DRIVES

Development and Research on Innovative Vocational Education Skills

Sustainability Manager

Job Role Skill Set

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www.project-drives.eu

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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 Sustainability Manager 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. 1):

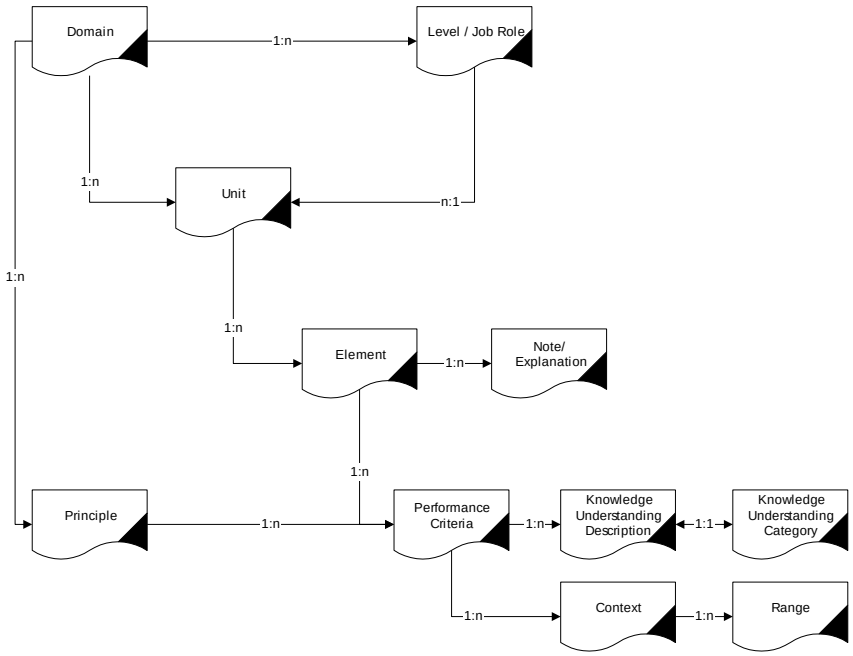


Figure 1 The Skill Definition Model (1:n = one to many relationship)

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.

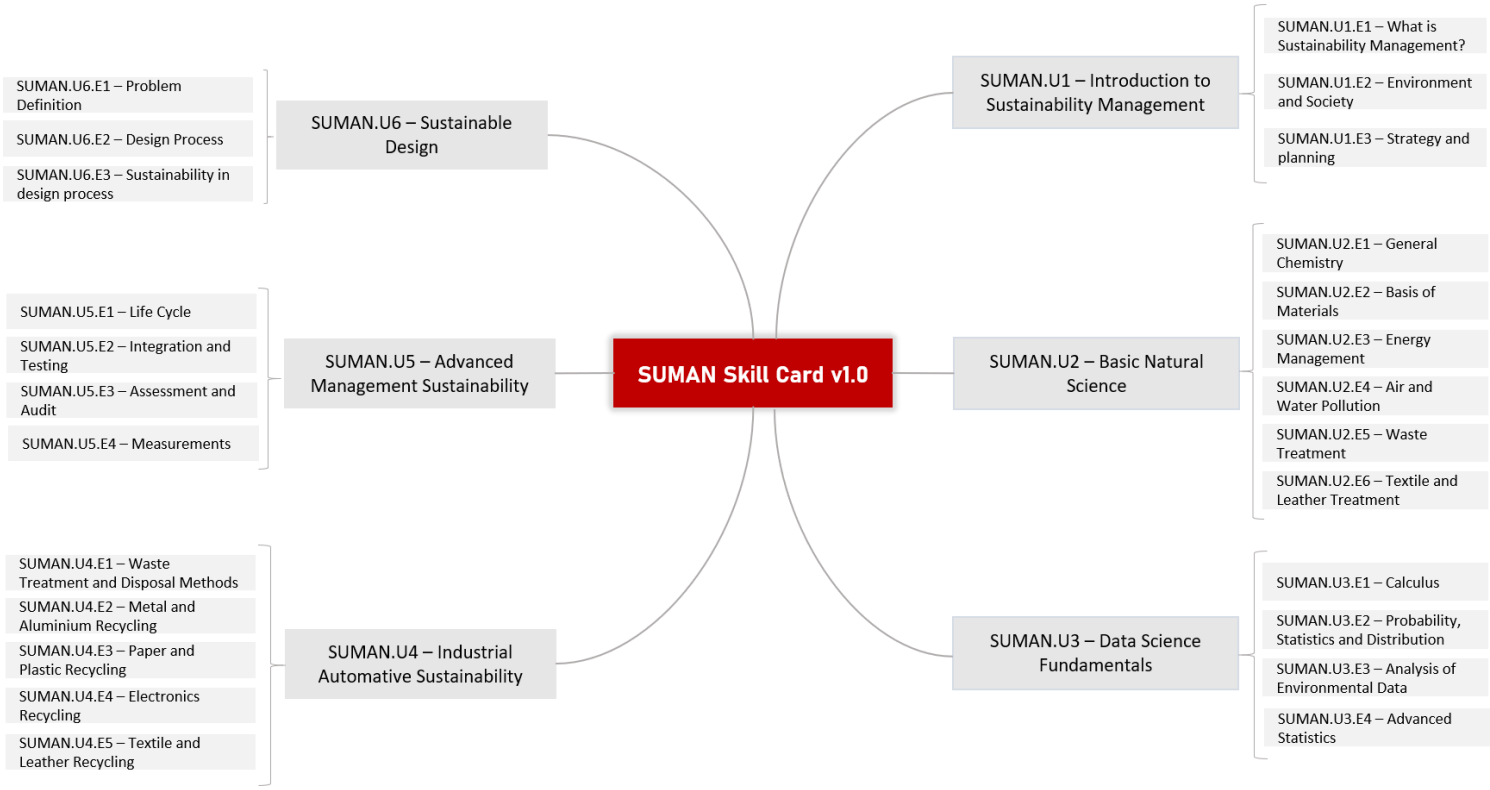
The rationales for developing the ECQA skills definition model is based on the skills definition proposed by the DTI (Department of Trade and Industry) in the UK for the NVQ (National Vocational Qualification) standards. These models have been re-used and slightly modified by other countries when they 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 "SUSTAINABILITY MANAGER"

