tourings

training for collaborative robotics integration

TOURINGS

Joint Curriculum

Final Version

Co-funded by the European Union

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Joint Curriculum

Project funded with support from the European Commission

Project Title

Innovative Training Solution for the Installation of Collaborative Robotics in Manufacturing Sectors
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Consortium

HKA (Germany)
CETEM (Spain)
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IMT-BS (France)

1 Content

2 Introduction

The aim of the TOURINGS Project is to design and develop a common curriculum and learning approach on Collaborative Robotics and its installation and proper integration on manufacturing companies. Thus, a joint curriculum will be summarized, and will define training objectives, learning outcomes and training and assessment methods. This will compromise in addition didactic materials and a common collaborative platform in line with needs of the different target users identified.

As a Vocational Education and Training (VET) course, TOURINGS will follow the recommendations of the European Commission to establish a European Credit System for VET (ECVET) to facilitate the learning approach on installation and integration of collaborative robotics on the manufacturing companies, and the recognition of learning outcomes in VET and borderless lifelong learning. Formal public institutes/VET providers and higher Education Institutions specialized in robotics, human resources, assembly line concepts and digital environments will be also considered.

The current document defines the European Framework and Consortium partners countries frameworks, specifications of each training module and units, including duration, learning outcomes or guidelines of the training content, and weight of the learning units as a stage of preparation for future acquisition of ECVET credit points. Once the jouint curriculum is established, the content will be carefully reviewed and improved to make the transition between consecutive modules in the smoothest way.

The objective is to be ready for a future implementation of the ECVET system in all European countries, that will facilitate transnational recognition, transference of the training course to other countries or organizations, and also be ready for a validation at a European level of the developed training course.

3 European Framework

The European Qualification Framework (EQF), which was adopted by the european parliament and the council in 2008, represents a common refence Framework and translation system for the european member countries to officially compare and adapt their qualifications and common policies in education and training, particularly in higher education.

The EQF is voluntary, and the member countries are not obliged to cross reference their frameworks but this makes it easier to determine a person's level of Qualification and to make strategies between countries in Europe, to realize transparency and recognition of competences in order to increase the mobility in the labor market.

3.1 European Credit System for Vocational Education and Training

The EQF is a lifelong learning framework and covers all types of qualifications. It also includes vocational qualifications. On 2009 the european Parliament and the Council launched, "the recommendation on the establishment of a European Credit System for Vocational Education and Training (ECVET)". The proposed ECVET system aims, to make it easier for people to get validation and recognition of work-related skills and knowledge acquired in different systems and countries – so that they can count towards vocational qualifications. In addition, it aims to make it more attractive to move between different countries and learning environments. The main goals are also to increase the compatibility between the different vocational education and training (VET) systems in place across Europe, and the qualifications they offer and to increase the employability of VET graduates and the confidence of employers that each VET qualification requires specific skills and knowledge.

Thus, ECVET should be applied in accordance with national legislation. In this way, the ECVET recommendation invited all European countries to create the necessary conditions and adopt measures to make it possible.

The table 1 shows the level of implementation of ECVET at 2015, from the last Monitoring report on ECVET which was developed by the European Centre for the Development of Vocational Training (CEDEFOP).

Table 1:Credit systems for transfer and accumulation of learning outcomes and ECVET development (CEDEFOP)

Country	Direction of ECVET development	Do the answers apply to CVET?
Countries with a credit system in IVET that allows accumulating and/or transferring learning outcomes of individuals		
Belgium-French Community	The system is ECVET-compatible.	No
Denmark	Some ECVET technical components are tested	Yes
Estonia	The system is ECVET-compatible.	Yes
Finland	The system is ECVET-compatible.	Yes
France	The system is ECVET-compatible.	Yes
Iceland	The system is ECVET-compatible.	No
Ireland	It may be possible to map elements of the well-established credit system to ECVET principles.	Yes
Luxembourg	The system is ECVET-compatible.	Yes
Malta	The system is ECVET-compatible.	Yes
Romania	Some ECVET technical components are tested.	No
Slovenia	The system is ECVET-compatible.	No
Spain	The system is ECVET-compatible.	No
Sweden	The system is ECVET-compatible.	No
UK-England	The system is ECVET-compatible.	Yes
UK-Northern Ireland	The system is ECVET-compatible.	Yes
UK-Scotland	The system is ECVET-compatible.	Yes
UK-Wales	The system is ECVET-compatible.	Yes
Countries where credits are used in some qualifications		
Austria	Some ECVET technical components are tested.	Yes
Bulgaria	A credit system compatible with ECVET is being developed.	Yes
Croatia	A credit system compatible with ECVET is being developed.	Yes
Czech Republic	A credit system compatible with ECVET is being developed.	No
Italy	Some ECVET technical components are tested.	Yes
Lithuania	Some ECVET technical components are tested.	Yes
Norway	Some ECVET technical components are tested.	Yes
Countries with no credit system		
Belgium-Flemish Community	Any initiative on ECVET implementation at system level is on hold.	Yes
Cyprus	A credit system compatible with ECVET is being developed.	No
Germany (*)	Some ECVET technical components are tested.	Yes
Greece	Any initiative on ECVET implementation at system level is on hold.	Yes
Hungary	Any initiative on ECVET implementation at system level is on hold.	Yes
Latvia	Some ECVET technical components are tested.	Yes
Liechtenstein	Any initiative on ECVET implementation at system level is on hold.	Yes
Netherlands	Some ECVET technical components are tested.	No

As it is shown in this table the european countries are classified in three different categories and not all countries can adapt and integrate the ECVET implementation at the same level with the other countries without a credit system.

The folowing ECVET principles and technical components resume the credit system to be better operational and effective:

1. Qualifications should be described in units of learning outcomes (LO), a central concept of ECVET principles, with associated points (ECVET points).
2. There should be a process for units of LO to be assessed, validated and recognized, and for their transfer and accumulation.

3. ECVET partnerships are supported by complementary documents, such as memorandum of understanding (MoU), or learning agreements (LA).

3.2 European Qualifications Framework

The ECVET system and the European Qualification Framework compleates each other in terms to make qualifications more readable and understandable across different countries and systems. Covering qualifications at all levels and in all sub-systems of education and training, the EQF provides a comprehensive overview over qualifications in the 39 European countries currently involved in its implementation.

The EQF defines eight reference levels in terms of learning outcomes, which gives individuals what to know, understand and what they are able to do at the end of learning process. Each of the 8 levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications, described in terms of knowledge, skills and competences which are in the context of EQF as below defined:

Knowledge: In the context of EQF, knowledge is described as theoretical and/or factual.

Skills: In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).

Competences: In the context of the EQF competence is described in terms of responsibility and autonomy. This is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility

The folowing table represented the EQF levels in terms of this.

	Knowledge	Skills	Competences
Level 1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work or study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials and information	Take responsibility for completion of tasks in work or study; adapt own behaviour to circumstances in solving problems

Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5	Comprehensive, specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; review and develop performance of self and others
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; take responsibility for managing professional development of individuals and groups
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	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8	Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

To be conform to the EQF countries have to develop or adapt their national qualifications frameworks (NQFs) to implement the EQF. This process of development and progress will be monitored by CEDEFOP.

4 National Frameworks

The current state of consortium partners frameworks related to ECVET and NQF is analyzed below.

4.1 National Framework – Qualification system in Germany

This section presents the Qualification system in Germany and its Levels

4.1.1 Introduction to the German education system and professional training.

The German education system, introduced on May 1, 2013, is a historically grown structure of education offers for people of all ages, from early childhood education in the elementary sector to the field of adult education in the sense of lifelong learning. It was developed to give the education system in Germany more transparency and structure. The formal education system is divided into school based general education, vocational education, and training, including initial vocational education and training and the further training opportunities building on it, higher education and continuing education.

In Germany, the vocational education and training system is of central importance. The middle qualification segment of vocational education and training is exceptionally strong and makes a major contribution to the skilled training of large parts of the working population. The generation of higher qualifications in Germany is the responsibility not only of academic education but also of vocational training. This contributes significantly to the strength of the German innovation system.

Training in the dual system, i.e. training in companies and in the “Berufsschule” (professional school -part-time vocational school), has a leading role. This form of training is complemented by a range of school-based forms of vocational training.

In Germany, access to many occupational fields is achieved through dual vocational education and training where other countries require education at a higher education institution. This means that the share of higher education graduates in the workforce is lower in Germany compared to other European countries. For that reason, further training qualifications such as “Meister” (master craftsman) and “Techniker” (technician) are comparatively more important. Individuals with these further training qualifications – like academics – are regarded as highly qualified workers and make up 10 per cent of the overall working population. Basic and further vocational education and training are closely interlinked and build upon each other.

The German vocational education and training system has divided into three major sectors each with their own institutional structures: the dual system of in-company and school-based training as the largest sector in quantitative terms, the vocational school system, and the transitional sector between general education schools and regular vocational education and training, in which different types of vocational preparation competences are taught rather than a full vocational qualification.

In Addition the DQR with his structure and transparency can contribute, to clarify the equivalence of general, vocational and university education, to promote the orientation of qualifications to competencies, and the orientation of the qualification processes on learning outcomes, also to support permeability and quality assurance in the German education system, and to improve opportunities for the recognition and crediting of non-

formally and informally acquired competences as well and to strengthen lifelong learning as a whole.

4.1.2 NQF - European Framework and links with the German one (DQR).

The Deutsche Qualification Rahmenwerk (DQR) is an instrument for the alignment of qualifications in the German educational system. Its aims are to facilitate orientation in the German educational system and to assist with the comparability of German qualifications in Europe. Linking the DQR to the European Qualifications Framework (EQF) makes it easier to compare qualifications - in Europe and in Germany. This supports the mobility of learners and professionals.

In order to make it more transparent which competences are acquired in the German educational system, the DQR assigns the qualifications of the different education areas in eight levels which are described by learning outcomes and can be aligned to the eight levels of the European Qualifications Framework (EQF). The EQF serves as a translation instrument which helps to make national qualifications more comprehensible across Europe.

The DQR has been developed and implemented under the aegis of the Federal Ministry of Education and Research and the Standing Conference of the Ministers of Education and Cultural Affairs, with the involvement of other stakeholders. The development of the DQR has at all times been a widely supported initiative in which the social partners and business organisations in particular have played a fundamental role. The competent authorities in each case are responsible in principle for the allocation of qualifications to the DQR. In the field of formal learning these are the regulatory bodies. These allocations must, however, be notified to the National Coordination Point (NCP), which monitors the process and considers the overall architecture of the DQR.

Table 2: Level correspondence established between the DQR and EQF

EQF	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
DQR	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8

Table 3: The national qualification framework in Germany

DQR Levels	**Qualifications**	**EQF Levels**
8	Doctoral studies	8

7	Master, strategic IT professional (certified)* *Strategischer IT Professional (Geprüfter)*	7
6	Bachelor, commercial specialist (certified) (*Fachkaufmann (Geprüfter))*, business management specialist (certified) (*Fachwirt (Geprüfter)),* master craftsman (certified), *(Meister (Geprüfter)),* operative IT professional (certified)] * (*Operativer IT Professional (Geprüfter)),* Fachschule (State-certified…), *Fachschule* (*(Staatlich Geprüfter…)*)	6
5	IT specialist (certified) (*IT-Spezialist (Zertifizierter)*), service technician (certified)* (*Service-techniker (Geprüfter))*	5
4	Dual VET (three-year and three-and-a-half-year training courses), full-time vocational school (assistant occupations) (*Berufsfachschule*), full vocational qualification (full-time vocational school) (*Berufsfachschule*)	4
3	Dual VET (two-year training courses), full-time vocational school (general education school leaving certificate obtained on completion of grade 10 at *Realschule* or, under certain circumstances, at other lower secondary school types) (*Berufsfachschule*) *(Mittlerer Schulabschluss)*	3
2	Vocational training preparation (*Berufsausbildungsvorbereitung*), employment agency measures (*Maßnahmen der Arbeitsagentur*), year of pre-vocational training (Berufsvorbereitungsjahr), introductory training for young people (*Einstiegsqualifizierung*), full-time vocational school (*Berufsfachschule*), basic vocational training, (*Berufliche Grundbildung*)	2
1	Vocational training preparation (*Berufsausbildungsvorbereitung*), employment agency measures (vocational preparation schemes) (*Maßnahmen der Arbeitsagentur (Berufsvorbereitende Bildungsmaßnahmen*), year of pre-vocational training (*Berufsvorbereitungsjahr*)	1

4.1.2.1 Structural comparison of the DQR and EQF.

The DQR has eight levels, which can be assigned to those of the EQF. The DQR levels are structured differently from the EQF, and a greater number of categories were used for the characterization. As a rule, an EQF level has the following structure:

Table 4: Structure of the EQF levels (source: European Commission 2008)

Each of the eight levels is defined by a set of descriptors indicating the learning outcomes relevant to qualifications at that level in any system of qualifications			
	Knowledge	**Skills**	**Competence**
Level X	In the European Qualifications Framework, knowledge is described as theoretical and/or factual.	In the European Qualifications Framework, skills are described as cognitive (using logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);	In the European Qualifications Framework, competence is described in terms of responsibility and autonomy.

