how Europe will look like in 2030.

Unit 1 is setting the scene.

European Alliance projects (EU Blueprints) made analysis to predict the drivers of change for Europe 2030. ISCN is partner in both and will share that. This future pictures go to unit 1 to set the scene for the future EU business developments.

Unit 2 is focussing on empowering teams to be creative and come up with new ideas and products.

This is based on the training approaches from InnoTeach, ResEUr etc. with exercises. The training targets engineers at all levels in the company.

Unit 3 is focussing on making whole organisations to dynamic learning organisations which constantly update to new market needs.

This is based on the organisational innovation concepts developed in ORGANC and the uodated innovation manager.

Unit 4 is focussing on open innovation with the new networked approaches supported by e.g. OpenInnoTrain and other projects.

This shall give guidance about how to use the cloud based future infrastructure for networked innovation teams, sharing, etc. building critical multidisciplinary mass, etc.

In this document we describe the skills set for the innovation agent – open innovation.

3.2 THE SKILLS DESCRIPTIONS – JOB ROLE INNOVATION AGENT - OPEN INNOVATION

Domain Acronym: INNO

Domain title: Innovation

Domain Description:

Companies that have a long lasting vision and exist for a long time are able to adapt to future needs dynamically. This requires innovation strategies at different levels such as a continuously updating and dynamically learning organisation, continuous development of new ideas and products and services, and recently the open innovation concept of networking the organisation into the cloud and using such strategies to empower teams, knowledge sharing and launching of new ideas and products.

Especially the DRIVERS of change in Automotive sector will lead to new partnerships, new types of products and services, new infrastructures, new partnerships etc.

The DRIVERS of Change are outlined in [8], a study performed in the EU Blueprint project DRIVES [9]. Global drivers influence the drivers in technological areas, and global drivers in the study are structured into:

New technologies and business models;

- Climate goals, environmental, and health challenges;

- Societal changes and changes in the way that consumers access, purchase, and use cars;
- Structural change;
- Globalisation and the rise of new players.

Future changes impacting automotive and production by using new smart technologies are described in the study [8] and project DRIVES as follows:

- Connected and automated driving (CAD) and advanced driver assistance systems (ADAS)
- Alternative power trains
- Electrification
- Advanced manufacturing, digitalisation, and robotisation of the manufacturing process
- Handling of/access to vehicle data
- 3D printing
- New communications technologies
- New/advanced materials