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 role "Sustainability Manager" has been designed.



Picture 8: The Skills Set for ECQA Sustainability Manager

3.2 THE SKILLS DESCRIPTIONS – JOB ROLE SUSTAINABILITY MANAGER

Job Role Acronym: SUMAN

Job Role Title: Sustainability Manager

Description:

A Sustainability Manager (SUMAN) works on developing and implementing a sustainability strategy for the company. The task generally resembles the work of an internal auditor, analysing sustainability issues independently within the company and introducing waste and waste minimization practices. In terms of qualifications, SUMAN can come from different professional environments, with the advantage of technical education associated with communication and management skills. These managers need to be continuously trained (a sustainability management certification program) and follow developments in legislation, environmental technologies and waste reduction.

The Skill card comprises the following thematic learning units:

Unit 1 – Introduction to Sustainability Management

Unit 2 – Basic Natural Science

Unit 3 – Data Science Fundamentals

Unit 4 – Industrial Automotive Sustainability

Unit 5 – Advanced Management Sustainability

Unit 6 – Sustainable Design

3.3 UNIT SUMAN.U1 INTRODUCTION TO SUSTAINABILITY MANAGEMENT

Acronym: SUMAN.U1

Title: "Introduction to Sustainability Management"

Description:

First Unit gives an overview about the purpose and necessity of each expert domain with respect to Sustainability Management, as well as the need of an integrated approach.

E1 What is Sustainability Management?

E2 Environment and Society.

E3 Strategy and planning.

3.3.1 Unit SUMAN.U1 - Element 1: What is Sustainability Management?

Acronym: SUMAN.U1.E1

Element Title: "What is Sustainability Management?"

Element Note:

This element describes Sustainability Management based on definition and industry applications.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U1.E1.PC1	The student is able to define what is Sustainability Management. The student understands why Sustainability Management is used.
SUMAN.U1.E1.PC2	The student is able to describe the motivation and the Automotive guidelines in Sustainability. The student knows the politics and strategy in Sustainability Automotive Sector.

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U1.E1.PC3	The student knows how Sustainability Management is applied in Industry and is able to list a few examples of those applications.

Table 1: Performance Criteria for the Element SUMAN.U1.E1

3.3.2 Unit SUMAN.U1 - Element 2: Environment and Society

Acronym: SUMAN.U1.E2

Element Title: "Environment and Society."