And the DQR level is structured as follows:

Table 5: Structure of the DQR levels (source: DQR document 2011)

Level Indicator			
Structure of requirements			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Depth and breadth	Instrumental and systemic skills, judgement	Team/leadership skills, involvement and communication	Autonomous responsibility/ responsibility, reflectiveness and learning competence

Comparing these two tables we can say that, simplifying the content, both are different in:

- The DQR has four (instead of three) “pillars” (knowledge – skills – social competence – autonomy) to describe the desired learning outcomes German education system. It thus makes it clear that a holistic understanding of competence is of key importance in the German education system. Unlike the EQF, each level is preceded by a short text that summarises the structure of requirements of the relevant level (“level indicator”).

- The concept of ‘competence’ plays a key role in the DQR. It does not – as in the EQF – exist alongside knowledge and skills, but forms the umbrella for all learning outcomes being considered. It describes the ability and readiness to use knowledge, skills and personal, social and/or methodological abilities in work or study situations and in professional and personal development. Knowledge and skills are therefore represented as aspects of professional competence.
- Knowledge and skills are therefore represented as aspects of professional competence.

Definitions of Terms in DQF and EOF

Term	DQF	EQF
Knowledge	Refers to the totality of facts, principles, theory and practice in an area of learning or work as a resultnjis of learning and understanding. The term knowledge is used synonymously with "knowing". Professional knowledge: Combines the knowledge of facts, principles, theory and practical knowledge, especially the knowledge of procedures and approaches in a field of activity relevant to the labour market.	The result of processing information through learning, knowledge refers to the totality of facts, principles, theories and practice in a field of work and learning. IN EQF, knowledge is described as theory and/or factual knowledge
Skills	Describe the abilities to apply knowledge and use know-how to perform tasks and solve problems. As in the EQF, skills are described as cognitive skills (logical, intuitive and creative thinking) and	The ability to apply knowledge and use know-how to perform tasks and solve problems. In the EQF, skills are described as cognitive skills (logical, intuitive and creative thinking) and practical

	practical skills (dexterity and use of materials, tools and instruments). Instrumental skills: SInd skills of application, whether of ideas, theories, methods, tools, technologies and devices. Systemic skills: are directed towards the generation of something new. They presuppose instrumental skills and require the assessment of the adequate handling of complex contexts.	skills (dexterity and use of materials, tools and instruments)
Responsibility and autonomy	Competences in the DQR describe the individual's ability and willingness to use knowledge and skills as well as personal, social and methodological abilities to behave in a thoughtful, individually and socially responsible manner. In this sense, competence is understood as comprehensive action competence. In the DQR, competence is presented in the dimensions of professional competence and personal competence. Methodological competence is understood	The proven ability to use knowledge, skills and personal, social and methodological abilities in work or learning situations and for professional and/or personal development. In the EQF, competence is described in terms of assuming responsibility and autonomy.

	as a cross-cutting competence and is therefore specifically mentioned in the DQR matrix. **Social competence** Describes the ability and willingness to work together with others in a goal-oriented manner, to understand their interests and social situations, to deal with them rationally and responsibly and to communicate with them, as well as to help shape working and living environments. **Personal competence** Personal/human competence includes social competence and independence. It refers to the ability and willingness to develop oneself and to shape one's own life independently and responsibly in the respective social, cultural or professional context. **Ability to work in a team** Is the ability to cooperate within a group to achieve goals. **Leadership ability**	

	Describes the ability to influence the behaviour of other people in a group or an organisation in a purposeful and constructive way. **Independence** Refers to the ability and willingness to act independently and responsibly, to reflect on one's own actions and those of others, and to further develop one's own ability to act.	

Level description DQF

Level 1			
Describes competences to fulfil simple requirements in a manageable and stably structured learning or working area. The tasks are performed under guidance.			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Have basic general knowledge. Have a first insight into a field of learning or work.	Have cognitive and practical skills to carry out simple tasks according to given rules and to evaluate their results. Make elementary connections.	Learning or working together with others, informing and exchanging information orally and in writing.	Learn or work under guidance. Assess one's own and others' actions and accept learning guidance.

Level 2

Describes competences that are needed for the professional fulfilment of basic requirements in a clearly and stably structured learning or working area. The tasks are largely performed under guidance.

Professional competence		Personal competence	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess basic general knowledge and basic technical knowledge in a field of learning or work.	Possess basic cognitive and practical skills to carry out tasks in a field of learning or work and to assess their results according to given standards as well as to make connections.	Participate in a group. Receiving and expressing general suggestions and criticism. Act and react appropriately in oral and written communication.	Learn or work responsibly in familiar and stable contexts largely under supervision. Evaluate own and others' actions. Use given learning aids and ask for learning guidance.

Level 3

Describes competences that are required for the independent fulfilment of technical requirements in a learning area or field of occupational activity that is still manageable and partly openly structured.

Professional competence		Personal competence	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess extended general knowledge or extended specialised knowledge in a field of learning or vocational field of activity.	Possess a range of cognitive and practical skills for planning and processing technical tasks in a field of learning or vocational activity. Evaluate results according to largely predefined standards, perform	Participate in a group and offer selective support. Helping to shape the learning or working environment, designing processes and presenting results in an addressee-related manner.	Learn or work independently and responsibly even in less familiar contexts. Evaluate own and others' actions. Ask for learning guidance and select different learning aids.

	simple transfer tasks.		

Level 4			
Describes competences that are required for the independent planning and processing of technical tasks in a comprehensive, changing field of learning or professional field of activity.			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess in-depth general knowledge or specialised theoretical knowledge in a learning area or field of occupational activity.	Possess a broad spectrum of cognitive and practical skills that enable independent task processing and problem solving as well as the assessment of work results and processes, considering alternative actions and interactions with neighbouring areas. Produce transfer performances.	Helping to shape the work in a group and its learning or working environment and offering continuous support. Justify procedures and results. Communicate comprehensively about issues.	Set learning and working goals, reflect on them, realise them and take responsibility for them.

Level 5			
Describes competences required for the independent planning and processing of comprehensive subject-related tasks in a complex, specialised, changing area of learning or field of occupational activity.			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**

Possess integrated subject knowledge in a field of learning or integrated vocational knowledge in a field of activity. This also includes in-depth subject-specific theoretical knowledge. Know the scope and limits of the learning area or vocational field of activity.	Possess a very broad range of specialised cognitive and practical skills. Plan work processes across the board and assess them with comprehensive consideration of alternative actions and interactions with neighbouring areas. Produce comprehensive transfer performances.	Plan and design work processes cooperatively, also in heterogeneous groups, guide others and support them with well-founded learning guidance. Present complex issues in a structured, target-oriented, and addressee-related manner, even across subjects. Consider the interests and needs of addressees in a forward-looking manner.	Reflect, evaluate, pursue and take responsibility for their own and other people's learning and work goals and draw consequences for the work processes in the team. for the work processes in the team.

Level 6			
Describes competences that are required for planning, processing and evaluating comprehensive subject-related tasks and problems as well as for independently controlling processes in sub-areas of a scientific subject or in a professional field of activity. The requirement structure is characterised by complexity and frequent changes.			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess broad and integrated knowledge including the scientific foundations, the practical application of a	Possess a very broad spectrum of methods for dealing with complex problems in a scientific subject, (corresponding to	Work responsibly in expert teams or lead groups or organisations* responsibly. Guide the professional development of	Define, reflect on and evaluate objectives for learning and work processes and design learning and work processes independently and sustainably.

scientific subject as well as a critical understanding of the most important theories and methods (corresponding to level 1 [Bachelor's level] of the Qualifications Framework for German Higher Education Qualifications) or broad and integrated professional knowledge including current professional developments. Possess knowledge for the further development of a scientific subject or a professional field of activity. Possess relevant knowledge at interfaces to other fields.	level 1 [Bachelor's level] of the Qualifications Framework for German Higher Education Qualifications), further learning areas or a field of professional activity. Develop new solutions and assess them taking into account different standards, also in the case of frequently changing requirements.	others and deal with problems in a team with foresight. Represent complex subject-related problems and solutions argumentatively to experts and develop them further with them. * This includes companies, administrative units or non-profit organisations.	

Level 7

Describes competences that are required to work on new complex tasks and problems as well as to independently control processes in a scientific subject or in a strategy-oriented professional field of activity. The requirement structure is characterised by frequent and unpredictable changes.

Professional competence		Personal competence	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess comprehensive, detailed and specialised knowledge at the latest level of knowledge in a scientific subject (corresponding to level 2 [Master's level] of the Qualifications Framework for German Higher Education Qualifications) or comprehensive professional knowledge in a strategy-oriented field of professional activity. Possess advanced knowledge in related fields.	Possess specialised technical or conceptual skills to solve problems, including strategic problems, in a scientific subject (corresponding to level 2 [Master's level] of the Qualifications Framework for German Higher Education Qualifications) or in a field of professional activity. Weigh up alternatives even in the case of incomplete information. Develop, apply and evaluate new ideas or procedures, taking into account different	Lead groups or organisations* responsibly within the framework of complex tasks and represent their work results. Promote the professional development of others in a targeted manner. Lead field-specific and cross-field discussions. * This includes companies, administrative units or non-profit organisations.	Define goals for new application- or research-oriented tasks, reflecting on the possible social, economic and cultural impacts, use appropriate means and independently develop knowledge for this purpose.

	assessment standards.		

Level 8			
Describes competences that are needed to gain research knowledge in a scientific subject or to develop innovative solutions and procedures in a professional field of activity. The requirement structure is characterised by novel and unclear problem situations.			
Professional competence		**Personal competence**	
Knowledge	**Skills**	**Social competence**	**Autonomy**
Possess comprehensive, specialised and systematic knowledge in a research discipline and contribute to the expansion of knowledge in the subject discipline (corresponding to level3 [doctorate level] of the Qualifications Framework for German Higher Education Qualifications) or possess comprehensive professional knowledge in a strategy and innovation-oriented field of professional activity.	Possess comprehensively developed skills in identifying and solving novel problems in the fields of research, development or innovation in a specialised scientific subject (corresponding to level 3 [doctorate level] of the Qualifications Framework for German Higher Education Qualifications) or in a professional field of activity. Design, implement, control, reflect on and assess innovative processes, also	Responsibly lead organisations or groups* with complex or interdisciplinary tasks, activating their potential. Promote the professional development of others in a sustainable and targeted manner. Lead interdisciplinary discussions and make innovative contributions in subject-specific discussions, also in international contexts. * This includes companies, administrative units	Define objectives for new complex application- or research-oriented tasks, reflecting on the possible social, economic and cultural impact, select appropriate means and develop new ideas and processes.

