



Training and Assessment

Frame Design



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DIGIGREEN

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Introduction

Training and Assessment Frame Design aims to develop a new training and assessment guideline for the transition from traditional manufacturing system to a digital and green manufacturing.

The transition to digital and green is a challenge to companies as well as VET providers. VET providers need to follow the transition and prepare the trainers and the curriculums with adequate knowledge and skills.

Digigreen project starting point was to understand the necessary and expected knowledge that manufacturing industry need to be involved in the transition to digital and green.

The main conclusions were gathered in the Table 1 Key Findings.

This matrix reflects the main conclusions on the Methodologies for the digital training and assessment report and provides, the key findings obtained from the questionnaires analysis and the intersection with the expected contents for the training and assessment frame Design.

In this guideline Training and Assessment Frame Design, the aim is to present a training program that can support companies to overcome the need of became more digital and green, facing the industry revolution 4.0.

The guideline will present the training program structure, focusing in three Digigreen Competence Units (CU DG) covering the digital and green transformation, as well as the transversal soft skills needed to support blue collar workers in this transformation.

The last part of this guideline will focus on micro credentials. Digigreen frame design, as a short learning experience, can be delivered as micro credential, by assuring its quality and transparency, the CU developed are consolidated and designed in learning outcomes, bringing quality and transparency to the process.

1 Training Program Overview

The training program is designed to increase or develop the competences in Digital and Green subjects.

The competence units are covering topics such as digital transformation, greening fabrication or transversal soft skills, both for level Comprehensive and Basic. The scope of the training is to gain minimal high-tech skills to serve the growing needs created by smart industrial specialisation and digital transformation. Also, to offer a solid foundation for the work of the future and to target in trainers in the field of manufacturing and manufacturing workers.

The process followed to design the training program is presented in figure 1:

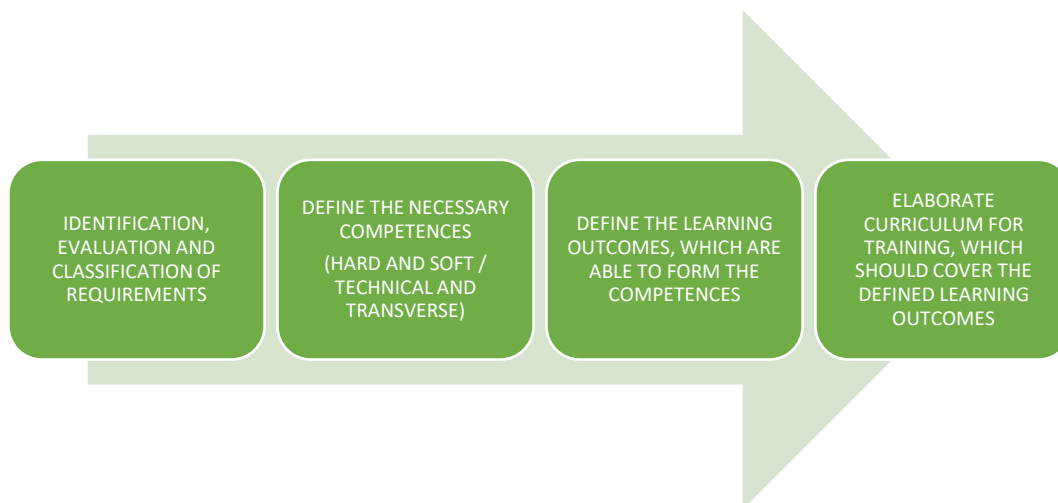


Figure 1 Process to design the training program

The training structure is organized in a modular approach, comprised of a general content in Digital and Green Competences for both White- and Blue-collar workers.

The course/curriculum for digital and green skills development is organized according to three Competence Units (CU) / Units of Learning Outcomes (ULOs), as shown in the table below.

COMPETENCE UNITS / UNITS OF LOs	RECOMMENDED CONTACT HOURS*	
SUBJECT TITLE	WHITE COLLARS	BLUE COLLARS
	Comprehensive	Basic
CU DG1. Digital transformation in fabrication and logistics	14	10.5
CU DG2. Greening fabrication	14	10.5
CU DG3. Transversal / Soft Skills	0	3.5
Total	28	24,5

Table 1 Structure of the training program

*Contact hour shall contain at least 50 minutes of direct teaching time.