Element Note:

This element introduces The students to the essentials environment and society.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U1.E2.PC1	The student is able to identify the problems associated to Global Climate Changes.
SUMAN.U1.E2.PC2	The student knows how to interpret Environmental Law & Policy. The student knows examples of Environment Law & Policy.
SUMAN.U1.E2.PC3	The student is able to describe the essential of Ecological Economics.
SUMAN.U1.E2.PC4	The student understands the essential of Environmental Management.

Table 2: Performance Criteria for the Element SUMAN.U1.E2

3.3.3 Unit SUMAN.U1 - Element 3: Strategy and planning

Acronym: SUMAN.U1.E3

Element Title: "Strategy and planning."

Element Note:

This learning element introduces The students to the essentials of management, such as strategy and planning.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U1.E3.PC1	The student is able to define the concept of a strategy and knows why strategy is important for sustainability management.
SUMAN.U1.E3.PC2	The student is able to define the concept of planning and knows planning as a management process.
SUMAN.U1.E3.PC3	The student knows concepts of a strategic plan, such as mission, objectives, vision, swot analysis, Porte´s Five Forces and is able to identify the different business development strategies.

Table 3: Performance Criteria for the Element SUMAN.U1.E3

3.4 UNIT SUMAN.U2 BASIC NATURAL SCIENCE

Acronym: SUMAN.U2

Title: "Basic Natural Science."

Description:

Second Unit is an introduction to basic natural science knowledge which is important to know the origin of problems that need Sustainability Management.

E1 General Chemistry

E2 Basis of materials

E3 Energy management

E4 Air and water pollution

E5 Waste treatment

E6 Textile and Leather treatment

3.4.1 Unit SUMAN.U2 - Element 1: General Chemistry.

Acronym: SUMAN.U2.E1

Element Title: "General Chemistry."

Element Note:

This element describes basic Chemistry concepts and essential characteristics of chemical reactions.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E1.PC1	The student is able to written chemical symbology, apply the law of conservation of mass in chemical reactions and describe different types of chemical reactions.
SUMAN.U2.E1.PC2	The student is able to calculate the yield of chemical reactions and interpret the results.
SUMAN.U2.E1.PC3	The student understands and describes how speed influence chemical reactions.
SUMAN.U2.E1.PC4	The student is able to do balancing chemical equations.

Table 4: Performance Criteria for the Element SUMAN.U2.E1

3.4.2 Unit SUMAN.U2 - Element 2: Basis of materials

Acronym: SUMAN.U2.E2

Element Title: "Basis of materials"

Element Note:

This learning element explains the basic concepts of materials.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E2.PC1	The student examines the structure of materials from the atomic scale to the macro scale.
SUMAN.U2.E2.PC2	The student is able to identify mechanical, chemical, electrical, thermal, optical, magnetic properties.
SUMAN.U2.E2.PC3	The student understands that different materials require different methods of processing or synthesis.
SUMAN.U2.E2.PC4	The student understands that thermodynamics is the basis for the treatment of general phenomena in materials science and engineering, including chemical reactions, magnetism, polarization and elasticity.

Table 5: Performance Criteria for the Element SUMAN.U2.E2

3.4.3 Unit SUMAN.U2 - Element 3: Energy Management

Acronym: SUMAN.U2.E3

Element Title: "Energy Management"

Element Note:

This learning element describes Energy Management in operational functions, energy efficiency and strategies.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E3.PC1	The student is able to control energy costs through energy audits to improve the existing energy usage.
SUMAN.U2.E3.PC2	The student knows it is important to integrate the energy management in the organizational structure.
SUMAN.U2.E3.PC3	The student recognizes the importance of energy management in operational functions such as logistics, production, maintenance, energy procurement and facility management.
SUMAN.U2.E3.PC4	The student is able to determine criteria for investments in energy and knows the different strategies such as energy strategies of politics, ethical and normative basis of energy strategies and energy strategies of companies.

Table 6: Performance Criteria for the Element SUMAN.U2.E3

3.4.4 Unit SUMAN.U2 - Element 4: Air and water pollution

Acronym: SUMAN.U2.E4

Element Title: "Air and water pollution."

Element Note:

This learning element explains air and water pollution concepts.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E4.PC1	The student is able to identify physical and chemical characteristics of air and water quality and understands and recognizes different parameters to evaluate the air and water quality.
SUMAN.U2.E4.PC2	The student is able to define main sources of air and water pollution and knows the impact of air and water pollution.
SUMAN.U2.E4.PC3	The student knows different methods to treat air and water and is able to give some examples of these treatments.