Possess appropriate knowledge at the interfaces to related fields.	across fields of activity. Evaluate new ideas and processes.	or non-profit organisations.	

Level description EQF	**Knowledge**	**Skills**	**Competence**
Level 1	Basic general knowledge.	Basic skills required to complete simple tasks.	Working or learning under direct guidance in a structured context.

	Knowledge	**Skills**	**Competence**
Level 2	Basic factual knowledge in an area of work or learning	Basic cognitive and practical skills needed to use relevant information to complete tasks and solve routine problems using simple rules and tools	Working or learning under guidance with some degree of independence

	Knowledge	**Skills**	**Competence**
Level 3	Knowledge of facts, principles, procedures and general concepts in an area of work or learning.	A range of cognitive and practical skills to complete tasks and solve problems, selecting and applying basic methods, tools, materials and information.	Take responsibility for completing work or learning tasks Adapt own behaviour to circumstances when solving problems.

	Knowledge	**Skills**	**Competence**

Level 4	A broad range of factual and theoretical knowledge in a field of work or learning.	A range of cognitive and practical skills required to find solutions to specific problems in a field of work or learning.	Acting independently within the parameters of action of work or learning contexts, which are usually known but may change. supervising the routine work of others, taking some responsibility for evaluating and improving work or learning activities

	Knowledge	**Skills**	**Competence**
Level 5	Comprehensive, specialised factual and theoretical knowledge in a field of work or learning and awareness of the limitations of this knowledge.	Comprehensive cognitive and practical skills required to develop creative solutions to abstract problems.	leading and supervising in work or learning contexts where unpredictable changes occur. Review and develop own performance and the performance of others.

	Knowledge	**Skills**	**Competence**
Level 6	Advanced knowledge in an area of work or learning using a critical understanding of theories and principles advanced skills demonstrating mastery of the subject and the ability to innovate, necessary to solve complex and unpredictable problems	Managing complex technical or professional activities or projects and taking decision-making responsibility in unpredictable work or learning contexts.	Taking responsibility for the professional development of individuals and groups.

	in a specialised area of work or study.		

	Knowledge	Skills	Competence
Level 7	Highly specialised knowledge, partly linked to the latest findings in a field of work or learning, as a basis for innovative thinking and/or research. Critical awareness of knowledge issues in a field and at the interface between different fields.	specialised problem-solving skills in research and/or innovation to gain new knowledge and develop new practices, and to integrate knowledge from different fields.	Managing and designing complex, unpredictable working or learning contexts that demand. Taking responsibility for contributions to expertise and professional practice and/or for reviewing the strategic performance of teams.

	Knowledge	Skills	Competence
Level 8	Cutting-edge knowledge in a field of work or learning and at the interface between different fields.	The highest level of advanced and specialised skills and methods, including synthesis and evaluation, to solve key problems in the areas of research and/or innovation and to extend or redefine existing knowledge or professional practice.	Professional authority, innovativeness, independence, scholarly and professional integrity and sustained commitment to the development of new ideas or practices in leading contexts of work or learning, including research.

4.1.3 Validating non-formal and informal learning and links to the NQF

A system for the validation of non-formally and informally acquired competences which spans all educational sectors and is based on a uniform legal basis does not exist in Germany. There are, however, a number of parallel legally enshrined procedures associated with formal recognition or admission or entitlement which are subject to different responsibilities. They ensure recognition or partial recognition of informally and non-formally acquired competences. This is particularly promoted by the fact that the German vocational education and training and continuing education system is largely

dovetailed with the employment system and provides for progressive vocational development. Given the high share of practical work experience in this system great significance is attached to experience-based learning, especially in dual vocational education and training, and in regulated further training. Germany is thus among those European countries with a qualification system in which learning within the work process is traditionally firmly anchored.

4.2 National Framework – Qualification System Spain

4.2.1 Introduction to the Spainsh education system and professional training.

Spain has developed its qualifications framework for lifelong learning, known as the Spanish qualifications framework (Marco Español de Cualificaciones (MECU)). It is based on learning outcomes and aims to link and coordinate different education and training subsystems. The framework will include qualifications obtained in compulsory, post-secondary and higher education, and will integrate validation of non-formal and informal learning processes.

The Royal Decree on the introduction of MECU is the legal basis for its implementation, although this decree has yet to come into force. It defines levels and level descriptors for referencing the MECU to the European qualifications framework (EQF) levels. It was developed in consultation with main stakeholders and supervised by the national advisory bodies.

The higher four levels of MECU will be linked to the qualifications framework for higher education (Marco Español de Cualificaciones para la Educación Superior (MECES), which has been put in place separately ([1]).

This framework has been self-certified against the framework for qualifications of the European higher education area (FQ-EHEA) as part of Spain's continuing commitment to the Bologna process. The self-certification followed the procedures and criteria set down for such work within the Bologna process, and involved a committee of senior Spanish and international experts and stakeholders.

- **National Catalogue of Professional Qualifications (CNCP)**

The National Catalog of Professional Qualifications (CNCP) is the instrument of the National System of Qualifications and Vocational Training (SNCFP) that orders the professional qualifications susceptible of recognition and accreditation, identified in the productive system, in function of the appropriate competences for the professional exercise. It is applicable to the entire national territory and allows adapting the different

[1] Established under Royal Decree: Ministry of Education (2011). Real Decreto 1027/2011, de 15 julio, por el que se establece el Marco Español de Cualificaciones para la Educación Superior [Royal Decree 2027/2011, of 15 July, for the establishment of the Spanish qualifications framework for Higher Education]: http://www.boe.es/boe/dias/2011/08/03/pdfs/BOE-A-2011-13317.pdf

training offers to the needs of the labor market making their accreditations to the business fabric transparent.

The CNCP thus includes the most significant professional qualifications of the Spanish productive system. It includes the content of the professional training associated with each qualification, with a structure of training modules articulated in a Modular Catalog of Vocational Training (CMFP). The National Institute of Qualifications (INCUAL) is responsible for defining, preparing and keeping updated the CNCP and the corresponding CMFP.

4.2.2 NQF – European Framework and link with the Spanish one.

The correlation of the Spanish model with the EQF is made from the Spanish Qualifications Framework (MECU) or National Qualification Framework (NQF), which covers all levels, from level 1 of basic education to 8 of university doctorate.

The MECU is therefore the product of the sum of the National Catalogue of Professional Qualifications (CNCP) and the Spanish Framework of Qualifications for Higher Education (MECES).

These specifications are superimposed on level 3 of the CNCP, which would correspond to level 1 of the MECES and level 5 of the EQF, establishing as higher education the corresponding to the title of Higher Vocational Training Technician.

For the effective correlation between the national framework and the European qualifications framework, references must be established in the different domains of responsibility, coordination, legal, administrative, methodological and quality assurance.

Table 6: Links between EQF and the Spanish Qualification Framework

EQF	**Spanish Qualification Framework**	
	Level	**Qualification**
Level 1 – Basic knowledge	CNCP Level 1	Operator / Workman
Level 2 – Basic factual knowledge of a field of work or study		
Level 3 – Knowledge of facts, principles and general concepts in a field of work or study	CNCP Level 2	Mid-level Technician

Level 4 – Factual and theoretical knowledge within a field of work or study		
Level 5 – Specialised factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	MECES Level 1	Higher VET Technician
Level 6 – Advanced knowledge of a field of work or study involving a critical understanding of theories and principles	MECES Level 2	Bachelor's Degree
Level 7 – Highly specialised knowledge some of +which at the forefront of knowledge in a field of work or study, as the basis for original thinking or research	MECES Level 3	University Master Degree
Level 8 – Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	MECES Level 4	Doctor (PhD)

4.2.3 Validating non-formal and informal learning and links to the NQF

Spain does not have a comprehensive national strategy for validation; different laws frame validation, targeting different education sectors. The Organic Law of Education and the Organic Law of Universities incorporate actions to validate non-formal and informal learning, such as access exams to VET and university studies aimed at those people who do not have the required qualifications.

Nevertheless, Spain has started to develop the Spanish qualifications framework for lifelong learning (Marco Español de Cualificaciones, MECU). However, framework development is not concluded at the moment, and MECU is not yet operational.

The future framework aims to include, in a first stage, all diplomas and certificates from the education system, while remaining open for inclusion of official qualifications issued by other administrative sectors. The Ministry of Education, Culture and Sport is currently (2017) working on aligning qualifications in the education system to the EQF levels, in accordance with the EQF recommendation.

A qualifications framework for higher (MECES) has been put in place separately and self-certified against the QF-EHEA. Qualifications are being designed taking into account compatibility and linking the highest four qualifications levels to MECES. The Spanish education system is planned to be referenced to EQF levels by 2018

4.3 National Framework – Qualification System in Estonia

4.3.1 Introduction to the NQF – Estonian qualifications framework (EstQF/EKR) – and context

Creation of the Estonian Qualifications Framework (EstQF/EKR) started in 2005.
An eight-level qualifications framework was established in 2008, with the Occupational Qualifications Act (http://www.kutsekoda.ee/en/kutsesysteem/oigusaktidkutseseadus). The level descriptors of the EstQF are identical to the level descriptors of the EQF. The EstQF is a comprehensive qualifications framework, which includes qualifications awarded by the education and training institutions (general education qualifications, vocational education and training (VET) qualifications, and higher education qualifications), and occupational qualifications awarded by state recognised awarding institutions (professional associations etc.). Occupational qualification means a qualification associated with a trade, occupation or profession. Occupational qualifications can be gained through work based learning, in-service training, and adult education. Some occupational qualifications can be gained also through formal education system. The creation and implementation of the EstQF is based on the principles for accountability and quality assurance of qualifications laid down by the European Parliament and Council recommendation on establishment of the EQF (http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6- TA-2007- 0463+0+DOC+XML+V0//EN).

In 1st July 2021, there are 558 professional standards that apply to 92 professions. In robotics, there are professional standards for robot operator, level 4, and robot technician, level 5.

The EstQF consists of four sub-frameworks: for general education qualifications, for VET qualifications, for higher education qualifications and for occupational qualifications. This sub-framework is described in terms of the legal framework, learning outcomes of the qualifications involved, analysis of their compatibility with the EstQF level descriptions, recognition of prior learning (RPL), awarding of qualifications, and their quality assurance.

figure 1:Structure of the EstQF (source: Executive Summary)

