



Automotive Mechatronics Manager

Basic Level

Job Role Skill Set



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DOCUMENT TITLE

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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 Automotive Mechatronics Manager Basic Level 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 clearly outlined the set of required courses.

2 ECQA SKILLS DEFINITION MODEL

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

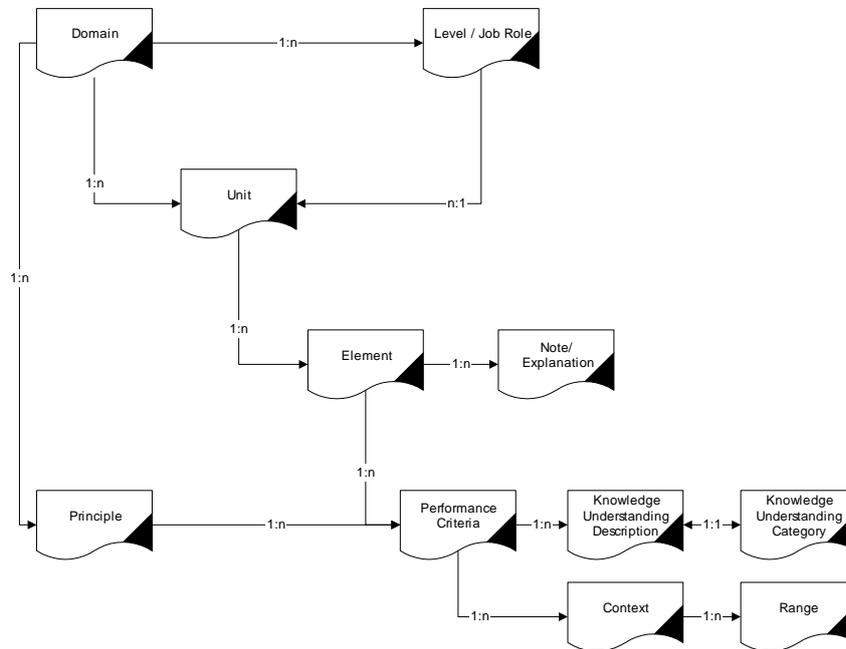


Figure 1: The Skill Definition Model (1:n = one to many relationship)

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 “AUTOMOTIVE MECHATRONICS MANAGER BASIC LEVEL”

3.1 THE SKILLS HIERARCHY

Using the terminology outlined in the skills definition model and including the skills identified during the demand analysis at the beginning of the project, the following skills hierarchy for the job roles of the “Automotive Mechatronics Training Programme” has been designed.