Table 7: Performance Criteria for the Element SUMAN.U2.E4

3.4.5 Unit SUMAN.U2 - Element 5: Waste Treatment

Acronym: SUMAN.U2.E5

Element Title: "Waste Treatment."

Element Note:

This learning element describes

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E5.PC1	The student understands waste management hierarchy and planning.
SUMAN.U2.E5.PC2	The student is able to identify different sources and types of waste.
SUMAN.U2.E5.PC3	The student knows the strategic plan of waste and recognize different laws for different types of waste.
SUMAN.U2.E5.PC4	The student is able to know how waste is produced and composited.
SUMAN.U2.E5.PC5	The student is able to interpret quantification, qualification and danger assessment methods for solid waste.
SUMAN.U2.E5.PC6	The student is able to describe the physical, chemical and biological properties of the waste.

Table 8: Performance Criteria for the Element SUMAN.U2.E5

3.4.6 Unit SUMAN.U2 - Element 6: Textile and Leather treatment

Acronym: SUMAN.U2.E6

Element Title: "Textile and Leather treatment."

Element Note:

This learning element describes

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U2.E6.PC1	The student is able to know how textile and leather materials are transformed in industries.
SUMAN.U2.E6.PC2	The student is able to describe the physical, chemical and biological properties of the textile and leather materials.

Table 9: Performance Criteria for the Element SUMAN.U2.E6

3.5 UNIT SUMAN.U3 DATA SCIENCE FUNDAMENTALS

Acronym: SUMAN.U3

Title: "Data Science Fundamentals."

Description:

Third Unit is dedicated to fundamentals of data science which are used in predictive maintenance.

E1 Calculus

E2 Probability, Statistics and Distribution

E3 Analysis of Environmental Data

E4 Advanced Statistics

3.5.1 Unit SUMAN.U3 - Element 1: Calculus

Acronym: SUMAN.U3.E1

Element Title: "Calculus"

Element Note:

This element describes basic mathematical concepts such as equations, functions and graphs.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U3.E1.PC1	The student is able to solve linear, simple polynomial, trigonometric, exponential and logarithmic equations.
SUMAN.U3.E1.PC2	The student knows the formal function definition and is familiar with elementary functions such as polynomials, rational, trigonometric, exponential and logarithmic functions. The student is able to define multi-variable functions.
SUMAN.U3.E1.PC3	The student knows what is graph of the function and can draw it.

Table 10: Performance Criteria for the Element SUMAN.U3.E1

3.5.2 Unit SUMAN.U3 - Element 2: Probability, Statistics and Distribution

Acronym: SUMAN.U3.E2

Element Title: "Probability, Statistic and Distribution."

Element Note:

This learning element explains basic mathematical concepts of probability and statistics.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U3.E2.PC1	The student knows the formal definition of probability for both finite and infinite elementary event space. The student is able to compute probability function for both discrete and continuous cases.
SUMAN.U3.E2.PC2	The student knows the formal definition of distribution, expected value, variance and cumulative distribution function.
SUMAN.U3.E2.PC3	The student is able to compute expected values and variances both for discrete and continuous distributions.
SUMAN.U3.E2.PC4	The student knows the formal definition of statistics, significance level and statistical test. The student is able to test statistical hypothesis.

Table 11: Performance Criteria for the Element SUMAN.U3.E2

3.5.3 Unit SUMAN.U3 - Element 3: Analysis of Environmental Data

Acronym: SUMAN.U3.E3

Element Title: "Analysis of Environmental Data."

Element Note:

This learning element describes methods for analysis of environmental data which are used in Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U3.E3.PC1	**Databases:** The student knows different types of data and know how they are stored in database.
SUMAN.U3.E3.PC2	The student has basic knowledge of compression methods and its application in databases.
SUMAN.U3.E3.PC3	**Information flow process:** The student knows the formal definition of information and is able to describe information flow between different applications.

Table 12: Performance Criteria for the Element SUMAN.U3.E3

3.5.4 Unit SUMAN.U3 - Element 4: Advanced Statistics

Acronym: SUMAN.U3.E4

Element Title: "Advanced Statistics."