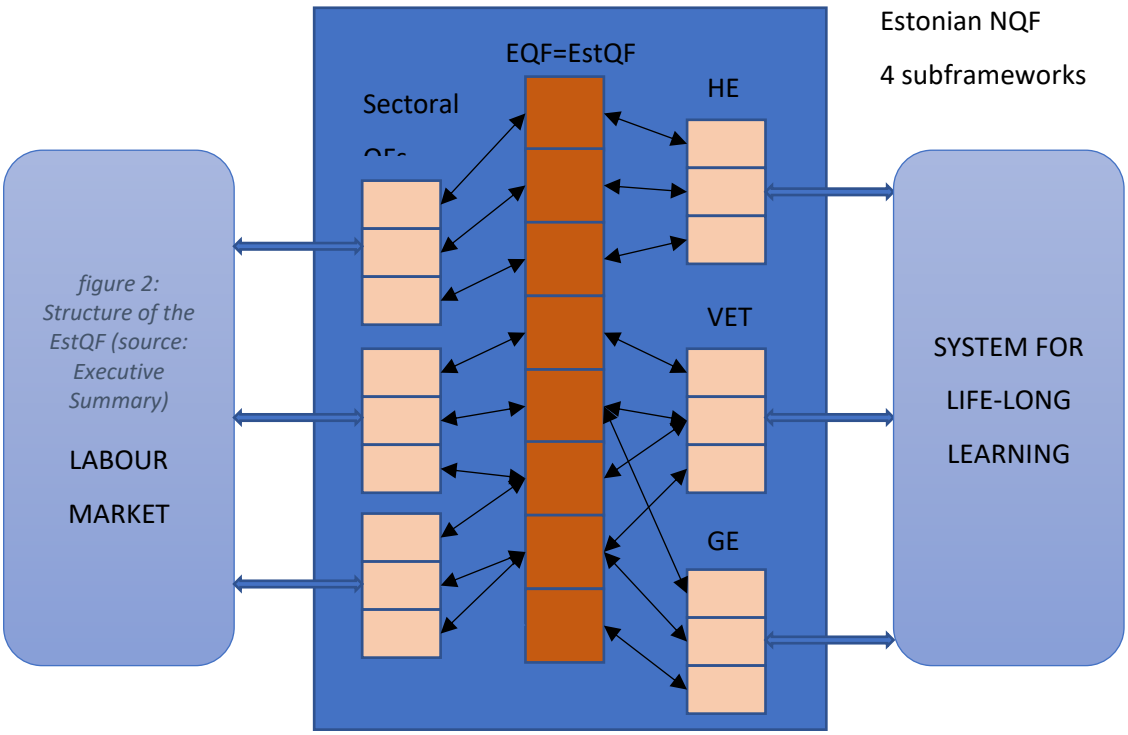


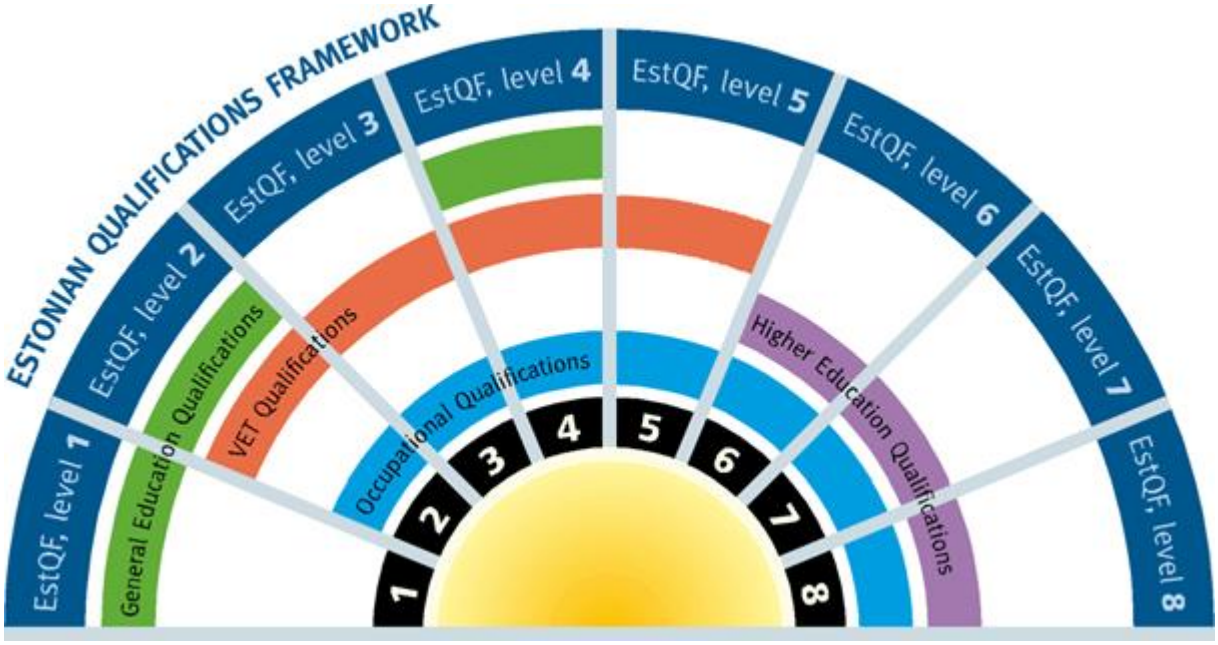
figure 2: Structure of the EstQF (source: Executive Summary)

HE – higher education qualifications sub-framework
VET – VET qualifications sub-framework
GE – general education qualifications sub-framework
Sectoral qualifications frameworks comprise the occupational qualifications framework

There is a clear and demonstrable link between the qualification level descriptions and the level descriptors of the EstQF. According to the Occupational Qualifications Act, the EstQF has 8 levels, the 1st of which is the lowest and the 8th is the highest. The descriptions of the EstQF qualification levels are identical to the EQF level descriptions. The sub-frameworks for general education qualifications, VET qualifications, higher

education qualifications, and occupational qualifications contain more detailed and specific descriptors and rules for designing and awarding qualifications. The EstQF levels are assigned to general education qualifications (on levels 1,2 and 4), VET qualifications (on levels 2-5), higher education qualifications (on levels 6-8), and occupational qualifications (on levels 2-8) (see Figure 2). Learning outcomes based descriptions of these types of qualifications have been compared with level descriptions of the EstQF and the best fitfound.

figure 3: Placement of qualifications in the EstQF (source: https://www.kutsekoda.ee/en/qualifications-framework/)



The qualifications are based on the principle and objective of learning outcomes and linked to arrangements for validation of non-formal and informal learning and, where these exist, to credit systems. The qualifications of general education, VET, and higher education are described in terms of LOs. For all the aforementioned qualification types, the principles of recognition of non-formal and informal learning are defined in the relevant regulations of the Government of the Republic (National Curriculum for Basic Schools, Simplified National Curriculum for Basic Schools, National Curriculum for Upper Secondary Schools, Standard of VET, and Standard of Higher Education). On the basis of these principles the awarding institutions shall establish the procedures for RPL. In higher education, a credit point system, which conforms to the ECTS, is used. In the VET sector a credit point system that conforms to the ECVET, is used.

Referencing general education, VET and higher education qualifications to the EstQF levels has been laid down in the relevant regulations ofthe Government ofthe Republic (National Curriculum for Basic Schools, Simplified National Curriculum for Basic Schools, National Curriculum for Upper Secondary Schools, Standard of VET, and Standard of

Higher Education). The EstQF levels of occupational qualifications are determined in the process of developing the corresponding occupational qualification standards and laid down by a corresponding decision of the sector skills council (SSC).

The national quality assurance system(s) for education and training refer(s) to the EstQF and are consistent with the relevant European principles and guidelines. In the general education system, a quality assurance system stipulated by the Basic Schools and Upper Secondary Schools Act has been implemented. In general education schools as awarders of qualification, self-assessment systems are created, the effectiveness of which is regularly assessed. External evaluation of general education qualifications includes state examinations in the end of upper secondary school. In the VET system, a quality assurance system stipulated by the VET Institutions Act has been implemented. Since September 2013 a new quality assurance system for VET qualifications, following the principles of European Quality Assurance Reference Framework for VET is implemented. In the new system the duties of a quality agency are carried out by the Estonian Quality Agency for Higher and Vocational Education (EKKA) (http://ekka.archimedes.ee/en/). In the higher education system, a comprehensive quality assurance system that follows the European Standards and Guidelines for Quality Assurance in the European Higher Education Area (ESG) has been implemented based on the Universities Act and the Institutions of Professional Higher Education Act. The duties of a quality agency are carried out by the EKKA. The responsibilities of the EKKA and the main principles of external quality assurance are in full accordance with the ESG. The EKKA has been included into the European Quality Assurance Register for Higher Education (EQAR) in October2013. In higher education institutions as awarders of qualifications, comprehensive quality assurance systems have been created. The effectiveness of internal quality assurance systems is assessed regularly in the process of institutional accreditation that was piloted in 2011 and is fully functioning since 2012. The principles and procedures for ensuring the quality in the occupational qualifications system have been laid down by the Occupational Qualifications Act, which follows the requirements of ISO 17924 (General requirements for certification of persons). Quality assurance in the occupational qualifications system involves: quality assurance of granting an institution awarding occupational qualification (IAOQ) the right to award occupational qualifications, quality assurance of occupational qualification standards, assessment of the quality of assessing the competence of applicants by the IAOQ, and regular external evaluation of IAOQ.

The referencing process shall include the stated agreement of the relevant quality assurance bodies. In the case of general education qualifications, the quality assurance institution is the MoER. The reference of general education qualifications to the EstQF

has been laid down in the National Curriculum for Basic Schools, Simplified National Curriculum for Basic Schools and the National Curriculum for Upper Secondary Schools. In the case of VET qualifications, the quality assurance institution is the EKKA. The reference of VET qualifications to the EstQF has been laid down in the Standard of VET. In the case of higher education qualifications, the quality assurance institution is the EKKA. The reference of higher education qualifications to the EstQF has been laid down in the Standard of Higher Education. In the case of occupational qualifications, the quality assurance institution is the EstQA. The reference of specific occupational qualifications to the EstQF is decided by the Sector Skills Council (SSC) of the relevant field of occupational activity. According to the Occupational Qualifications Act, the EstQA monitors the activities of SSC-s. All the above mentioned quality assurance bodies have been represented in the steering committee for governing the referencing process.

International experts were involved to referencing process (NQF – EQF). Estonia completed the referencing process of its qualifications to the EQF and obtained a confirmation on the positive result of the external evaluation by the EQF Advisory Group in October 2011.

Starting from 2012 institutions awarding higher education qualifications and occupational qualifications are adding a reference to the corresponding EQF and EstQF level to the issued qualification certificates, diplomas and Europass documents, incl. academic transcripts and Diploma Supplements, provided that the corresponding qualification meets all the requirements for inclusion into the EstQF. Since September 2013 institutions awarding VET qualifications are adding a reference to the corresponding EQF and EstQF level to the issued qualification certificates. Since May 2014 institutions awarding general education qualifications are adding a reference to the corresponding EQF and EstQF level to the issued qualification certificates.

National coordination point for the EQF implementation is Estonian Qualification Authority – Kutsekoda.

4.3.2 Comparison of NQF (EstQF/EKR) and EQF levels

Qualification is officially recognised competence which involves certain rights and obligations. Qualifications are divided as follows:

- Formal education qualifications – general education (Basic and upper secondary education), vocational education, higher education;
- Professional qualifications, i.e. professions.

The part of a qualification subject to independent description and assessment is partial qualification. Partial qualifications are, for example, foreign language skills, a course in a subject, final paper, or partial profession. Partial qualifications are often obtained upon completing adult education courses (https://www.hm.ee/en/activities/qualifications).

According to the Occupational Qualifications Act, the EstQF has 8 levels, the first of which is the lowest and the eighth is the highest. **The descriptions of the EstQF qualification levels are identical with the EQF level descriptions.**

EQF	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8
EstQF	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7	Level 8

Estonian qualification framework level descriptions are presented in Table 1. The level descriptions of the EstQF determine the general requirements for the learning outcomes of the general education qualifications, VET qualifications, higher education qualifications, and occupational qualifications.

figure 4: Estonian Qualification Framework (EstQF) level descriptions (source: https://www.kutsekoda.ee/wp-content/uploads/2019/kutsekoda/EstQF_level-descriptions.pdf)

EstQF level	**Knowledge** (described as theoretical and/or factual)	**Skills** (described as cognitive: involving the use of logical, intuitive and creative thinking, and practical: involving manual dexterity and the use of methods, materials, tools and instruments)	**Scope of responsibility and autonomy**
Level 1	Basic general Knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured content
Level 2	Basic factual knowledge of a field of work or study	Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	Work and study under supervision with some autonomy
Level 3	Knowledge of facts, principles, processes and general concepts, in a field of work or study	A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools,	Take responsibility for completion of tasks in work or study; Adapt own behaviour to circumstances in

Level 4	Factual and theoretical knowledge in broad contexts within a field of work or study	A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities
Level 5	Specialised, factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge	A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems	Exercise management and supervision in contexts of work or study activities where there is unpredictable change; Review and develop performance of self and others
Level 6	Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles	Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialised field of work or study	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; Take responsibility for managing professional development of individuals and groups
Level 7	Highly specialised knowledge; some of which is at the forefront of knowledge in the 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	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams
Level 8	Knowledge at the most advanced frontier in the field of work or study and at the interface between fields	The most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research

EstQF is a comprehensive framework, consisting of four sub-frameworks for:

- general education qualifications;
- VET qualifications;
- higher education qualifications;
- occupational qualifications.

