



COLLABORATIVE ROBOTICS FOR CIRCULAR ECONOMY IN MANUFACTURING SECTORS

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Joint Curriculum



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1. Introduction into the summary

As a Vocational Education and Training (VET) course, CROCEMS 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 joint 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.

2. European Framework

The European Qualification Framework (EQF), which was adopted by the European parliament and the council in 2008, represents a common reference 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 framework, 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 labour market.

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

Table 1. ECVET implementation in EU countries by 2015



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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
Poland	Some ECVET technical components are tested.	No
Portugal	Some ECVET technical components are tested.	Yes
Slovakia	Any initiative on ECVET implementation at system level is on hold.	Yes
Switzerland	Any initiative on ECVET implementation at system level is on hold.	Yes

(*) In Germany, there is no initiative related to ECVET at system level; however, technical components have been tested both in IVET and CVET at provider level (see also Box 4 and country summary in Annex 1).

Source: Cedefop.

As is shown in this table, the European countries are classified in three different categories and not all countries can adapt and integrate ECVET implementation at the same level with the other countries

without a credit system. The following 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).

2.2. European Qualification Framework

The ECVET system and the European Qualification Framework completes 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 following table represented the EQF levels in terms of this.



Table 2. EQF levels

Level	Knowledge	Skills	Competences
1	Basic general knowledge	Basic skills required to carry out simple tasks	Work or study under direct supervision in a structured context
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
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
4	Factual and theoretical knowledge in a broad context 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
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
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
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	Specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different	Manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and



	awareness of knowledge issues in a field and at the interface between different fields	fields	practice and/or for reviewing the strategic performance of teams
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 analysed below.

3. National Frameworks

3.1. Qualifications System in Spain

Introduction to the Spanish 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 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.

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>

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 3. Comparison between SPF and EQF

EQF	Spanish Qualifications 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	PhD

Validating non-formal and informal learning and link 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.

3.2. Qualifications System in Germany

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 built 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.

NQF – European Framework and link with the German one (DQR)

The “Deutscher Qualifikationsrahmen” (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 4. 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 5. The national qualification framework in Germany

DQR Levels	Qualifications	EQF Levels
8	Doctoral studies	8
7	Master strategic IT professional (certified) (<i>Strategischer IT Professional (Geprüfter)</i>)*	7
6	Bachelor commercial specialist (certified) (<i>Fachkaufmann (Geprüfter)</i>), business management specialist (certified) (<i>Fachwirt (Geprüfter)</i>), master craftsman (certified), (<i>Meister (Geprüfter)</i>), operative IT professional (certified)]* (<i>Operativer IT Professional (Geprüfter)</i>), Fachschule (State-certified...), <i>Fachschule ((Staatlich Geprüfter...))</i>	6
5	IT specialist (certified) (<i>IT-Spezialist (Zertifizierter)</i>),	5

	service technician (certified) ² (<i>Service-techniker (Geprüfter)</i>)	
4	Dual VET (three-year and three-and-a-half-year training courses), full-time vocational school (assistant occupations) (<i>Berufsfachschule</i>), full vocational qualification (full-time vocational school) (<i>Berufsfachschule</i>)	4
3	Dual VET (two-year training courses), full-time vocational school (general education school leaving certificate obtained on completion of grade 10 at <i>Realschule</i> or, under certain circumstances, at other lower secondary school types) (<i>Berufsfachschule</i>) (<i>Mittlerer Schulabschluss</i>)	3
2	Vocational training preparation (<i>Berufsausbildungsvorbereitung</i>), employment agency measures (<i>Maßnahmen der Arbeitsagentur</i>), year of pre-vocational training (<i>Berufsvorbereitungsjahr</i>), introductory training for young people (<i>Einstiegsqualifizierung</i>), full-time vocational school (<i>Berufsfachschule</i>), basic vocational training, (<i>Berufliche Grundbildung</i>)	2
1	Vocational training preparation (<i>Berufsausbildungsvorbereitung</i>), employment agency measures (vocational preparation schemes) (<i>Maßnahmen der Arbeitsagentur (Berufsvorbereitende Bildungsmaßnahmen)</i>), year of pre-vocational training (<i>Berufsvorbereitungsjahr</i>)	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 6. 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:

² The *Arbeitskreis* DQR agreed that additional further vocational training qualifications should be allocated in accordance with the procedures described in the DQR manual. *Source:* BMBF and KMK, 2013.

Table 7. 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.