Element Note:

This learning element introduce advanced mathematic statistic into Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U3.E4.PC1	The student knows how to calculate ”a posteriori” probability according to Bayes equation.
SUMAN.U3.E4.PC2	The student can explain the difference between prior and posterior probability.
SUMAN.U3.E4.PC3	The student can calculate function of priori and posterior data distribution for Bayesian prediction.
SUMAN.U3.E4.PC4	**Statistical Inference:** The student is able to define some simple statistical model based on data from measurements.
SUMAN.U3.E4.PC5	The student understands model assumptions and can define which parameter they depend on.
SUMAN.U3.E4.PC6	The student is able to verify those assumptions and calculate estimated data distribution.
SUMAN.U3.E4.PC7	**Design of Experiment:** The student knows methods (f. e. Regression) to calculate and quantify relationship between Xs and Y for created model.

SUMAN.U3.E4.PC8	The student knows how to reduce sustainability models using Pareto method.
SUMAN.U3.E4.PC9	The student knows method of validation sustainability models using residual calculation and graphs.

Table 13: Performance Criteria for the Element SUMAN.U3.E4

3.6 UNIT SUMAN.U4 INDUSTRIAL AUTOMOTIVE SUSTAINABILITY

Acronym: SUMAN.U4

Title: "Industrial Automotive Sustainability."

Description:

Fourth Unit describes Industrial Automotive Sustainability, where The students learn methods for waste treatments and how to recycle metal, aluminium, paper, plastic, electronics and leather materials.

E1 Waste Treatment and Disposal Methods

E2 Metal and Aluminium Recycling

E3 Paper and Plastic Recycling

E4 Electronics Recycling

E5 Textile and Leather Recycling

3.6.1 Unit SUMAN.U4 - Element 1: Waste Treatment and Disposal Methods

Acronym: SUMAN.U4.E1

Element Title: "Waste Treatment and Disposal Methods."

Element Note:

This element describes methods for waste treatment it is important to Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U4.E1.PC1	The student is able to describe thermal waste treatment techniques such as Incineration, Gasification, Pyrolysis and Open Burning.
SUMAN.U4.E1.PC2	The student is able to know how dumps and landfills works and can describe solutions such as Sanitary landfills, Controlled dumps and Bioreactor landfills.
SUMAN.U4.E1.PC3	**Biological Waste Treatment:** The student describes biological treatment methods such as Composting and Anaerobic Digestion.

Table 14: Performance Criteria for the Element SUMAN.U4.E1

3.6.2 Unit SUMAN.U4 - Element 2: Metal and Aluminium Recycling

Acronym: SUMAN.U4.E2

Element Title: "Metal and Aluminium Recycling"

Element Note:

This learning element shows The students how metal and aluminium should be recycled in Industry Automotive Sustainability.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U4.E2.PC1	The student knows the types of metal and aluminium recycled and their importance for sustainability management.
SUMAN.U4.E2.PC2	The student is able to identify and describe the first, main and final phases of metal and aluminium recycling process.
SUMAN.U4.E2.PC3	The student is able to recognize different techniques for metal and aluminium recycling process.

Table 15: Performance Criteria for the Element SUMAN.U4.E2

3.6.3 Unit SUMAN.U4 - Element 3: Paper and Plastic Recycling

Acronym: SUMAN.U4.E3

Element Title: "Paper and Plastic Recycling"

Element Note:

This learning element shows The students how paper and plastic should be recycled in Industry Automotive Sustainability.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U4.E3.PC1	The student is able to identify and describe the first, main and final phases of paper and plastic recycling process.
SUMAN.U4.E3.PC2	The student recognizes the requirements for recycling paper and plastic.
SUMAN.U4.E3.PC3	The student is able to understand the challenges of the paper and plastic recycling industry, as well as the importance of these industries for the environment.

Table 16: Performance Criteria for the Element SUMAN.U4.E3

3.6.4 Unit SUMAN.U4 - Element 4: Electronics Recycling

Acronym: SUMAN.U4.E4

Element Title: "Electronics Recycling"

Element Note:

This element shows The students how electronics should be recycled in Industry Automotive Sustainability.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U4.E4.PC1	The student is able to know the benefits of Electronics Recycling.

SUMAN.U4.E4.PC2	The student is able to identify the steps of Electronic Recycling such as Collection and Transportation, Shredding, Sorting, Separation, and Preparation for sale as recycled materials.
SUMAN.U4.E4.PC3	The student knows how different components of batteries are recycled.

Table 17: Performance Criteria for the Element SUMAN.U4.E4

3.6.5 Unit SUMAN.U4 - Element 5: Textile and Leather Recycling

Acronym: SUMAN.U4.E5

Element Title: "Textile and Leather Recycling."