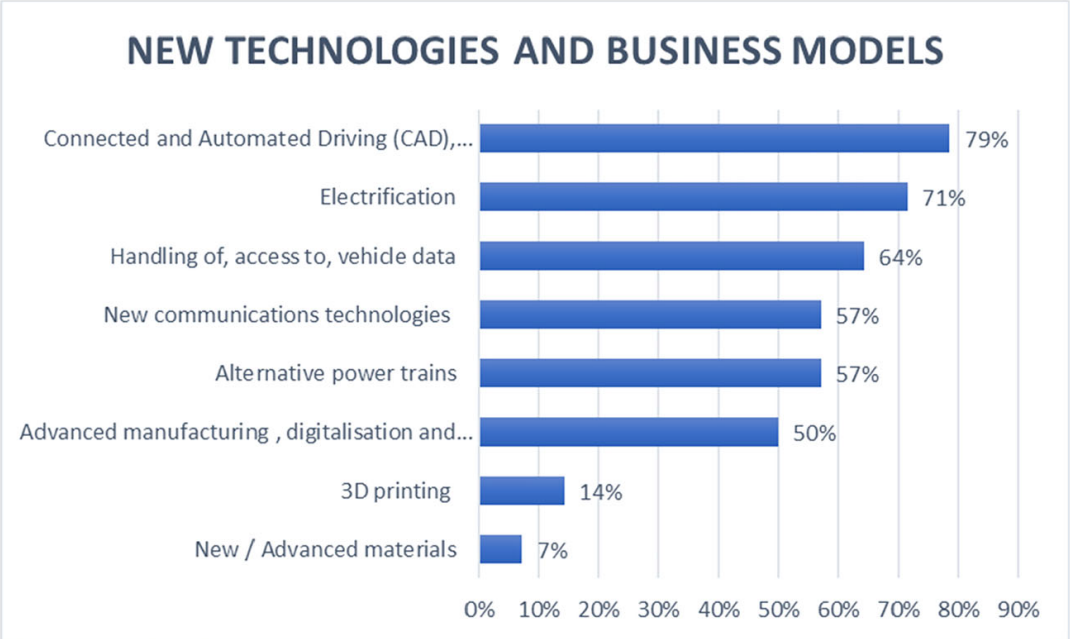

Figure 3 New technologies and business models

Job Role Acronym: INNOAGE

Job Role Title: Innovation Agent – Business Model Innovation

Public Description:

Companies nowadays need to be able to quickly adapt to future needs dynamically. This requires innovation at different levels such as to set up a continuously updating and dynamically learning organisation, empowering staff to continuously develop new ideas and products and services, and recently the open innovation concept of using the cloud and networking to build thematic and knowledge driven new partnerships, alliances and value chains.

The innovation agent knows tools and methods to empower employees and managers to implement innovation at these three levels in an organisation and can act as a catalyst for the organisation to adapt to the new market needs and global trends.

The Innovation Agent helps to develop new business scenarios for leading European industry in the areas outlined by DRIVES to hep to adapt industry for the main drivers of change in the DRIVES study [8].

This includes innovation and business scenarios for the use of

- Connected and automated driving (CAD) and advanced driver assistance systems (ADAS)
- Alternative power trains
- Electrification
- Advanced manufacturing, digitalisation, and robotisation of the manufacturing process
- Handling of/access to vehicle data
- 3D printing
- New communications technologies
- New/advanced materials

Also the Innovation Agent helps to realise strategy initiatives at European level like Gear 2030 and ALBATTS.

The Gear 2030 [9] initiative includes the European Automotive manufacturer association, the European Automotive supplier association, key players in Automotive education to develop the skills needed for future dependent vehicles in a complex eco system and environment. Gear 2030 proposes a very wide scope of qualifications including the whole life cycle of vehicle design and production. The

Gear 2030 formed a so called Skills council providing guidance to the European Commission and the European automobile manufacturer association (ACEA). The Gear 2030 skills council report to the European Commission and the ACEA mentions key job roles of the future based on a high level European commission viewpoint level.

ALBATTS is a new EU blueprint project where Northvolt as a strategy to create Europe's battery production chain and research (VW, BMW are co-investing with EU) and developed a set of new innovative drivers and job roles that need to be supported in future.

Description:

The Skill card comprises the following thematic learning units

1. Unit 1 Introduction
    a. U1.E1 Innovation Vision 2030 (awareness)
    b. U1.E2 Divers of Change (awareness)
2. Unit 4 Business Model Innovation
    a. U4.E1 Open Networking Strategies (expert)
    b. U4.E2 Service Innovation Strategies (expert)
    c. U4.E2 Big Data and Cloud and new business scenarios (expert)
    d. U4.E3 Smart Technologies and new business scenarios (expert)
    e. U4.E4 Smart production and new business scenarios (expert)

3.3 UNIT INNOAGE.U1 INTRODUCTION

Acronym: INNOAGE.U1

Title: Introduction

Description:

This unit deals with studies [8] that outline future developments and targets of major European industry. This gives a direction towards what innovation needs to be supported to achieve the EU 2030 goals in the industry. The studies referenced have been supported by major industry associations in Europe, such as the ACEA (European Automobile Manufacturer Association).