** Workload is calculated in hours, corresponds to an estimation of the time students typically need to complete all learning activities required to achieve the defined learning outcomes in formal learning environments plus the necessary time for individual study

The expected learning outcomes are described in two ways:

- 1- The training programme generic outcome descriptors, organized in terms of knowledge, skills, autonomy, and responsibility (see chapter 2 Competence Units/Units of Learning Outcomes)
- 2- The competence units (CU) organized according to three main subjects, designed in terms of Learning Outcomes (LO), as show in Table 2 Training Program Summary.

Training Programme			
Level	Knowledge	Skills	Autonomy and Responsibility
Basic until level 4 EQF (Blue Collar)	Factual and board concepts in the field of digital and green processes of fabrication and transversal soft skills.	Fundamental cognitive and practical skills required to develop proper solution and application of procedures and tolls on simple and specific information on the digital data and information. To operate the devices and digital equipment, with safe.	Self-manage of professional activities and simple standards in the work produced. Supervise routine tasks and similar function workers, as well as take responsibility for decision making in basic work.
Comprehensive Level 5 to 7 EQF (White Collar)	Advanced knowledge and critical understanding of theory, principles, and applicability of digital and green processes of fabrication and transversal soft skills.	Advanced problem-solving skills including critical evaluation, allowing to choose the proper technical, economical, and sustainable solutions when applying digital and green processes of fabrication, in complex and unpredictable conditions.	Manage the transition to a digital and green fabrication, in a highly complex context. Fully responsible for the definition and revision of personnel's tasks.

Table 2 Training program summary

1.1 Entry Requirements

The Information and Communications technology (ICT) skill to attend this training are listed below, for both White Collar (WC) and Blue Collar (BC) groups of workers.



Entry requirements– Blue Collar Group

- Using keyboards, touch screens and storage devices
- The ability to use computer operating systems, to access software programmes and manage the basic functions of a computer.
- Being able to confidently use core computer programmes to produce common digital information such as text editors and spreadsheet editors and presentation editors, at basic level.
- Organise and basic analyse information with the help of computer spreadsheet and database software
- The ability to communicate and interact with other ICT users through the use of internet and email.
- Create and engage with digital information for a specific task.

Table 3 Entry requirements - Blue Collar group

Entry requirements or Access Conditions – White Collar Group

- The ability to use computer operating systems, to access software programmes and manage the basic functions of a computer.
- Being able to confidently use core computer programmes to produce common digital information such as text editors and spreadsheet editors and presentation editors, at comprehensive level.
- Organise and comprehensive analyse information with the help of computer spreadsheet and database software
- The ability to communicate and interact with other ICT users through the use of internet and email.
- Create and engage with digital information for a specific task.
- Extensive use of the internet and data programmes for research
- Use ICT knowledge and skills to make a change to a project or process

- Use presentation software application and other communication technologies in a presentation or group work, online, offline and hybrid.

Table 4 Entry requirements - White Collar group

2 Training Programme Curriculum

For each Competence units / Units of learning outcomes objectives and scope are defined for a specific depth of knowledge and skills. The EQF level for White Collar Workers is 5 to 7 and for Blue Collar Workers is 4.

The detailed description of the four CUs is given onwards:

2.1 CU DG1 Digital Transformation in Fabrication and Logistics

CU DG1 Digital Transformation in Fabrication and Logistics	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC	WC
Digital data and digital information	3,5	4
Digital devices and equipment	6	5
Simulation of processes and products	0	4
Business ecosystem/innovative model & Digital Strategy	0	0,5
Health and Safety	1	0,5
Total	10,5	14
Workload	21	28

Learning Outcomes - CU DG 1 Digital transformation in fabrication and logistics		
LEVEL	BC	WC
KNOWLEDGE	Factual and broad concepts of: - Digital data and digital information - Digital devices and equipment - Simulation of processes and products - Business ecosystem/innovative model & Digital Strategy - Health and Safety	Advanced knowledge and critical understanding of the theory, principles, and applicability of: - Digital data and digital information - Digital devices and equipment - Simulation of processes and products - Business ecosystem/innovative model & Digital Strategy - Health and Safety