Element Note:

This learning element shows The students how leather should be recycled in Industry Automotive Sustainability.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U4.E5.PC1	The student is able to know the benefits of textile and leather waste recycling.
SUMAN.U4.E5.PC2	The student is able to identify the steps of Textile and Leather Recycling. The student describes what happens when Textile and Leather waste is recycled.

Table 18: Performance Criteria for the Element SUMAN.U4.E5

3.7 UNIT SUMAN.U5 ADVANCED MANAGEMENT SUSTAINABILITY

Acronym: SUMAN.U5

Title: "Advanced Management Sustainability."

Description:

Fifth Unit describes the domain expert and integrated views on the subject Sustainability Management. Based on the life cycle view, the principal subjects are design, integration and testing, assessment and audit, as well as measurements.

E1 Life Cycle

E2 Design

E3 Integration and Testing

E4 Assessment and Audit

E5 Measurements

3.7.1 Unit SUMAN.U5 - Element 1: Life Cycle

Acronym: SUMAN.U5.E1

Element Title: "Life Cycle."

Element Note:

This element deals with the life cycle view and understanding according to the Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U5.E1.PC1	The student describes the life cycle concepts underlying Sustainability Management.
SUMAN.U5.E1.PC2	The student understands and follow the Sustainability Management road map.
SUMAN.U5.E1.PC3	The student is able to identify and select the proper tools to use during the process.
SUMAN.U5.E1.PC4	The student describes the safety life cycle according to ISO 14044.

Table 19: Performance Criteria for the Element SUMAN.U5.E1

3.7.2 Unit SUMAN.U5 - Element 2: INTEGRATION AND TESTING

Acronym: SUMAN.U5.E2

Element Title: "Integration and Testing."

Element Note:

This learning element explains how integration and testing are managed in Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U5.E2.PC1	The student is able to describe and apply environmental test concepts.
SUMAN.U5.E2.PC2	The student describes the verification and validation concepts according to ISO 14001.
SUMAN.U5.E2.PC3	The student is able to understand which different types of tests can be used during sustainability management.

Table 20: Performance Criteria for the Element SUMAN.U5.E2

3.7.3 Unit SUMAN.U5 - Element 3: ASSESSMENT AND AUDIT

Acronym: SUMAN.U5.E3

Element Title: "Assessment and Audit."

Element Note:

This learning element explains the essential role of assessments and audits in Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U5.E3.PC1	The student understands how assessment and audit methods are used in Sustainability Management.
	The student is able to describe assessment method Sustainability Management.

SUMAN.U5.E3.PC2	The student understands how to prepare for internal audits and understands the audit process and different roles.
SUMAN.U5.E3.PC3	The student describes safety audit and assessment requirements according to ISO 19011.

Table 21: Performance Criteria for the Element SUMAN.U5.E3

3.7.4 Unit SUMAN.U5 - Element 4: MEASUREMENTS

Acronym: SUMAN.U5.E4

Element Title: "Measurements."

Element Note:

This learning element investigates the role of measurements in the Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U5.E4.PC1	The student understands how sustainability management can have a measurement system and is able to describe the typical measurements expected by sustainability management.
SUMAN.U5.E4.PC2	The student recognizes sustainability indicators and their function.
SUMAN.U5.E4.PC3	The student is able to identify environmental sustainability, economic and social indicators.

Table 22: Performance Criteria for the Element SUMAN.U5.E4

3.8 UNIT SUMAN.U6 SUSTAINABLE DESIGN

Acronym: SUMAN.U6

Title: "Sustainable Design"

Description:

Sixth Unit describes the domain expert and integrated views on the subject Sustainable Design.

E1 Problem Definition

E2 Design Process

E3 Sustainability in design process

3.8.1 Unit SUMAN.U6 - Element 1: Problem Definition

Acronym: SUMAN.U6.E1

Element Title: "Problem definition"

Element Note:

This element deals with the problem definition, which are the requests of the user/client and which are the requests or constrains of sustainability.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U6.E1.PC1	The student describes the technical requests for a product.
SUMAN.U6.E1.PC2	The student understands and define the sustainability requests for a product, for all stages of the product and specific processes .
SUMAN.U6.E1.PC3	The student describes the main functionalities of the product based on the user needs and sustainability requests.