Content Unit of the Training Skill Card	Introduction to Automotive Mechatronics	Automotive Mechatronics Manager Basic Level	Automotive Mechatronics Expert	Automotive Mechatronics Developer
Unit 1 - Introduction to Automotive Mechatronics (virtual course)				
U1E1 Introduction to Mechatronics Systems	comprehension			
U1E2 Mechatronics Systems Development & Production	comprehension			
U1E3 Required Skills and Boundary Conditions	comprehension			
Unit 2 - Automotive Mechatronics Systems Development				
U2E1 Boundary Conditions in Automotive Industry		comprehension	comprehension	comprehension
U2E2 Characteristics, Structures and Functions of Mechatronics Systems		comprehension	comprehension	comprehension
U2E3 Mechatronics Systems Development Processes and -Standards		application	application	application
U2E4 Mechatronics System Engineering Basics		application	application	application
Unit 3 - Introduction of Electrical Engineering & Information Technology				
U3E1 Basic Elements of Electric Circuits			comprehension	comprehension
U3E2 DC-Circuits Layout and Calculation, AC-Current Basics			analysis	analysis
U3E3 Basics of Magnetic and Electric Fields			analysis	analysis
U3E4 IT Development Process and Embedded System Integration			comprehension	comprehension
U3E5 Introduction of IT Hardware and Software Engineering			comprehension	comprehension
U3E6 Automotive Communication Systems & Data Interfaces			application	application
Unit 4 - Sensor, Actuator and Electric Motor Technologies				
U4E1 Sensing & Measurement Principles			analysis	analysis
U4E2 Sensor System Data Processing			application	application
U4E3 Sensor & Measurement Technologies			application	application
U4E4 Types and Functions of Electric Motors and Actuators			analysis	analysis
U4E5 Electric Motor / Actuator Design & Control Characteristics			application	application
Unit 5 - Quality Management & Verification of Mechatronics Systems				
U5E1 Mechatronics Development Processes, Standards and Guidelines			comprehension	comprehension
U5E2 Basics of Functional Safety, System Verification and Optimization			comprehension	comprehension
U5E3 Quality Management			application	application
U5E4 ISO 26262, ASPICE, CMMI			application	application
U5E5 Risk Assessment, System Test and Integration			application	application
Unit 6 - Introduction of Matlab-Simulink				
U6E1 Introduction and Overview of Simulation Basics				comprehension
U6E2 Program Introduction and User-Handling				comprehension
U6E3 Constants, Variables, Vectors, Matrices				analysis
U6E4 Modelling of Simple Systems, Solution of Linear Equation Systems				application
U6E5 Data Processing and Programming Structures				application
U6E6 Model-Based Simulation of Mechatronics Systems				application
Unit 7 - Introduction of Control Engineering				
U7E1 Notion of Control				comprehension
U7E2 Feedback Control vs. Feedforward Control				analysis
U7E3 Basic Modelling and Simulation Concepts				analysis
U7E4 Transfer Functions and Stability				application
U7E5 PID controllers				application
U7E6 Simulation of Feedback Loops / Applications				application
Unit 8 - Advanced Systems & Components Design				
U8E1 Mechatronics System Layout and Design				application
U8E2 Mechatronics System Simulation				application
U8E3 Sensor, Actuators and ECU Hardware Simulation and Optimization				application
U8E4 Investigations of Control Strategies				application
U8E5 Application and Discussion based on a Project Work				application

Fig. 2: The Skills Set for ECQA Certified Automotive Mechatronics Roles (overview)



3.2 THE SKILLS DESCRIPTIONS – JOB ROLE AUTOMOTIVE MECHATRONICS MANAGER BASIC LEVEL

Domain Acronym: Engineering

Domain title: Mechatronics

Domain Description:

With rising degree of electrification and digitalization of automotive systems, an effective integration of the domains mechanics, electrics and information technology plays a significant role in automotive development processes. Besides engineering expertise in each of the domains, vehicle manufacturer and supplier increasingly need human resources for the management, development and administration of mechatronics systems throughout the entire value-creation chain. This includes conception, design, simulation, manufacturing engineering as well as production, logistics, maintenance and quality management of mechatronics systems, which are composed of modules and components of the three mentioned domains. The complexity of mechatronics systems is considered and represented by several standardized development processes, e.g. the V-model according to VDI 2206 or the Functional Safety Standard ISO 26262.

The job roles of Automotive Mechatronics Manager / Expert / Developer are embedded into the complex development processes in the automotive industry. These roles fit into both system- and vehicle development as well as production engineering. The training is designed as modular course; in this way the trainees can attend units and elements separately and independently, although it is recommended to attend the entire unit structure according to the targeted job role. In general, there are four levels offered:

1. Introduction to Automotive Mechatronics (online training course)
2. Automotive Mechatronics Manager Basic Level
3. Automotive Mechatronics Expert
4. Automotive Mechatronics Developer

This document focusses on the “Automotive Mechatronics Manager Basic Level”. The training includes one unit comprising four main elements. The duration of training is one week. After having accomplished the training, the trainees can take an exam and become a certified Automotive Mechatronics Manager Basic Level.

Job Role Acronym: AMMBL

Job Role Title: Automotive Mechatronics Manager Basic Level



Description:

The Skill card comprises the following thematic learning units

In modern cars a main share of the functions is controlled by software, electronics, and mechatronics.