3.3.1 Unit INNOAGE.U1 - Element 1: Innovation Vision 2030

Acronym: INNOAGE.U1.E1

Element Title: Innovation Vision 2030

Element Note:

This element specifically deals with expectations from industry and Europe towards products, services, environments in 2030 and down to the year 2050. The example automotive and manufacturing are used to demonstrate the future changes and drivers of change.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
INNOAGE.U1.E1.PC1	The student knows drivers of change and can list smart technologies which are related to the drivers of change.
INNOAGE.U1.E1.PC2	The student knows the initiatives like Gear 2030, DRIVES, and ALBATTS and can explain the drivers promoted by these initiatives for Europe.

Table 1: Performance Criteria Example for the Element INNOAGE.U1.E1

3.3.2 Unit INNOAGE.U1 - Element 2: Drivers of Change Analysis

Acronym: INNOAGE.U1.E2

Element Title: Drivers of Change Analysis

Element Note:

This element outlines how to map existing services and departments in an organisation towards the drivers of change and list of new smart technologies. This mapping will help later as a strategy road map as an input for brainstorming or new business scenarios to be identified.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

Performance Criterion	Evidence Check: The student can demonstrate
INNOAGE.U1.E1.PC1	The student is able to map the existing services of the organisation onto the drivers of change.

Performance Criterion	Evidence Check: The student can demonstrate
INNOAGE.U1.E1.PC2	The student is able to create a high level strategy road map picture showing which service area of the company is impacted by which driver of change and assigns a business impact rating.

Table 2: Performance Criteria Example for the Element INNOAGE.U1.E2

3.4 UNIT INNOAGE.U4 BUSINESS MODEL INNOVATION

Acronym: INNOAGE.U4

Title: Business Model Innovation

Description:

When implementing new smart technologies and networking them into own products and services this creates new business models, new cash flows, new opportunities, but also new threats. In the unit three potential business environments are used as an example based on three main industry domains for Europe.

- Design of business scenarios for smart cars and smart car production.
- Design of business scenarios for smart energy production and batteries.
- Design of business scenarios for health care and medical industry.

e.g. In medical systems currently there is the threat of a pandemic disease. This can lead to new scenarios involving smart technologies. E.g. Mobile phones and watches include data like temperature and pulse of a body and also can automatically generate am image of all mobile phones in a nearby distance.

e.g. in highly autonomous vehicles the cars get connected, the environment gets connected, the mobility services get connected etc. This leads to new business cases and services that can be developed and offered.

e.g. in the strategy to build innovate and new energy clusters and battery production in Europe (ref. ALBATTS) new service scenarios can be created, like how to exchange batteries, build network of batteries, concept of green energy clusters, etc.

New technologies require guidance to develop new business models.

3.4.1 Unit INNOAGE.U4 - Element 1: Open Network Strategies

Acronym: INNOAGE.U4.E1

Element Title: Open Network Strategies

Element Note:

This element deals with Open Innovation, a modern concept coined by Henry Chesbroug. And this element deals with networking as a core paradigm of modern innovation management.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

INNOAGE.U4.E1.PC1	The student understands the core concepts of Open Innovation.
INNOAGE.U4.E1.PC2	The student knows concepts of how Open Innovation can be implemented.
INNOAGE.U4.E1.PC3	The student understands analysing Open Innovation concepts in a practical industry environment.
INNOAGE.U4.E1.PC4	The student knows typical steps needed to create a pool of interested customers / stakeholders.
INNOAGE.U4.E1.PC5	The student knows typical steps needed to create business case related interest networks connecting research ideas and industry.
INNOAGE.U4.E1.PC6	The student knows the typical norms and standards (ISO) which apply when one enters commercial product offers and deliveries.

Table 3: Performance Criteria Example for the Element INNOAGE.U4.E1

3.4.2 Unit INNOAGE.U4 - Element 2: Service Innovation Strategies

Acronym: INNOAGE.U4.E2

Element Title: Service Innovation Strategies

Element Note:

This element focusses on Service Innovation, i.e., innovation leveraged by the integrated design of value-added services, products and processes.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

INNOAGE.U4.E2.PC1	The student understands the need for proposing services complementary to products.