Table 23: Performance Criteria for the Element SUMAN.U6.E1

3.8.2 Unit SUMAN.U6 - Element 2: Design Process

Acronym: SUMAN.U6.E2

Element Title: "Design Process"

Element Note:

This learning element deals with the view on the sustainable design approach of the Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U6.E2.PC1	The student defines and uses the concepts and the main steps to design a product.

SUMAN.U6.E2.PC2	The student is able to use software platform to simulate the product as well as the sustainable elements of the design process.
SUMAN.U6.E2.PC3	The student is able to use some decision techniques to select the best technical solution of a product.

Table 24: Performance Criteria for the Element SUMAN.U6.E2

3.8.3 Unit SUMAN.U6 - Element 3: Sustainability in design process

Acronym: SUMAN.U6.E3

Element Title: "Sustainability in design process"

Element Note:

This learning element explains how to use sustainble elements in design process in Sustainability Management.

Performance Criteria:

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

Performance Criterion	Evidence Check: The The student can demonstrate
SUMAN.U5.E3.PC1	The student is able to describe and apply the main constrains and requests in design process.
SUMAN.U6.E3.PC2	The student describes the different levels of design and implication of sustainability in these levels.
SUMAN.U6.E3.PC3	The student describes and uses various techniques to prototype and test a product based on sustainable requests.

Table 25: Performance Criteria's for the Element SUMAN.U6.E3

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 The 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.

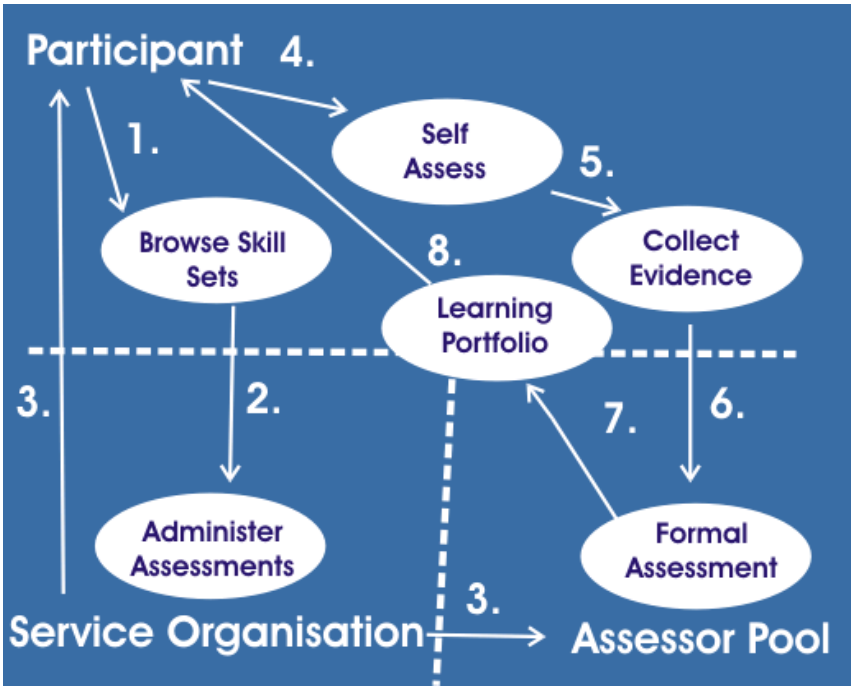
ECQA SKILLS ASSESSMENT MODEL

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 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

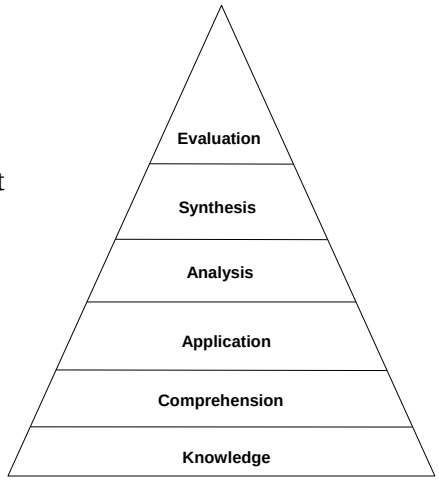
In most cases the same job role can be offered on different levels. e.g. IT Security Manager Basic Level (NVQ level 2), IT Security Manager Advanced level (NVQ Level 3), and IT Security Manager Expert Level (NVQ Levels 4 and 5).

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.

ANNEX D REFERENCES

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