The following table presents the results of assigning the EstQF levels to Estonian formal education qualifications, and levelling of some occupational qualifications.

figure 5:Assigning the EstQF levels to Estonian formal education qualifications (souce: https://www.kutsekoda.ee/en/estonian-qualifications-framework-estqf/)

Formal education qualifications	Level	Occupational groups and occupational qualifications
Basic education certificate based on simplified curriculum	**1**	
Basic education certificate; VET certificate level 2 (without basic education requirement)	**2**	**Elementary workers** (cleaner assistant ...)
VET certificate level 3	**3**	**Skilled workers, machine operators, Service and sales workers, Clerical support workers** (Logger, Baker, Carpenter, ...)
Upper secondary general education certificate; VET certificate level 4 (upper secondary VET)	**4**	
VET certificate level 5 (Based on upper secondary education)	**5**	**Technicians and craft masters, front line managers, clerical workers** (Electrician, Construction Site Manaegr, Accountant, ...)
Bachelor's degree, Professional higher education certificate	**6**	**Specialists, supervisors** (Energy auditor, Career Counsellor, ...)
Master's degree	**7**	**Specialists, managers** (Diploma Engineer, ...)
Doctoral degree	**8**	**Senior specialists, top managers** (Principal Architect, Chartered Engineer, ...)

The quality criteria and procedures for referencing the NQF to the EQF foresee two types of referencing: “including into the NQF” and “describing the position in the NQF”. In the context of Estonia these two ways of referencing are called correspondingly including a qualification into the EstQF and assigning the EstQF levels to a qualification. Only state recognised qualifications are included into the EstQF. Actually, a qualification is included in one of the sub-frameworks of the EstQF. The state recognised qualifications are:

- defined in a LOs based qualification standard (framework standard for a qualification type, national curriculum or occupational qualifications standard), meeting the requirements of the national framework standard(s) (if applicable),
- have state recognised awarding institution (educational institution, professional association etc.), i.e. be quality assured. Since the EstQF level descriptions are identical to the EQF level descriptions, the centre of gravity of the referencing process is shifted to assigning of the EstQF levels to a qualification.

Since the EstQF level descriptions are identical to the EQF level descriptions, the centre of gravity of the referencing process is shifted to assigning of the EstQF levels to a qualification (source: Referencing report).

4.3.3 Terminology

EstQF levels (1-8) are described in the same manner as EQF levels (see Table 3).

figure 6:Table 3. Structure of EQF and EstQF levels (source: European Commission 2008, www.kutsekoda.ee)

Level x	**Knowledge** (described as theoretical and/or	**Skills** (described as cognitive: involving the use of logical, intuitive and creative thinking, and practical: involving manual dexterity and the	**Compentence, understood as**

Definitions found in EstQF and Estonian Professional Act in comparison with EQF are presented in Table 4.

Table 7:Comparison of definitions of EstQF and EQF

Definition	**EstQF**	**EQF**
Competence	The set of knowledge, skills, experience and attitudes necessary to engage successfully in professional activities *	‘competence’ means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in

	In the context of EstQF, competence is described in terms of responsibility and autonomy.	work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.
Profession	The qualification received after passing a professional examination and the level of which has been determined in the relevant professional qualification standard *	
Professional area	An area of activity which requires similar competence *	
Professional examination	The process of awarding profession in the course of which the body that aqards professions assesses whether a person has the required competence in the professional area *	
Domain of professional activity	An area of activity which includes several close professional areas *	
Qualification	Competence recognised as an official result of assessment *	’qualification’ means a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards

Knowledge	same as EQF	’knowledge’ means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual;
Skills	same as EQF	‘skills’ means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments);
Learning outcomes	same as EQF	‘learning outcomes’ means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence;

* Definitions presented in Professional Act of Estonian Republic.

As a summary we may state that EstQF uses the same terminology as EQF and the meanings of definitions are the same.

4.4 National Framework – Qualification System in Italy

Folowing description represents the qualification systemin Italy

4.4.1 Introduction to the Italian education system and professional training

The Italian Education system is organized according to the different institutions:

- The state has legislative competences on the general organization of the education system, which includes the minimum standards of education, the school staff, the quality assurance and State financial resources.
- Regions have joint responsibility with the State in some sectors of the education system (e.g. organisation of ECEC (0-3), school calendar, distribution of schools in their territory, right to study at higher level). Regions have exclusive legislative competence in the organisation of the regional vocational education and training system.
- Local authorities organise the offer (e.g. maintenance of premises, merging or establishment of schools, transport of pupils) from ECEC to upper secondary education at local level.
- Schools have a high degree of autonomy: they define curricula, widen the educational offer, organise teaching (school time and groups of pupils). Every three years, schools draw up their own 'three-year educational offer plan' (*Piano triennale dell'offerta formativa* - PTOF).

At higher education level, universities and institutions of Higher education for the fine arts, music and dance (*Alta formazione artistica, musicale e coreutica* - Afam) have statutory, regulatory, teaching and organisational autonomy.

Education at all levels must be open to everyone: Italian citizens as well as foreigner minors from both

EU and non-EU countries. Compulsory education is free of charge. The principle of inclusion applies to scholars with disabilities, to learners with social and economic disadvantages and to immigrant students.

The State guarantees the right to education to students who are unable to attend school because hospitalised, detained or at home for a long illness (please see the section 'Organisational variations and alternative structures in secondary education'.

The Italian education system is a public State system. However, private subjects and public bodies can establish education institutions. Such non-State schools can be either equal to State schools (called scuole paritarie) or merely private schools. These latter

cannot issue qualifications. The State directly finances State schools. Scuole paritarie receive State contributions according to criteria established annually by the Ministry of education. The stages of the Italian education system are summarized in Table 1.

Table 8: Stages of the Italian education system

Stages of the education system	
Early childhood education and care (ECEC)	ECEC for children aged less than 3 years is offered by educational services (*servizi educativi per l'infanzia*) and is organised by the Regions according to the single regional legislations. ECEC for children aged from 3 to 6 years is available at preprimary schools (*scuole dell'infanzia*) and is under the responsibility of the Ministry of education.
First cycle of education	The first cycle of education is compulsory and is made up of primary and lower secondary education. Primary education (*scuola primaria*) starts at 6 years of age and lasts 5 years. Lower secondary education (*scuola secondaria di I grado*) starts at 11 years of age and lasts 3 years. Within the first cycle, students pass from one level to the next one without exams. At the end of the first cycle of education, students who pass the final state examination progress directly to the second cycle of education, the first two years of which are compulsory.
Second cycle of education	The second cycle of education starts at the age of 14 and offers two different pathways: • the upper secondary school education • the regional vocational training system (IFP). The first two years of the second cycle of education are compulsory. The upper secondary school education (*scuola secondaria di II grado*) offers both general (liceo) and vocational (technical and vocational) programmes. Courses last 5 years. At the end of the upper secondary school education, students who successfully pass the final exam, receive a certificate that gives them access to higher education. The regional vocational training system (IFP) offers three or four-year courses organised by accredited training agencies

	or by upper secondary schools. At the end of regional courses, learners receive a qualification that gives them access to second-level regional vocational courses or, under certain conditions, short-cycle courses at higher education level.
Higher education	The following institutes offer education at higher level: • Universities (polytechnics included); • High level arts, music and dance education institutes (Alta formazione artistica, musicale e • coreutica - Afam); • Higher schools for language mediators (Scuole superiori per mediatori linguistici - SSML); • Higher technical institutes (Istituti tecnici superiosi - ITS). Access to university, Afam and SSML programmes is solely for students with an upper secondary school leaving certificate. The Ministry of education and individual institutions establish the specific conditions for admission. Courses at ITSs are accessible to students with an upper secondary leaving certificate and to students who have attended a four-year regional vocational course followed by an additional one-year course in the Higher technical education and training system (IFTS). ITS offer short-cycle bachelor programmes, according to the Bologna structure.
Adult education	Adult education includes all activities aimed at the cultural enrichment, requalification and professional mobility of adults. Within the broader term ‘adult education’, the domain “school education for adults” (*istruzione degli adulti*) only refers to the educational activities aimed at the acquisition of a qualification as well as to literacy and Italian language courses. Adult education is provided by centres for school education for adults (*Centri provinciali per l’istruzione degli adulti -CPIA*) and by upper secondary schools.

4.4.2 National Qualification Framework in relation with the European Qualification Framework

The creation of a Qualification framework (QF) comes from the necessity of a transparent description of the qualifications awarded by the different Higher Education Institutions. The QF is based on the classification of the qualifications in different levels differentiated one from another according the learning outcomes, which describe the results (in terms of capability, knowledge and ability), acquired with the issuance of an academic qualification or of a professional certification. The existence of a national qualifications framework is certainly supportive and of help with regard to the understanding of the education system referred to. Each European country committed to put together a National Qualifications Framework - NQF that is compatible with the Qualifications Framework for the European Higher Education Area (EQF). All the different National Qualification Frameworks can be compared at this link.

In 2005, the Italian Ministry of Education, University and Research (MIUR) started working on the Italian Qualifications Framework, in compliance with the procedures established at European level. CIMEA (**Information Centre on Academic Mobility and Equivalence)** has been entrusted to produce the first example model of the National Framework and, after a process of national consultation, the Italian Qualifications Framework – QTI has been published in 2010. Starting from 2013 the national qualification framework from formal education and training linked directly to EQF.

The comprehensive NQF, adopted in January 2018, was developed using the learning outcomes approach in close alignment to the structure of the EQF. It consists of eight qualification levels defined by level descriptors covering three dimensions: knowledge, skills, and responsibility and autonomy. To ensure all national qualifications are included, sub-descriptors have also been developed, extending the EQF level descriptors.

The Italian Qualification Framework includes all the levels and types of qualification from formal education and training and regional qualifications.

Table 9: General overview of QTI

Country	Scope of the framework	Number of levels	Level descriptors	Stage of development	NQF linked to EQF
Italy	Comprehensive framework will include all levels and types of	Eight	• knowledge • skills • autonomy and responsibility	Formally adopted	2013 major national qualifications from formal education

	qualification from formal education and training and regional qualifications.				and training linked directly to EQF

The levels correspondence between QTI and EQF is shown in table 3.

Table 3: Level correspondence between QTI and EQF.

QTI levels	Description	EQF levels
8	**NQF 8** ▪ Research doctorate - Dottorato di ricerca (Architettura, Ingegneria, Lettere, Psicologia, Sociologia). ▪ Academic diploma for research training - Diploma accademico di formazione alla ricerca (Accademie di belle arti statali e legalmente riconosciute, Accademia Nazionale di Danza, Accademia Nazionale di Arte Drammatica, Accademia Internazionale di Teatro, istituti superiori per le industrie artistiche). ▪ Specialisation diploma - Diploma di specializzazione (Diploma di specializzazione in odontoiatria pediatrica, Diploma di specializzazione per le professioni legali). ▪ Second level university master - Master universitario di secondo livello (Master in chirurgia estetica, Master in digital humanities). ▪ Academic specialisation diploma - Diploma accademico di specializzazione (Specializzazione in audiologia e foniatria, Specializzazione in radiodiagnostica). ▪ Higher specialisation diploma or master - Diploma di perfezionamento o Master (Diploma di perfezionamento scientifico in organizzazione della cooperazione e dell'Integrazione Europea).	
7	**NQF 7** ▪ Master degree - Laurea magistrale (Architettura, Ingegneria, Lettere, Psicologia and Sociologia).	