Learning Outcomes - CU DG 1 Digital transformation in fabrication and logistics		
LEVEL	BC	WC
SKILLS	The learner is expected to: Distinguish and recognise different computing systems. Use and select the information on the internet avoiding viruses and malware software. Analyse features to organize and understand specific output data. Identify potential threats during equipment operating. Execute specific procedures to avoid threats when using digital equipment. Recognise and apply personal health and safe procedures when using digital equipment.	The learner is expected to: Analyse specific data and information avoiding viruses and malware software. Manage risk and threats when using specific digital devices and equipment in online working. Identify the importance of a business ecosystem network and develop a plan to involve digital processes and equipment in the company routines. Reframe innovation models according to demands on marketplace. Analyse the structure and functionalities of specific equipment. Plan the maintenance of equipment. Lead simulation in specific processes and products.

2.2 CU DG2. Greening fabrication

CU DG2 Greening Fabrication	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC	WC
Sustainable production	3	3,5
Resources consumption and measures to reduce	3	2
Scraps and Wastes	3	2
Reutilization and Recycling	2	1
Pollutant emissions and measures to reduce	3	2

Total	14	10.5
Workload	28	21

Learning Outcomes - CU DG 2 Greening Fabrication		
LEVEL	BC	WC
KNOWLEDGE	Factual and broad concepts of: Sustainable production Resources consumption and measures to reduce within raw materials, energy and consumables. Scraps and Wastes Reutilization and Recycling Pollutant emissions and measures to reduce	Advanced knowledge and critical understanding of the theory, principles and applicability of: Sustainable production Resources consumption and measures to reduce within raw materials, energy and consumables Scraps and Wastes Reutilization and Recycling Pollutant emissions and measures to reduce
SKILLS	The learner is expected to: Identify sustainable practical in production Recognise and interpreting measures to reduce resources consumption, scraps, and wastes Execute recycling processes	The learner is expected to: Organise and design the conversion to a sustainable production Create measures to reduce resources consumption, scraps, and wastes during the production process Develop recycling processes inside the organization Create solutions to reduce pollutant emissions in the organization

2.3 CU DG3. Transversal / Soft skills

CU DG3 Transversal / Soft Skills *	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC	WC
Communication – vertical and horizontal	2	-
Ethics	1,5	-
Total	3,5	-
Workload	7	-



*The CU DG 3 Transversal / Soft Skills is designed only for Blue Collars. The White Collars already have covered these contents when attending higher education programs.

Learning Outcomes - CU DG 3 Transversal / Soft Skills*		
LEVEL	BC	WC
KNOWLEDGE	Factual and broad concepts of: Vertical and horizontal communication Ethics	
SKILLS	The learner is expected to: Interpret and execute with property terminology in the communication among colleagues in the same team or with members from different hierarchical level. Use active listen in the process of communication among his/her co-workers. Use different communication techniques for reporting. Predict the impacts of a correct and incorrect classification of information, when developing specific procedures.	

*The CU DG 3 Transversal / Soft Skills is designed only for Blue Collars. The White Collars already have covered these contents when attending higher education programs.



3 Micro credentials

3.1 Definition of Micro credentials

The concept of micro credentials was defined by the European Commission, attempting to clarify not only the term itself, but most of all, to define what is the purpose of Micro credentials once several countries already use similar processes.

According to the European Commission (2020) ¹ a micro credential is

‘A micro credential is a proof of the learning outcomes that a learner has acquired following a short learning experience. These learning outcomes have been assessed against transparent standards. The proof is contained in a certified document that lists the name of the holder, the achieved learning outcomes, the assessment method, the awarding body and, where applicable, the qualifications framework level and the credits gained. Micro credentials are owned by the learner, can be shared, are portable and may be combined into larger credentials or qualifications. They are underpinned by quality assurance following agreed standards.’

European countries are working on the best way to process and operationalise the term, at different speeds. While in some countries discussions about micro credentials are still at an initial phase, in other countries micro credentials are already explicitly referenced. (Cedefop 2023)

Estonia and Spain are already formally considering micro credentials as part of formal systems. Micro credentials are seen a bridge between labour market needs and lifelong learning, reskilling and upskilling, recognising of prior learning, in a wide range of learners.