INNOAGE.U4.E2.PC2	The student knows the concept of Product-Service Co-Design.
INNOAGE.U4.E2.PC3	The student understands value creation through services for the enterprise.
INNOAGE.U4.E2.PC4	The student understands value creation through services for the customer.
INNOAGE.U4.E2.PC5	The student knows examples of successful value creation through Product-Service Systems.

Table 4: Performance Criteria Example for the Element INNOAGE.U4.E2

3.4.3 Unit INNOAGE.U4 - Element 3: Big Data and Cloud and new business scenarios

Acronym: INNOAGE.U4.E3

Element Title: Big Data and Cloud and new business scenarios

Element Note:

Automotive

The largest IT company in Germany is VW IT. Why? Because data and services across the whole fleet of cars are stored and analysed, and also all tools and results of work need to be stored, managed and linked. The difference between data and knowledge is that knowledge can connect data by a context. This knowledge creation by a context can create new scenarios, and the cloud is not only in a large company but the cloud is in the open network and can be connected as well. A car in the future is in a data cloud and depending on data will make decisions. This unlimited amount of data shared between cars, in the environment and personal data in mobile phones and profiles of drivers can be combined to new services. This can be e-mobility services, personalised services, work place services etc. and all the new scenarios need promising sales and business scenarios.

Medical

Medical data are private and need to be protected. Still medical data, if people allow, can be connected for better services. E.g. Imagine that in times of pandemic you allow your mobile to measure your temperature and pulse and to store data about mobile numbers in an area around you. Of course, it assumes that you allow it. Then pandemic situations can be controlled. Also if the devices can measure they will automatically for people in pension observe their health and report to services automatically in case you need help.

Energy

In the strategy project ALBATTS the EU currently supports the creation of a energy systems and Li battery production chain in Europe, and this requires building up new business scenarios and fining new business models that allow the European system to compete with the Asian providers. And here data across all energy clusters in Europe can lead to new business models which empower that the new energy production chain is created. E.g. enforcing green energy to empower Li Ion batteries, or making green battery cars more attractive by new business models, etc. Big data (advantages, user

profile, etc.) can be shared by context among all energy clusters to form joined strategies to launch green energy and batteries.

This element focusses on Service Innovation, i.e., innovation leveraged by the integrated design of value-added services, products and processes.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

INNOAGE.U4.E3.PC1	The student understands the concept of big data and knowledge creation.
INNOAGE.U4.E3.PC2	The student can apply the big data concept for a business example in automotive.
INNOAGE.U4.E3.PC3	The student can apply the big data concept for a business example in medical.
INNOAGE.U4.E3.PC4	The student can apply the big data concept for a business example in medical.

Table 5: Performance Criteria Example for the Element INNOAGE.U4.E3

3.4.4 Unit INNOAGE.U4 - Element 4: Smart Technologies and new business scenarios

Acronym: INNOAGE.U4.E4

Element Title: Smart Technologies and new business scenarios

Element Note:

Smart technologies are new technologies with software intelligence that can be connected or can be integrated into existing systems. There are smart cars, smart medical devices, smart electric systems.

e.g. A smart car can be combined with any other smart services in the cloud creating new business models. E.g. you become member of an IoT service where automatically in winter time when you drive home the heating is switched on and when you arrive the light is switched on.

e.g. A smart mobile service measures your blood pressure and while you drive recognises a drop (you could sleep) and communicates with the car so tat the car warns you with a sound.

Etc.

There is an unlimited set of connected devices, sensors available now, it is necessary to create a pool of new smart services and launch the to make the European cars, the European medical systems, etc. competitive for the next decades.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

INNOAGE.U4.E4.PC1	The student understands the concept of smart technologies and their integration into innovative services.
INNOAGE.U4.E4.PC2	The student can apply the smart services concept for a business example in automotive.
INNOAGE.U4.E4.PC3	The student can apply the smart services concept for a business example in medical.
INNOAGE.U4.E4.PC4	The student can apply the smart services concept for a business example in medical.