	▪ Second level academic diploma - Diploma accademico di secondo livello (Accademie di belle arti statali e legalmente riconosciute, Accademia Nazionale di Danza, Accademia Nazionale di Arte Drammatica, Accademia Internazionale di Teatro, istituti superiori per le industrie artistiche). ▪ First level university master - Master universitario di primo livello (Master in Imprenditorialità, Master in Design del Colore e Tecnologia). ▪ Academic specialisation diploma - Diploma accademico di specializzazione (Master di Specializzazione in Studi Europei, Master di Specializzazione in Educazione artistica). ▪ Higher specialisation diploma or master - Diploma di perfezionamento o Master (Master Mediatore Familiare, Master Insegnare Italiano a Stranieri).	
6	**NQF 6** ▪ Bachelor degree- Laurea (Architettura, Ingegneria, Lettere, Psicologia, Sociologia). ▪ First level academic diploma - Diploma accademico di primo livello (Accademie di belle arti statali e legalmente riconosciute, Accademia Nazionale di Danza, Accademia Nazionale di Arte Drammatica, Accademia Internazionale di Teatro, istituti superiori per le industrie artistiche).	
5	**NQF 5** ▪ Higher technical education diploma - Diploma di tecnico superiore (Tecnico superiore responsabile delle produzioni e delle trasformazioni agrarie, agro-alimentari e agro-industriali; Tecnico superiore per la gestione dell'ambiente nel sistema agro-alimentare; Tecnico superiore per il controllo, la valorizzazione e il marketing delle produzioni agrarie, agro-alimentari e agro-industriali; Tecnico superiore di processo e prodotto per la nobilitazione degli articoli tessili - abbigliamento – moda; tecnico superiore di processo, prodotto, comunicazione e marketing per il settore calzature – moda; Tecnico superiore di processo, prodotto, comunicazione e marketing per il settore tessile – abbigliamento – moda)	
4	**NQF 4**	

	▪ Professional technician diploma - Diploma istruzione professionale (Agricoltura, sviluppo rurale, valorizzazione dei prodotti del territorio e gestione delle risorse forestali e montane; Pesca commerciale e produzioni ittiche (di nuova introduzione); Industria e artigianato per il Made in Italy; Manutenzione e assistenza tecnica; Gestione delle acque e risanamento ambientale (di nuova introduzione)). ▪ Upper secondary education diploma Licei - diploma liceale (Artistico, Classico, Scientifico, Scienze umane, Linguistico). ▪ Upper secondary education diploma – Diploma di istruzione tecnica (Turismo, Finanza e marketing, Sistema moda, Trasporti e logistica, Informatica e telecomunicazioni). ▪ Upper secondary education diploma – vocational schools Diploma di istruzione professionale (tecnico agricolo, tecnico del legno, tecnico edile, tecnico elettrico, tecnico grafico). ▪ "Higher technical specialisation certificate Certificato di specializzazione tecnica superiore" (Tecniche di disegno e progettazione industriale, Tecniche di industrializzazione del prodotto e del processo, Tecniche per la programmazione della produzione e la logistica, Tecniche di installazione e manutenzione di impianti civili e industriali, Tecniche dei sistemi di sicurezza ambientali e qualità dei processi industriali).	
3	**NQF 3** ▪ Professional operator certificate - Attestato di qualifica di operatore professionale (operatore edile, operatore elettrico, operatore elettronico, operatore grafico, operatore delle lavorazioni artistiche).	
2	**NQF 2** ▪ Compulsory education certificate - Certificato delle competenze di base acquisite in esito all'assolvimento dell'obbligo di istruzione	
1	**NQF 1** ▪ Lower secondary school-leaving diploma - Diploma di licenza conclusiva del primo ciclo di istruzione.	

The learning outcomes are defined in terms of Knowledge, Skills and Responsibility and autonomy as definite in the EQF:

- Knowledge: in the context of EQF, knowledge is described as theoretical and/or factual.
- Skills: In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).
- Responsibility and autonomy: In the context of the EQF responsibility and autonomy is described as the ability of the learner to apply knowledge and skills autonomously and with responsibility.

4.5 National Framework – Qualification System in France

The description below represents the national qualification system in France.

4.5.1 Introduction to the French qualification Framework

The French national framework for professional qualifications (RNCP) is composed by eight levels like the European qualification framework (EQF)[2]. This allows the comparison between the French ones with the European ones in the form of a database. As mentioned on the French government website, the objective of the RNCP (also called RS) is:

"To ensure that qualifications are relevant and up to date, France Compétences identifies emerging and changing professions and incorporates new professional skills associated with those professions into the RNCP or RS. (…) Designated as an NCP (National Coordination Point) for implementation of the EQF, France compétences is an active partner in the Europass set up by the European Commission on 1 July 2020. "[3]

France Compétences is available on internet at the following address: francecompétences.fr

Even though the database and website France compétences makes it possible to give a standard and a comparison point between French diplomas and European ones, this website also makes it possible for the French students to know more about the profession they want to practice by giving them standards about the skills required, examples of training content and so on.

[2] https://www.francecompetences.fr/international-en/international/cadre-national-de-certifications-mise-en-oeuvre-du-cec/?lang=en
[3] https://www.francecompetences.fr/international-en/international/cadre-national-de-certifications-mise-en-oeuvre-du-cec/?lang=en

4.5.2 Presentation of the French national register of professional qualifications (RNCP)

The RNCP is the central element for all diplomas, qualifications, and titles because *"A degree registered in the RNCP is fully recognized by the French government."* [4]

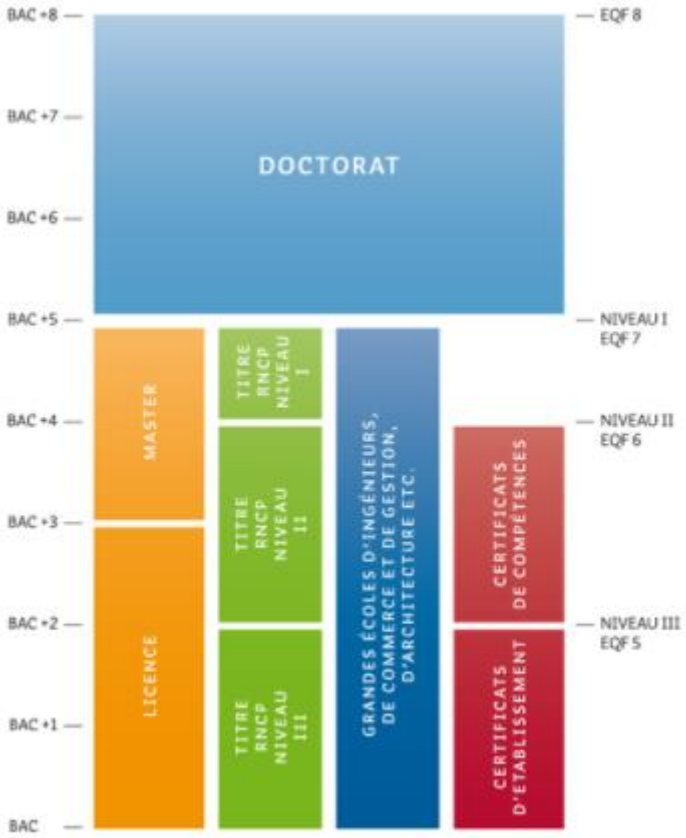
All trainings, diplomas and titles will not necessarily be referenced by the RNCP, even if they are taught in schools or certified organizations because "*Recognition in the framework in the RNCP is not only based on the quality of the academic program but on the knowledge, skills and competences which are transmitted and evaluated. The accrediting body (CNCP) assesses the necessity of a qualification with regard to the job market, the relevance of the skills and competences for the profession, and the capacity of the degree-delivering institution to update its program according to the development of the profession. Recognition in the framework of the RNCP demonstrates not only that the graduates of the program are employable, but also that they are in employment: the accrediting body (CNCP) verifies that at least three quarters of the graduates actually work in the professional field covered by the qualification. Only those qualifications which guarantee a high degree of professional integration of their graduates can receive recognition through the CNCP."*[5]

4.5.3 French education system

The following figure presents the French higher education system comparing diplomas and EQF and former RNCP levels.

[4] https://www.cife.eu/en/3/degree-recognition_64-1
[5] http://www.inplace.cz/download/EQF_NQF_report.pdf

*figure 7: French higher education system[6]**



It is important to consider that the "Baccalauréat (or BAC)" diploma is the base for any higher education in France

[6] https://www.cife.eu/en/3/degree-recognition_64-1

4.5.4 Comparison between RNCP standard levels and EQF

As it will be shown in the two following subparts, the RNCP is very close to the EQF standards.

4.5.4.1 Comparison considering the knowledge

Thanks to the comparison between the two following**,** we can draw the **table** which compares the EQF standards and RNCP standards regarding knowledge.

figure 8: RNCP level standards compared with diplomas [7]

Years of study after the BAC diploma	Diploma and French graduation	RNCP nomenclature
BAC +8	Doctorate	RNCP level 8
BAC +5	Master's degree	RNCP level 7
BAC +3	License diploma (equivalent of a bachelor)	RNCP level 6
BAC +2	BTS and DUT	RNCP level 5
BAC	BAC (general, technologic, or professional)	RNCP level 4
Before the BAC	CAP, BEP, MC	RNCP level 3
Before high school	Certificate of general training, Brevet degree	RNCP level 2

Thanks to the comparison of the two previous figures, we can draw the following table comparing knowledge requirements for EQF standard and RNCP ones.

**In the context of EQF, knowledge is described as theoretical and/or factual.*

Table 10: Comparison between EQF standards and RNCP standards concerning knowledge

EQF Standards	RNCP Standards	French Diplomas/Age of Students

[7] Figure translated from : https://ecole-esdac.com/formations-reconnues-par-letat-titres-certifies-rncp-a-lecole-esdac/

Level 1 – Basic knowledge.	RNCP level 1	In France, basic knowledge does not permit to deliver a diploma. It is considered that the RNCP level 1 refers to pupils aged before 13 years old.
Level 2 – Basic factual knowledge of a field of work or study.	RNCP level 2	The RNCP level 2 delivers the diploma “Brevet des collèges”. It concerns pupils aged around 14 years old.
Level 3 – Knowledge of facts, principles, and general concepts in a field of work or study.	RNCP level 3	The RNCP level 3 concerns pupils who will not continue general studies and who will learn technical or manual knowledge, the diplomas delivered by a RNCP level 3 are: CAP, BEP, MC.
Level 4 – Factual and theoretical knowledge within a field of work or study.	RNCP level 4	The BAC diploma intervenes at the end of high school and concerns students aged around 18 years old. The BAC diploma can be either general, technical, or specified in fields of study. The BAC diploma type will be determinant for the students in their higher study.
Level 5 – Specialized factual and theoretical knowledge within a field of work or study and an awareness of the boundaries of that knowledge.	RNCP level 5	Those diplomas are delivered after 2 years of study after the BAC diploma and are called BTS and DUT. After the BAC diploma, student ages are not realistic because any people can go back to university or school.
Level 6 – Advanced knowledge of a field of work or study involving a critical understanding of theories and principles.	RNCP level 6	In France, the bachelor’s degree is not that used therefore, the RNCP level 6 does not perfectly fit the EQF level 6. The RNCP refers to 4 years of studies as a superior student but does not refer to a precise diploma in this academic year. French higher education system delivers a diploma after 3 years of study in a specified field and this diploma is called “Licence”.
Level 7 – Highly specialized knowledge some of +which at the forefront of knowledge in a field of work or study, as the basis for original thinking or research	RNCP level 7	The RNCP level 7 refers to the master’s degree.
Level 8 – Knowledge at the most advanced frontier of a field of work or study and at the interface between fields	RNCP level 8	The RNCP level 8 refers to the Doctorate diploma.

4.5.4.2 Considering the skills

In the EQF standards knowledge are differentiated from skills and personal competences. In this context, the following table presents a comparison between the skills requirements both for EQF and RNCP standards.