Automotive Mechatronics Manager Basic Level understand the legal background, complexity and behaviour of mechatronics functions and products. In addition, they understand risks and impacts on design and costs and required organisation roles and responsibilities in the development and production of mechatronics systems. **Automotive Mechatronics Manager Basic Level** have a knowledge about the complex interactions of the development domains mechanics, electrics and IT and can plan and manage the proper methods to be applied in successful development projects. They know the required development standards and guidelines and can manage the involvement of required expertise and resources.

Description:

The skill card comprises the following thematic learning unit, and 4 learning elements

Unit 2 - Automotive Mechatronics Systems Development

U2E1: Motivation & Boundary Conditions in Automotive Industry

U2E2: Characteristics, Structures and Functions of Mechatronics Systems

U2E3: Mechatronics Systems Development Processes and -Standards

U2E4: Mechatronics Systems Engineering Basics

3.3 UNIT AMMBL.U2 AUTOMOTIVE MECHATRONICS SYSTEMS DEVELOPMENT

Acronym: AMMBL.U2

Title: Automotive Mechatronics Systems Development

Description:

Die training unit introduces into the field of automotive mechatronics and the boundary conditions of mechatronics product development, addressing:

- Introduction of mechatronics systems in automotive applications
- Overview of mechatronics systems components
- Development processes and standards of mechatronics systems
- Mechatronics systems requirements- and systems engineering

Also the unit discusses

- Challenges in multi-domain development

And the unit finally presents

- the impact on product design, the impact on cost, and
- the roles of Automotive Mechatronics Manager – Basic Level under different viewpoints.

3.3.1 Unit AMMBL.U2 - Element 1: Motivation & Boundary Conditions in Automotive Industry

Acronym: AMMBL.U2.E1

Element Title: Motivation & Boundary Conditions in Automotive Industry

Element Note:

This element gives an introduction and overview about the following aspects:

- You know about historical development, state-of-the-art and trends of mechatronics systems in automotive applications.
- You know about the integration of mechatronics systems into automotive products development.
- You have knowledge about the corresponding legislative boundary conditions in different worldwide markets.

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
AMMBL.U2.E1.PC1	The students know mechatronics systems in automotive applications and their historical background and future trends.
AMMBL.U2.E1.PC2	The students know about the integration of mechatronics systems within automotive system architectures.
AMMBL.U2.E1.PC3	The students know the corresponding legislative boundary conditions in different worldwide markets.

Table 1: Performance Criteria for the Element AMMBL.U2.E1

3.3.2 Unit AMMBL.U2 - Element 2: Characteristics, Structures and Functions of Mechatronics Systems

Acronym: AMMBL.U2.E2

Element Title: Characteristics, Structures and Functions of Mechatronics Systems

Element Note:

This element gives an introduction and overview about the following aspects:

- You know the characteristics of mechatronics systems and their control.
- You know the architectural design of different mechatronics systems.
- You know the main components of mechatronics systems.

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
AMMBL.U2.E2.PC1	The students know the characteristics of mechatronics systems and are able to distinguish between different types of control.
AMMBL.U2.E2.PC2	The students know the architectural design of different mechatronics systems.
AMMBL.U2.E2.PC3	The students know the main components of mechatronics systems.

Table 2: Performance Criteria for the Element AMMBL.U2.E2

3.3.3 Unit AMMBL.U2 - Element 3: Mechatronics Systems Development Processes and - Standards

Acronym: AMMBL.U2.E3

Element Title: Mechatronics Systems Development Processes and -Standards

Element Note:

This element gives an introduction and overview about the following aspects:

- You know automotive development processes and the integration of mechatronics systems development.
- You know the development processes for mechatronics products.
- You know the development standards and guidelines.

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
AMMBL.U2.E3.PC1	The students know automotive development processes and understand the integration of mechatronics systems development.
AMMBL.U2.E3.PC2	The students the development processes for mechatronics products.
AMMBL.U2.E3.PC3	The students know the development standards and guidelines.