For instance, Poland, Slovenia and Finland defined consultation groups on micro credentials.

The Netherlands and Norway already embed micro credentials into formal VET systems. In Sweden several government bodies are taking forward discussion on the description, recognition, premises and portability of micro credentials.

Spain formally considered the micro credentials as part of formal VET.

Ireland has included short courses and certificates in its NQF (since 2003) considering micro credentials crucial to their national education and training landscape. Initially delivered by colleges and universities (NQF level 6), micro credentials have also spread into VET; digital badges and other micro credentials. In 2021, the Irish Qualifications Authority introduced a working definition stating that ‘a micro credential is a qualification that attests to a small-volume, highly specific learning achievement’.

The Industrial revolution 4.0 increased the need of reskilling and upskilling. Companies are aware that people need to learn how to use new technology – internet of things, artificial intelligence,

¹ Source: European Commission (2020); definition used in CEDEFOP’s study

nanotechnology – and micro credentials can support the learning in areas where the formal qualification are limited.

In terms of framework, micro credentials can be issued either by public or private providers, onsite or using online learning platforms, blend learning, classrooms lectures or even apprenticeships. The impact on adult education was increasing and its flexibility, allows workers to have more opportunities to do career progress or changes.

Another feature coming from this flexibility, appreciated mostly in companies, it's the easier and cheaper possibility to improve employability and address skills needs and gaps thru lifelong learning.

Despite the add value of micro credentials and the different developments among European state members, it is important to highlight that there is no common European approach to micro credentials and the modularisation of VET programmes, for the time being.

The fact that micro credentials are not clearly defined and implemented, led to the threat of unregulated certificates and lack of transparency. Due to this, private institutions are delivering the contents on their own, recognising the Knowledge, Skills and Competences coming from their experiences and labour market standards. Also, the compatibility of non-formal and private sector qualifications it's not always aligned with National Qualifications Framework (NQF).

The table below summarise the strengths and the weaknesses of micro credentials:

Strengths	Weaknesses
• Microcredentials respond to the changing needs of the labour market • Promote lifelong learning • Assist in upskilling and reskilling • Enable learners to build and validate professional skills (non-formal and informal learning), • Offer opportunities for better understanding and cooperation between education providers and employers • Have the potential to provide access to education to a greater variety of learners • Provide flexible learning pathways	• Microcredentials cause uncertainty among stakeholders as to their benefits • Proliferate in unregulated ways • Confuse users owing to their complexity and variety • Lack transparency as to who ensures their quality • Present challenges concerning their recognition • Are often unable to reach the most vulnerable or disadvantaged learner groups

Table 5 Micro credentials Strengths and Weaknesses²

On another hand, manufacturing is one of the major fields in industry, it includes a wide range of sub-sectors, which makes this field one of the most challenging when the topic is employee's

² Source: Cedefop (2022) Are Microcredentials becoming a big deal?

qualifications. The qualification of people in Manufacturing is crucial, because of the fast evolution of technology and the quick changes in the production process. Establish and maintain the employee's teams updated with the required skills is one of the most challenges. Manufacturing requires rapid adjustments to their workforce in terms of their knowledge, skills and competences (Cedefop 2023) (table 6)

Main Changes in Manufacturing
• Introduction of new production technologies and growing level of technological complexity • Advent of new materials • Growing automation and robotisation of industrial production through Industry 4.0 • Digitalisation and shortening of value chains • Growing need for interdisciplinary and broader basic knowledge

Table 6 - Main Changes in Manufacturing

Source: Adapt from Cedefop 2020, pg 38

Industry needs to adapt quickly, and the workforce will need to be reskilled and/or upskilled to keep pace with these structural changes in technology and machinery.