Table 6: Performance Criteria Example for the Element INNOAGE.U4.E4

3.4.5 Unit INNOAGE.U4 - Element 5: Smart production and new business scenarios

Acronym: INNOAGE.U4.E5

Element Title: Smart production and new business scenarios

Element Note:

The integration of smart technologies into a bigger product and service requires an update and change of supply chains, production processes, but also maintenance (e.g. over the air update and cloud update services).

e.g. A smart car can be combined with any other smart services in the cloud creating new business models. E.g. you become member of an IoT service where automatically in winter time when you drive home the heating is switched on and when you arrive the light is switched on.

- ➔ And the number of IPT services that are connected is growing and with an update you can connect more and more infrastructure.
- ➔ An artificial intelligence is analysing profiles and recommends you what you will need and configures for you the extended services.
- ➔ The production is hosted on a purely virtual system that by AI selects the proper production sites and logistics and creates for you a worldwide production system.
- ➔ Smart factories storing data that allow to analyse and optimise production to reach 0 ppm (parts per million). Artificial intelligence recommending you the optimisation necessary.

There is an unlimited set of connected devices, sensors available now, and also a growing number of AI developments, and it is necessary to create a concept of integrating this innovation in the smart production strategies.

Performance Criteria:

The student must be able to show evidence of competencies for the following performance criteria/skills (PCs):

INNOAGE.U4.E4.PC1	The student understands the concept of smart production and the integration of new smart services into innovative mart production.
INNOAGE.U4.E4.PC2	The student can apply the smart production concept for a business example in automotive.
INNOAGE.U4.E4.PC3	The student can apply the smart production concept for a business example in medical.
INNOAGE.U4.E4.PC4	The student can apply the smart production concept for a business example in medical.

Table 7: Performance Criteria Example for the Element INNOAGE.U4.E5

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.

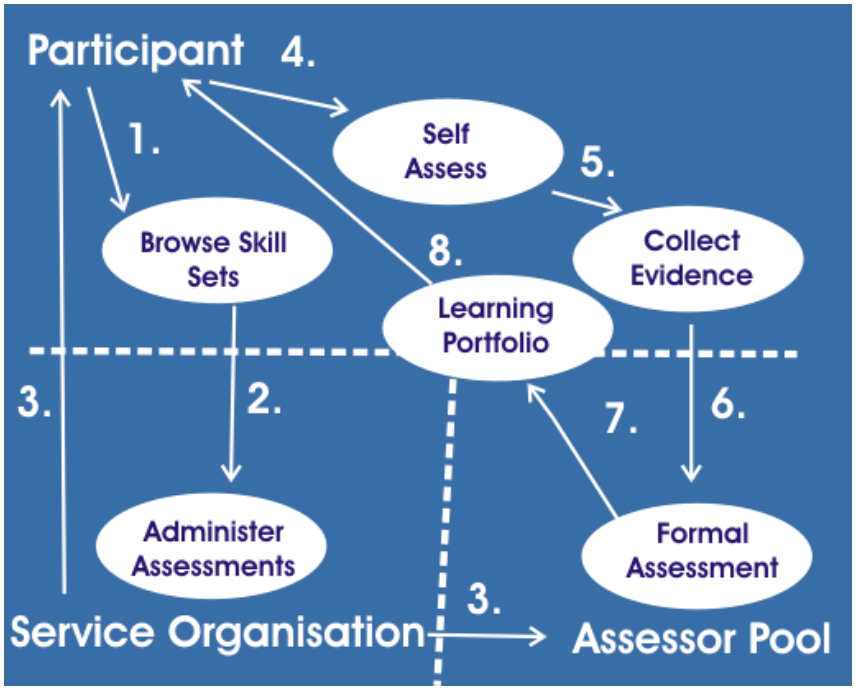

Figure 4 Basic steps of the skills assessment model

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)