3.3. Qualifications System in Poland

Introduction to the Polish Education System and Professional Training

The currently integrated education system in Poland has been in force since 2016. It is based on the 8-level Polish Qualifications Framework (PQR), which is based on the European Qualifications Framework (EQF) and on the Integrated Qualifications Register (IQR). Qualifications in the PQR are defined in terms of learning outcomes (knowledge, skills and social competences). The education system distinguishes between full, partial, regulated and market qualifications. Full qualifications are awarded only within the school education system after completion of education at a certain level, and within the higher education system after completion of specialized courses, first, second and long-term level courses, and doctoral education. Partial qualifications can be obtained within the school and higher education systems, as well as within the non-formal education system. The range of learning outcomes to be achieved for a partial qualification is usually narrower than for a full qualification. Regulated qualifications are defined by specific national regulations and awarded accordingly, with the exception of those awarded within the framework of school and higher education. Market-based qualifications



are not regulated by law and are awarded under economic freedom of action.

Institutions at all levels may be either public or non-public (with the exception of non-public arts schools, which may be granted 'public school' status if they meet requirements established by law). Education and/or care is free in public facilities.

Public facilities that provide early childhood education and care, as well as public schools, are operated primarily by central or local government entities. Non-public facilities are maintained by legal entities or individuals. Non-public schools and other non-public facilities must be registered in the registry maintained by the relevant local government agency. Non-public schools are specifically required by law to provide instruction based on national curricula and framework curricula for public schools, to train for occupations listed in the Classification of Occupations for Vocational Education and Training if they provide vocational education and training, to comply with national regulations on internal and external assessment and promotion of students, and to employ teachers who have the qualifications required in public schools. Public higher education institutions are operated by the state, represented by the competent authority or public administration. Non-public higher education institutions are managed by natural or legal persons. They are entered in the register of non-public higher education institutions on the basis of an application examined by the Polish Accreditation Committee and an authorization issued by the Minister responsible for higher education.

Table 8. Polish Qualification Framework

Education system before the ongoing school education reform	Education system after the ongoing school education reform	PQF/EQF Level
6-year primary school leaving certificate		1
3-year lower secondary school leaving certificate	8-year primary school leaving certificate	2
Diploma conferring vocational qualifications obtained after finishing a 3-year basic vocational school	Diploma conferring vocational qualifications obtained after finishing a 3-year stage I sectoral vocational school	3
Diploma conferring qualifications obtained after finishing a 4-year technical upper secondary school or a post-secondary school	Diploma conferring vocational qualifications obtained after finishing a 5-year technical secondary school or a post-secondary school, or a stage II sectoral vocational school	4
Maturity certificate obtained upon passing the maturity exam in a general or technical upper secondary school	Maturity certificate obtained upon passing the maturity exam in a general or technical secondary school, or stage II sectoral vocational school	4
Diploma of a college of social work Chartered Specialist (dyplomowany specjalista) and Chartered Specialist-Technologist (dyplomowany specjalista technolog) certificates awarded by a non-university HEI		5
Diploma confirming completion of a first-cycle programme (Bachelor's degree – licencjat or inżynier)		6
Diploma confirming completion of a second- or long-cycle programme (Master's – magister or equivalent degree)		7
Doctoral diploma (doctoral degree – doktor)		8

4. CROCEMS Learning units

CROCEMS Training Course will comprises 6 different and complementary training modules to teach



the needed skills and competences on collaborative robotics for waste management and circular economy processes. Each module has learning outcomes associated and is made of different manageable units, formulated from these learning outcomes, and related to the same set of occupational activities and field of knowledge. It describes the multimodal learning process, the objective of the Units 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 interest 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.

Module 1 – Collaborative Robotics Basics- Modular Design & Behaviour	
Objective of the module	<p>The aim is:</p> <ul style="list-style-type: none"> - 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 (Human-Robot Collaboration) and that they will be able to follow the other modules (pedagogical aim) - To deliver the needed tools to understand the potential of collaborative robotics and its modular design and behaviour to be adapted to different industrial processes or activities.
Knowledge	<p>The learner will know and understand:</p> <ul style="list-style-type: none"> - Robotics components, - Automatization technology, - Gripping Technologies, - Safety Aspects - To read, understand and modify technical designs, and - To quote different softwares suitable for the robot cell's task.
Skills	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Add the proper tools to the robotic cell, - Assembly robotic cell, - Assembly sensors, - Programming robot cells, - Conduct a risk assessment, - Implement safe cells.
Competences	<p>The learners will be able to:</p> <ul style="list-style-type: none"> - Adjust fabrication equipments, - Maintain Robotics, - Adaption and re-programming of robotic cells,



- Perform risks analysis.