Table 3: Performance Criteria for the Element AMMBL.U2.E3



3.3.4 Unit AMMBL.U2 - Element 4: Mechatronics Systems Engineering Basics

Acronym: AMMBL.U2.E4

Element Title: Mechatronics Systems Engineering Basics

Element Note:

This element gives an introduction and overview about the following aspects:

- You know the basics of requirements engineering of mechatronics systems development.
- You know the main aspects of systems engineering in multi-domain development.
- You know about simulation-based systems engineering tools for mechatronics development.

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
AMMBL.U2.E4.PC1	The students know the basics of requirements engineering of mechatronics systems development.
AMMBL.U2.E4.PC2	The students understand the main aspects of systems engineering in multi-domain development.
AMMBL.U2.E4.PC3	The students know about simulation-based systems engineering tools for mechatronics development.

Table 4: Performance Criteria for the Element AMMBL.U2.E4



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.

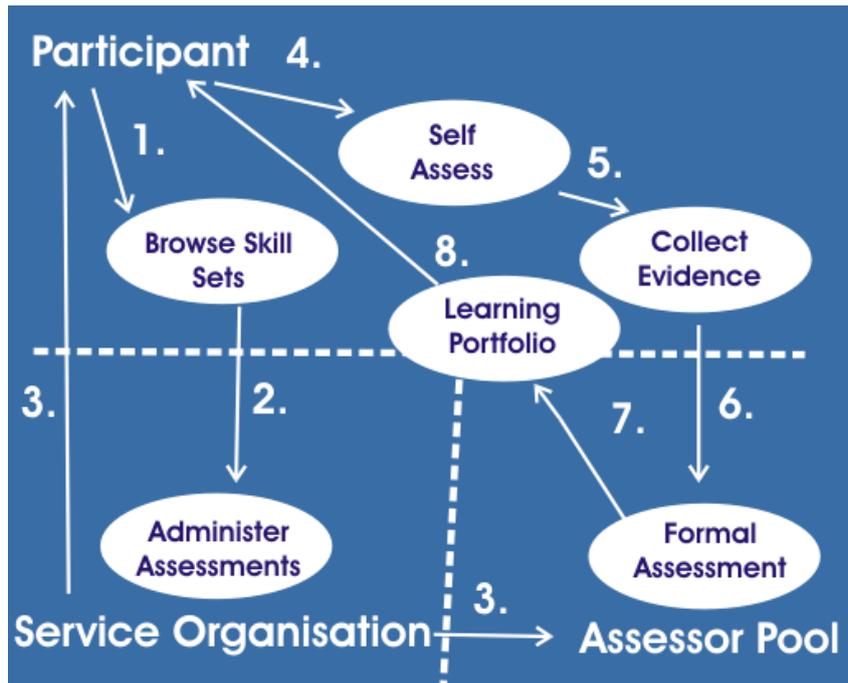
ECQA SKILLS ASSESSMENT MODEL

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, as 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 and strategic thinking
- Level 5: professional / university level

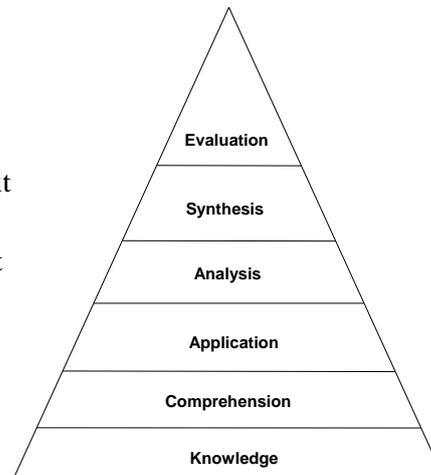
In most cases the same job role can be offered on different levels. e.g. IT Security Manager Basic Level (NVQ level 2), IT Security Manager Advanced level (NVQ Level 3), and IT Security Manager Expert Level (NVQ Levels 4 and 5).

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	<ul style="list-style-type: none"> • 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 in 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 are 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.



ANNEX D REFERENCES

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