**In the context of EQF, skills are described as cognitive (involving the use of logical, intuitive, and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments).*

Table 11:Comparison between EQF standards and RNCP standards regarding skills

EQF standards [8]	RNCP standards [9]
Level 1. Basic skills required to carry out simple tasks.	RNCP Level 1. Mastery of basic knowledge without application.
Level 2. Basic cognitive and practical skills required to use relevant information in order to carry out tasks and to solve routine problems using simple rules and tools	RNCP Level 2. Ability to perform simple activities and solve common problems in a structured context.
Level 3. A range of cognitive and practical skills required to accomplish tasks and solve problems by selecting and applying basic methods, tools, materials, and information.	RNCP Level 3. Ability to carry out activities and solve problems in a known context and to adapt the means of execution of one's behavior to the circumstances.
Level 4. A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study.	RNCP Level 4. Ability to master know-how in a field of activity to develop solutions to new problems analyze and interpret information mobilizing concepts and transmit know-how and methods.

[8] http://www.inplace.cz/download/EQF_NQF_report.pdf
[9] https://eugene.grandeecolenumerique.fr/article/tout-savoir-sur-le-rncp

Level 5. A comprehensive range of cognitive and practical skills required to develop creative solutions to abstract problems.	RNCP Level 5. Ability to master know-how in a field of activity to develop solutions to new problems, analyze and interpret information by mobilizing concepts and transmitting know-how and methods.
Level 6. Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study.	RNCP Level 6. Ability to analyze and solve unforeseen complex problems in a specific field to formalize know-how and methods and go to capitalize.
Level 7. Specialized problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields.	RNCP Level 7. Ability to develop and implement alternative strategies for the development of professional activity in complex professional contexts and assess the risks and consequences of its activity.
Level 8. The most advanced and specialized skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice.	RNCP Level 8. Ability to identify and solve complex and new problems involving a plurality of fields by mobilizing the most advanced knowledge and know-how to design and manage research and innovation projects and processes.

Thanks to the two previous tables), we can notice that the RNCP is very close to the EQF standards. This proximity between both standards permits a quick evaluation of each French training and diploma at a European level.

4.5.5 The jobs linked to collaborative robotics seen by the RNCP standards.

As seen in the first part of the present report, the website France compétences allows to evaluate the RNCP level of each job. Considering the fact that one of their objectives is "*To ensure that qualifications are relevant and up to date, France compétences (**francecompétences.fr)** identifies emerging and changing professions and incorporates new professional skills associated with those professions into the RNCP or RS".* Since our field of study is about collaborative robotics, the following part will focus on the indications revealed by the RNCP levels and the information delivered by the website France compétences concerning the jobs directly or indirectly linked to collaborative

robotics. In order to facilitate the sum-up of this part, the following table presents the jobs linked to the collaborative robotics and their RNCP level indication.

Table 12: List of the jobs directly or indirectly linked to collaborative robotics and their RNCP level

Job evoked	Indications about this job in France compétences website	RNCP level
FANUC jobs typology		
Robot operator	Even if the "robot operator" job is not yet referenced by the France compétences database, it appears that the job of operator is more linked to the sector of activity of his company than on the tools the operator will use. *For example:* · *Industrial cosmetic operator job is referenced while the operator can either work with collaborative robotics or automated robots or even no robotics cell at all.*	Whatever the operator's sector of activity is, the level of RNCP is a level 3.
Robot system technician	No indication.	No indication.
System engineer	Even if there are no indications for the specific job of system engineer in robotics, 63 other jobs and qualifications/ diplomas overlap the knowledge and skills required to perform this job. *Few examples:* · *Engineer in industrial systems* · *Engineer specialized in macro and nano electronic systems*	Even if the majority of those jobs are at a RNCP level 7, few jobs can be classified at level 5.
Other jobs linked to collaborative robotics found on the website France compétences		

Industrial robotics integration manager	This training is proposed by the “Union industries métallurgiques mineries”. This job consists in leading the implementation of robotic cells on production lines (it can concern collaborative robotics or even full automated robotics).	RNCP Level 6.
Engineer in robotics	Available in many big cities in France. The engineer in robotics will be necessary mainly for the cobot constructors.	RNCP Level 7.
Informatic and robotics project manager	This job aims to train the operator team managers.	RNCP Level 7.

As we can see in the previous table, French standards have not yet integrated the collaborative robotics jobs and the required skills to perform them. It is important to remember that collaborative robotics is a new phenomenon in industrial companies (first cobots sold in 2008). French level standards have been recently reviewed in order to correspond better to the EQF standards. By consequence, what we can see on the present report is that even if the French qualification level standards are not well defined yet, collaborative robotics field offers a wide range of jobs ranging from RNCP level 3 jobs to RNCP level 7 jobs.

5 TOURINGS Learning Units

TOURINGS Training Course will be composed by 5 essential and complementary training modules to teach the skills and competences of collaborative robotics. Each Module has the learning outcomes associated and is composed of different manageable units, which are formulated from the leraning Outcomes related to the same set of occupational activities and field of knowledge and describes the multimodal learning process, the objective of the Unit and its general concept. The learning outcomes indicate what the learner is expected to understand and know at the end of the learning process and comprise optional and “free-choice” units to enable learners to adapt their learning pathways to their main training interst in the course.

The different qualification frameworks had a different level of details. The descriptors of qualifications frameworks, are usually written at a high level of generality, allowing them to inform and interact with the wide diversity of qualifications and qualification types forming part of sectoral, national and/or international qualifications systems.

5.1 Module 1: Basics of collaborative robotics

Unit	**Basics of collaborative robotics**
Objective of the Unit	The aim is: • to know what a collaborative robot is, what opportunities and risks a cobot offers, what it can and cannot be used for and what distinguishes it from conventional industrial robots. • making it possible for trainees to get the fundamentals about HRC and that they will be able to follow the other modules (this first aim is a pedagogical aim). • to deliver the proper tools to understand the potential of collaborative robotics in the different fields of the assembly line with the focus on the manufacturing processes.
Knowledge	The lerner will know and understand: • robotics components • Manufacturing processes • Automatisation technology • To read, understand & modify technical designs • to quote different softwares suitable for the robot cell’s task
Skills	The learner will be able to: • Add the proper tools to the robotic cell

	• check products quality • software installation • check and register work capacity • assembly robotic cell • assembly sensors • optimise production • optimise financial restults • programming robot cells • CAM software • CAE software
Competences	The learner will be able to: • Adjust fabrication equipments • maintain robotic cells • control systems maintaining & programming • Perform risk analysis
Pedagogical Approach	The pedagogical approach was defined in TOURINGS Educational Philosophy document. (Text + Audios + Videos)

5.2 Module 2: Collaborative Robotics Modular Design and Behaviour

Unit	**Collaborative Robotics Modular Design and Behaviour**
Objective of the Unit	To give understanding, knowledge and skills about cobots' modular design and behaviour and show the possibilities of modularity and re-programmability of collaborative robotics' functionalities and different robotic cells
Knowledge	The learner will know and understand: • Technical trends • Principles of Cobots' modular design and behaviour • Cobot behaviour related to production needs • Structure and mode of operation of a robot (electrical, mechanical, controller, etc.) • Safety sensors integrated • Gripping technologies • Gripper designs • Reconfiguration principles • Communication principles • Machine control system • Programming of Cobots incl. safety measures and on-line/off-line human involvement • Risk analysis
Skills	The learner will be able to: • Use sensors, controllers • Align components • Read technical drawings • Choose the right gripping technology

	• Designing gripping fingers • Compose technical drawings • Make simulations • Install hardware and software • Assemble robotics • Calibrate and test robotics • Perform maintenance of robotics • Use CAD software • Use CAM software • Make cost-benefit analysis • Make risk assessment
Competences	The programme develops competences in the areas of: • Robotics • Mechanics • Mechatronics • Production process • Production system • Performance indicators • Cost-benefit analysis • Project management
Pedagogical Approach	The pedagogical approach was defined in TOURINGS Educational Philosophy document. (Text + Audios + Videos)

5.3 Module 3: Collaborative Robotics safety requirements

Unit	**Collaborative Robotics safety requirements**
Objective of the Unit	This aims at : • give to the trainees an overview of the basic safety risks while using cobots (injuries, WMSDs, Psychological health and safety) • requirements while implementing or using collaborative robotics. • to promote the EU commission's work on norms, standardization... • reduce the number of risks while using or implementing collaborative robotics. • reduce the distrust of the workers about the use of collaborative robotics.
Knowledge	The learner will be able to: • apply statistical analysis techniques / (to know statiscal tools which can be used / IT tools) + Using ICT tools to analyse and process data.

	• quote ISO norms TS 15066 • quote correctional procedures • quote database quality standards • quote industrial design • quote industrial engineering • quote industrial softwares • quote quality standards • quote and explain audit techniques • quote and explain industrial design • quote and explain industrial engineering • quote and explain industrial software • quote and explain internal auditing
Skills	The learner will be able to: • perform risk analysis • analyse results of the risk analysis • evaluate results of the risk analysis • conduct workplace audits • use information from safety bases to analyse threats to safety • use information from safety databases to analyse threats to safety • follow safety precautions in work practices • perform occupational health and safety • follow personal protective equipment • update software for electronic equipment • maintain controlling systems for automated equipment • maintain systems to control automated equipment • check, maintain and repair control systems for automated equipment • installing, maintaining and repairing electrical, electronic and precision equipment • parameter the CAD on safety • To analyze ICT debugging tools • detect software anomalies • adjust manufacturing equipment • apply statistical analysis techniques • use ICT tools to analyse and process data.
Competences	The learner will be able to create useful: • *defensive safety equipment* • *protective equipment for safety* • *preserving safety equipment* • *safeguarding safety equipment*
Pedagogical Approach	• The pedagogical approach was defined in TOURINGS Educational Philosophy document. (Text + Audios + Videos)

5.4 Module 4: Collaborative Robotics Installation on the Assembly Line

Unit	**Collaborative Robotics Installation on the Assembly Line**
Objective of the Unit	The learner: Has understanding and is able to demonstrate how to install cobots on assembly line and balance assembly line
Knowledge	The learner will know and understand: • Human-robot collaboration • K.O. criteria for HRC • Design of layout of the workplace • Installation of Cobots • Integration of Cobots into assembly line • Assembly line balancing • Economic aspects of using Cobots • Cycle time and its optimisation • Payback time and performance indicators (productivity, efficiency, OEE) • Cost management • Special characteristics of certain work processes
Skills	The learner will be able to: • Determine tasks in manufacturing process suitable to be done by Cobot • Task allocation between Cobot and human • Calculate payback time • Measure and calculate performance indicators • Set up assembly line using Cobots • Design a rough and fine concept of the HRC • Configure assembly line and reconfigure assembly line to new products • Integrate new products to manufacturing • Use sensors, controllers • Use CAE, CAM software • Program Cobots
Competences	The programme develops competences in the areas of: • Robotics • Production process • Production system • Performance indicators • Project management
Pedagogical Approach	The pedagogical approach was defined in TOURINGS Educational Philosophy document. (Text + Audios + Videos)

5.5 Module 5: Collaborative Robotics Interactions. Digital Human Model, Digital Human Simulation and RULA Method

Unit	**Collaborative Robotics Interactions. Digital Human Model, Digital Human Simulation and RULA Method**
Objective of the Unit	This aims at: • providing a helpful base for the companies to work on performance and WMSDs risks decrease. • being able to measure the advantages led by the collaborative robotics implementation. • give a base simulation for collaborative robotics implementation
Knowledge	The learner will be able to: • quote business ICT systems • quote decision support systems
Skills	The learner will be able to: • Modify designs according to changed circumstances • Adapt existing designs to circumstances that changed • Adapt existing designs to changing circumstances • Perform simulations • Create physical interactions and cognitive interactions (eye tracking) • Perform simulations • make independent operating decisions • use digital tools for collaboration and productivity • Diagnose heart conditions • Diagnose mental disorders • Interpret medical images • Diagnose nursing care • Assess fish health conditions • Analysing and interpreting medical test results • Examining patients, deceased persons or animals to diagnose physical and mental illnesses, injuries and medical conditions.
Competences	The learner will be able to: • Adapt to change • Adapt to changing situations • Vary existing designs to circumstances that changed

Pedagogical Approach	• The pedagogical approach was defined in TOURINGS Educational Philosophy document. (Text + Audios + Videos)

6 TOURINGS European Qualifications Framework Level

The European Qualification Framework (EQF) with its eight common European reference levels which are described in terms of knowledge, skills and competences, represents a tool that helps communication between several national qualification systems in Europe.