Module 2 – Sustainability & Circular Economy in Manufacturing Sectors

Objective of the module	<p>The aim is:</p> <ul style="list-style-type: none"> - To know what Circular Economy is and its impact on the Sustainability of European Manufacturing Sector. - To assess resource use and waste generation to develop and implement project to ‘close the loop’ within manufacturing companies. - To propose circular solutions for products operations, processes and services and/or new circular business models.
Knowledge	<p>The learner will know and understand:</p> <ul style="list-style-type: none"> - Global standards for sustainability reporting, - Environmental policy on European level, - Environmental management monitoring, - Corporate social responsibility, - Circular Economy processes, - Waste management processes.
Skills	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Ensure compliance with environmental legislation, - Assess environmental impact, - Advise on sustainable management policies and solutions
Competences	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Promote environmental awareness, - Evaluate company needs, - Measure company’s sustainability performance.

Module 3 – Lean Robotics Methodology

Objective of the module	<p>The aims are:</p> <ul style="list-style-type: none"> - To find a systematic way to complete robotic cell deployment cycle, from design to integration and operation - To perform the deployment quicker and more efficiently, - To focus on continuous improvement and eliminating waste across the whole development cycle.
Knowledge	<p>The learner will know and understand:</p> <ul style="list-style-type: none"> - Maintain control system for automated equipment, - Monitor automated machines, - Perform machine maintenance, - Approve and adjust engineering design.
Skills	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Execute feasibility study, - Monitor machine operations, - Perform test run,





	<ul style="list-style-type: none"> - Follow standards for machinery safety.
Competences	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Liaise with engineers, - Set up automotive robot, - Set up machine controls.

Module 4 – Circular Business Models for Waste Management	
Objective of the module	<p>The aim is:</p> <ul style="list-style-type: none"> - To provide basic knowledge on business model. - To clarify the connection between sustainable business models and circular business models. - To define and characterise circular business models.
Knowledge	<p>The learner will know and understand:</p> <ul style="list-style-type: none"> - The concept of (circular) business model - The value creation mechanisms in circular business model innovation - Circular Economy strategies.
Skills	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Recognise specific mechanisms to create, deliver and capture value on a generalized level. - Position circular business models within sustainable business models. - Identify starting points and value creation mechanisms specific to the industry.
Competences	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Contribute to business plan and strategy for implementation within own sector.

Module 5 – Circular Strategy Mapping & Value Networks for Waste Management	
Objective of the module	<p>The aim is:</p> <ul style="list-style-type: none"> - To understand the role of networks in creating Circular Economy Business Models. - To deliver the needed tools to develop business and new value propositions from opportunities presented by the transition towards a circular economy. - To map different strategies able to be used to close company's material-loops and explore new emerging business models.
Knowledge	<p>The learner will know and understand:</p> <ul style="list-style-type: none"> - Characteristics of waste, - Business management principles, -
Skills	<p>The learner will be able to:</p> <ul style="list-style-type: none"> - Apply organisational techniques, - Advise on waste management procedures,





	<ul style="list-style-type: none">- Waste and scrap products,- Develop waste management processes.
Competences	The learner will be able to: <ul style="list-style-type: none">- Maintain waste collection records,- Assess environmental impact,- Monitor legislation developments.



Module 6 – Product Deployment Cycle & Ecodesign (CETEM/HKA)	
Objective of the module	The aim is: <ul style="list-style-type: none"> - To help reach the Green Deal objectives of lower resource consumption and less environmental impact - To bring all developed products in line with technical standards for sustainability, - To improve coherence with existing instruments regulating products in various stages of their life cycle.
Knowledge	The learner will know and understand: <ul style="list-style-type: none"> - Socio-economic trends in the sector, - Market research, - Product life cycle, - Product comprehension.
Skills	The learner will be able to: <ul style="list-style-type: none"> - Manage customer experience, - Design customer experiences, - Identify market niches, - Develop revenue generation strategies.
Competences	The learner will be able to: <ul style="list-style-type: none"> - Analyse cultural trends, - Manage profitability, - Provide improvement strategies.
Pedagogical approach	The pedagogical approach will be defined in CROCEMS Educational Philosophy (PDF + PPT + H5P Videos)

Annex I. Overview of Terminology in EQF and DQR.

EQF	DQR
<p>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.</p>	<p>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.</p>
<p>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</p>	<p>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</p>
<p>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</p>	<p>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.</p>
<p>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).</p>	<p>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.</p>
<p>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.</p>	<p>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.)</p> <p>Social competence: Social competence describes a person's ability and readiness to work together with others in a target-</p>



	<p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p> <p>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.</p>
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