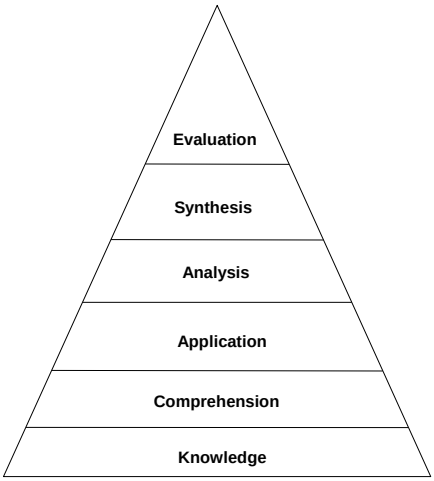

Figure 5 BLOOMS Learning Levels

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

Figure 6 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

Figure 7 EQF 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

Figure 8 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

Figure 9 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.

ANNEX D REFERENCES

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.

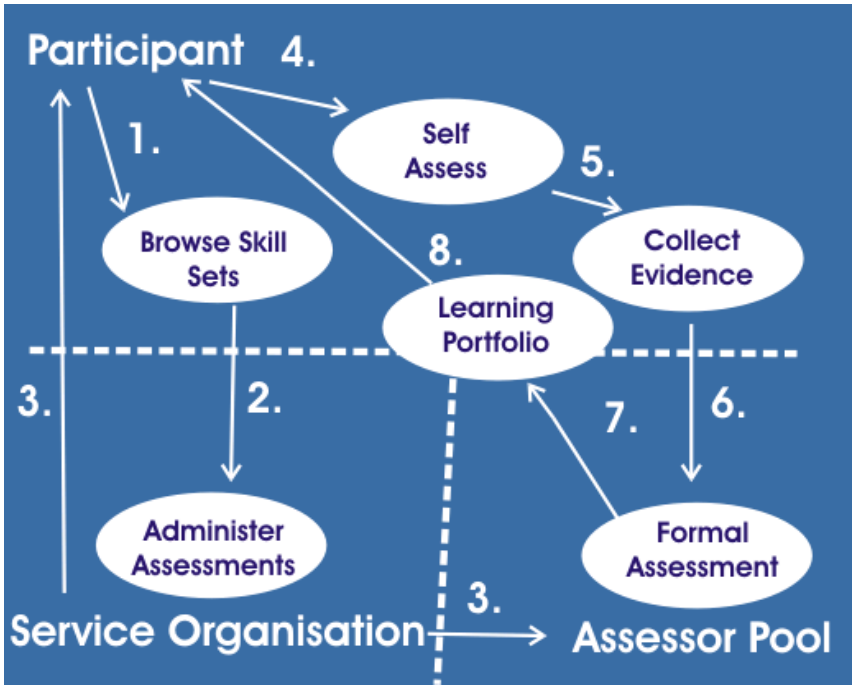

Figure 10 Basic steps of the skills assessment model

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

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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):
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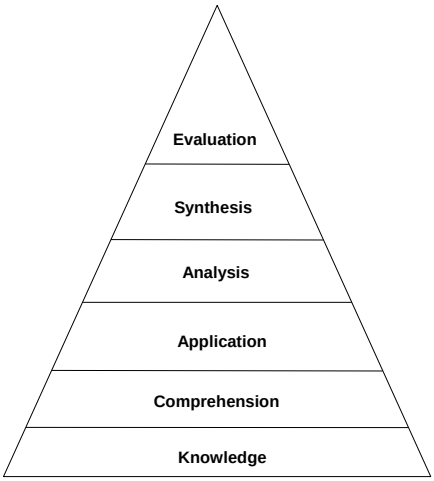

Figure 11 BLOOMS Learning Levels

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
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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

Figure 12 EQF Learning Levels

MAPPING BASED ON ECTS AND ECVET SCHEMA

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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				
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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
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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

Figure 13 EQF 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.

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		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

Figure 14 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

Figure 15 ECVET Mapping example – Functional Safety Manager / Engineer

ANNEX C ECQA LEGAL BACKGROUND FOR CERTIFICATION

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ECQA AND ISO/IEC 17024 STANDARD

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ANNEX D REFERENCES

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