The following table represents a comparison of the important information between EQF and each of the National Qualification Frameworks from the consortium partners of the TOURINGS Project.

EQF	Spanish NQF (MECU-RNCP)	German NQF (DQF)	French NQF	Estonian NQF	Italian NQF
Level 1	Level 1 (RNCP): Operator / Workman	Vocational training preparation (*Berufsausbildungsvorbereitung*), employment agency measures (vocational preparation schemes) (*Maßnahmen der Arbeitsagentur (Berufsvorbereitende Bildungsmaßnahmen*), year of pre-vocational training (*Berufsvorbereitungsjahr*)	Basic knowledge does not permit to deliver a diploma. It is considered that the RNCP level 1 refers to pupils aged before 13 years old.	Work or study under direct supervision in a structured content	Lower secondary school-leaving diploma
Level 2		Vocational training preparation (*Berufsausbildungsvorbereitung*), employment agency measures (*Maßnahmen der Arbeitsagentur*), year of pre-vocational training (Berufsvorbereitungsjahr), introductory training for young	Delivers the diploma “Brevet des collèges”. It concerns pupils aged around 14 years old.	Work and study under supervision with some autonomy	Compulsory education certificate

		people (*Einstiegsqualifizierung*), full-time vocational school (*Berufsfachschule*), basic vocational training, (*Berufliche Grundbildung*)			
Level 3	Level 2 (RNCP): Mid-level Technician	Dual VET (two-year training courses), full-time vocational school (general education school leaving certificate obtained on completion of grade 10 at *Realschule* or, under certain circumstances, at other lower secondary school types) (*Berufsfachschule*) *(Mittlerer Schulabschluss)*	The RNCP level 3 concerns pupils who will not continue general studies and who will learn technical or manual knowledge, the diplomas delivered by a RNCP level 3 are: CAP, BEP, MC.	Take responsibility for completion of tasks in work or study; Adapt own behaviour to circumstances in solving problems	Professional operator certificate
Level 4		Dual VET (three-year and three-and-a-half-year training courses), full-time vocational school (assistant occupations) (*Berufsfachschule*), full vocational qualification (full-time vocational school) (*Berufsfachschule*)	The BAC diploma intervenes at the end of high school and concerns students aged around 18 years old. The BAC diploma can be either general, technical, or specified in fields of study. The BAC diploma type will be determinant for the students in their higher study.	Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities	Professional technician diploma Upper secondary education diploma Licei Upper secondary education diploma Upper secondary education diploma – vocational schools Higher technical specialisation certificate
Level 5		IT specialist (certified) (*IT-Spezialist (Zertifizierter)*),	Those diplomas are delivered after 2 years of study after the BAC diploma and	Exercise management and supervision in contexts of work	Higher technical education diploma

	Level 1 (MECE): Higher VET Technician	service technician (certified)* (*Service-techniker (Geprüfter)*)	are called BTS and DUT. After the BAC diploma, student ages are not realistic because any people can go back to university or school.	or study activities where there is unpredictable change; Review and develop performance of self and others	
Level 6	Level 2 (MECE): Bachelor's Degree	Bachelor, commercial specialist (certified) (*Fachkaufmann (Geprüfter)*), business management specialist (certified) (*Fachwirt (Geprüfter)),* master craftsman (certified), *(Meister (Geprüfter)),* operative IT professional (certified)] * (*Operativer IT Professional (Geprüfter)),* Fachschule (State-certified…), *Fachschule* (*(Staatlich Geprüfter…)*)	In France, the bachelor's degree is not that used therefore, the RNCP level 6 does not perfectly fit the EQF level 6. The RNCP refers to 4 years of studies as a superior student but does not refer to a precise diploma in this academic year. French higher education system delivers a diploma after 3 years of study in a specified field and this diploma is called "Licence".	Manage complex technical or professional activities or projects, taking responsibility for decision-making in unpredictable work or study contexts; Take responsibility for managing professional development of individuals and groups.	Bachelor degree First level academic diploma
Level 7	Level 3 (MECE): University Master Degree	Master, strategic IT professional (certified)* *Strategischer IT Professional (Geprüfter)*	The RNCP level 7 refers to the master's degree.	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; Take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams	Master degree Second level academic diploma First level university master Academic specialisation diploma Higher specialisation diploma or master

Level 8	Level 4 (MECE): Doctor (PhD)	Doctoral studies	The RNCP level 8 refers to the Doctorate diploma	Demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research	Research doctorate - Dottorato di ricerca Academic diploma for research training Specialisation diploma Second level university master Academic specialisation diploma Higher specialisation diploma or master

Modules	**Levels**					
	EQF	GE	IT	FR	EST	ESP
Collaborative Robotics Basics	5/6/7	5/6	5	6	7	½
Collaborative Robotics Modular Design and Behaviour	5/6/7	5/6	5	6	7	½
Collaborative Robotics Safety Requirements	5/6/7	5/6	5	6	7	½
Collaborative Robotics Installation on the Assembly Line	5/6/7	5/6	5	6	7	½
Collaborative Robotics Interactions. Digital Human Model, Digital Human Simulation and the RULA Method.	5/6/7	5/6	5	6	7	½

Based on the comparision between the different levels of the countries with the European Qualification Framework and although for most of the countries is not clear or complete a definition for training course such as TOURINGS, it could be considered that the training course for TOURINGS could mutch more with the description of the ***IT specialist (certified) (IT-Spezialist (Zertifizierter)), service technician (certified)* (Service-techniker (Geprüfter))*** of the German Qualification Framework, at EQF Level 5, "***Higher VET Technician***".

Consequently, and in accordance to the different NQFs, it is possible to conclude that TOURINGS could correspond with the EQF Level 5.

7 TOURINGS ECVET Points

The European Credit System for Vocational Education and Training (ECVET) is an adopted european system for accumulation and transfer of credit points in the professional education and training in europe. It describes a qualification in Units of learning outcomes in terms of relative weight in relation of a specific qualification which also can be optinally represented numerically. Leraning outcomes are a statement about what a person knows (Knowledge), understands (Skills) and about what he is able to do after completing a lerning process (competences).
We resume the following key ideas, which schould be taken into consideration in the process of definition of the ECVET points of the TOURINGS course:

- Consider the number of *Higher VET Technician* and its corresponds credit in the european one.
- The ECVET points assigned to a specific course show you how much work you should plan
- Allocate ECVET points to all units of learning outcomes in the frames of Qualification. That schould give information about the scope of the learning outcomes to be achieved.
- According to the assuption of the ECVET secretariat and most of the National Authorities; 1 full course is equal to 60 ECVET credits, 1 ECVET is equal to one ECTS learning credits, 1 ECTS is equal to 25 hours of total learning and one full course is equal to 1500 hours.
- The total hours of learning include study hours, ‘going deeper’, doing practical exercises, then preparation for assessment and the assessment itself.

  In the following table we give a first estimation of what has to be considered as one hour of study for the training course of Tourings. This will be adjusted during the completion of the training course.

	Hours of training
4 pages of reading	1 hour
15 interactive slides	1 hour
Extra lectures 20 pages	1 hour

- The following table define the structure of the Course for a Higher VET Technicien as folow:

Modules	ECVET
Collaborative Robotics Basics	

Collaborative Robotics Modular Design and Behaviour	
Collaborative Robotics Safety Requirements	
Collaborative Robotics Installation on the Assembly Line	
Collaborative Robotics Interactions. Digital Human Model, Digital Human Simulation and the RULA Method.	
Higher VET Technicien	
Total Credits	

Modules of the Master and ECTS credits.

8 Conclusion

This document illustrates the different points wich has been implemented to fulfill all the requirements of EQF recommendations made by the european Commision and in accordance with ECVET.

- The training course of TOURINGS contains 5 differnt Modules which are structured in different units and described the way of learning outcomes in terms of knowledge, skills, and competences.
- Taking into account the defined weight in terms of time and the estimated ECVET points for each unit and module, the whole time(hours) of xxx and xxx ECVET points for training course of TOURINGS has been estimated for the overall course.
- In accordance with the comparison made between NQF of the consortium partners and the EQF-Levels we conclude that TOURINGS adresses the EQF Level 5.

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Annexe I

Table 13: Allocation form - documentation template.

Name of the qualification			
Documents and source texts used			
Proposed level allocation			
Area of competences	**Categories/subcategories**	**Level**	**Justification/explanations**
Professional Competences	Knowledge (depth and breadth)		
	Skills (instrumental and systemic skills, judgement)		
Personal Competences	Social competence (team/leadership skills, involvement and communication)		
	Autonomy (autonomous responsibility/responsibility, reflectiveness, learning competences)		
Difficulties in allocation			

Annexe II

Table 14: Overview of terminology in EQF and DQR

EQF	DQR
Qualification: 'Qualification' means a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards.	**Qualification:** Qualification describes a formal outcome of an assessment and validation process which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards.
Learning outcomes: 'Learning outcomes' means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence	**Learning outcomes:** Learning outcomes describe what learners know, understand and are able and ready to do on completion of a learning process. The DQR describes learning outcomes which have been bundled to form Competences
Knowledge: 'Knowledge' means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. In the context of the European Qualifications Framework, knowledge is described as theoretical and/or factual	**Knowledge:** Knowledge describes the body of facts, principles, theories and practice within a Field of study or work as the result of learning and understanding. Professional knowledge describes knowledge of facts, rules and/or justifications.
Skills: 'Skills' means the ability to apply knowledge and use know-how to complete tasks and solve problems. In the context of the European Qualifications Framework, skills are described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments).	**Skills:** Skills describe the ability to apply knowledge and use know-how to complete tasks and solve problems. As in the European Qualifications Framework, skills are described as cognitive (use of logical, intuitive and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools and instruments). Instrumental skills are applied skills deployed in respect of ideas, theories, methods, tools, technologies and devices. Systemic skills are targeted at generating something new. They are

	conditional on Instrumental skills and require an ability to assess complex correlations and deal with these adequately.
Competence: 'Competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy.	**Competence:** Competence within the DQR describes the ability and readiness of the individual to use knowledge, Skills and personal, social and methodological competences and to behave in a considered, individual and socially responsible manner. Competence is understood in this sense as comprehensive action skills. The DQR presents competence within the dimensions of professional competence and personal competence. Methodological competence is understood as a cross-sectional competence and for this reason is not separately stated within the DQR matrix. (By way of contrast, the EQF describes competence only in terms of the assumption of responsibility and autonomy.) **Social competence:** Social competence describes a person's ability and readiness to work together with others in a target oriented manner, understand the interests and social situations of others, deal with and communicate with others in a rational and responsible way and be involved in shaping the world of work and life. **Personal competence:** Personal Competence is also referred to as human competence and encompasses social competence and autonomy. It describes a person's ability and readiness to develop further and to shape his or her own life in an autonomous and responsible manner within the respective social, cultural or occupational context. **Ability to act as part of a team:**

	The ability to act as part of a team is the ability to cooperate on the achievement of goals within a group. **Leadership skills:** Leadership skills designate the ability to act in a targeted and constructive manner within a group or organisation to steer and guide others and exert an influence on their behaviour. **Autonomy:** Autonomy describes a person's ability and readiness to act in an independent and responsible manner, reflect on the own actions and on the actions of others and to develop his or her own action skills further.

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