3.2 Main Characteristics

Even though micro credentials are not, yet, clearly, and uniformly implemented, CEDEFOP identified ³several overarching features that are often used and try to explore them, having in mind the definition of qualifications, as provided by the 2017 EQF – Recommendation⁴:

In order to add transparency and understanding to all, the critical and recommended information to be part of the elements are in below. The elements marked with an asterisk (*) are optional:

- a) Identification of the learner;

³ Cedefop (2022). Microcredentials for labour market education and training: first look at mapping microcredentials in European labour-market-related education, training and learning: take-up, characteristics and functions

⁴ [https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615\(01\)](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017H0615(01))



- b) Title of the micro credential;
- c) Duration of a learning activity;
- d) Provider of the course;
- e) Identification of the content needed to achieve the Learning Outcomes (ECTS, whenever possible);
- f) Level of the learning experience leading to the micro credential (EQF or NQF);
- g) Learning outcomes;
- h) Form of participation in the learning activity;
- i) Prerequisites*;
- j) Type of assessment;
- k) Supervision and identity verification during assessment*;
- l) Quality assurance, with the identification of the body ensuring the quality of the course;
- m) Grade achieved*;
- n) Integration/ stackability options*;
- o) Further information

3.3 Micro credentials and quality assurance

The lack of transparency is point out as the nuclear set up to assure quality in micro credentials and one of the main barriers for recognition⁵. In order to bring trust to the process, transparency is needed in three dimensions:

⁵ European Commission (2020)

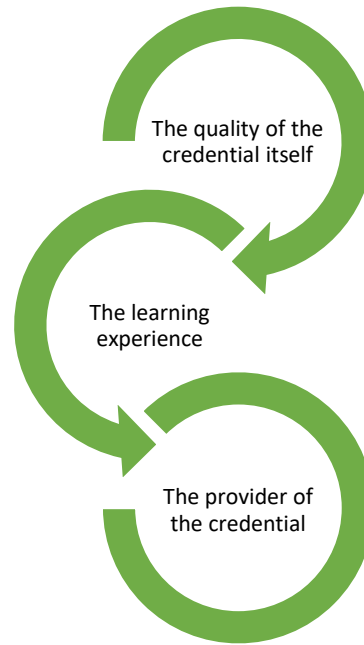


Figure 2 Quality assurance dimensions

The first dimension is related to the quality of the credential itself, meaning the authenticity and technology that supports it. Also, in the second dimension, the learning experienced in the credential, full linked to the quality of the content. And, finally, the trust and reputation in the provider. These three aspects are identified.

In sum, and based on the Final Report of the European Commission (2020) and on NESET report (2020), micro credentials when following the current European standards and key elements for formal recognition and quality assurance in higher education, are recommended in addition, to review and add additional measures for quality assurance faced on the digitalisation in teaching and learning, once micro credentials can be delivered in several virtual learning environment.

For secondary VET or adult learning sector, the quality assurance is recommended to follow the recommendations/quality principles for qualifications in the Council Recommendation (2017)⁶ on the European Qualifications Framework for lifelong and the European Qualifications Framework for lifelong learning.

3.4 Mode of delivery and type of certification

The way that micro credentials are delivered have several options regarding the format. It can be delivered in a classroom mode, online or blended. On each option micro credentials have positive aspects, we point out the online and blended options, according to Digigreen analyses from PR1 Methodologies for the digital training and assessment, whose report identified that “the majority

⁶ European Commission (2017)

of the participants believed that Hybrid, online and face to face combined lectures are the best learning method, in terms of type of lesson”⁷.

Online delivery option gives the opportunity to be more flexible in what it comes place and time dedicated to the learning activity.

However, this topic is not consensual for all the players. Training institutions usually prefer to deliver the micro credentials in a classroom-based learning environment, while companies choose the blended or even online learning (Cedefop 2022).

When it comes to the duration of the micro credential, the length of a learning experience varies significantly, and depending on the provider and its purpose. When the learning activity is very specific and narrow, with restricted skills and competences the duration of it is shorter, when compared to other general qualifications.

Regarding assessment, and according to Cedefop (2022), this is a crucial topic in any learning process, since it can reflect the quality and the trust in credentials. For this, micro credentials can use different assessments methods, and the evidence are usually based on the attendance of learners, but mostly assignments that can better reflect the acquired knowledge. Finally, assessments are usually made in-house and undertaken by external/independent providers.

3.5 Micro credentials and the allocation of credits

The European Credit Transfer and Accumulation System (ECTS) is identified as one of the solutions to support the approach to credits in micro credentials. ECTS is a recognised mechanism to make the learning outcomes (LO) and estimate the workload and duration of a course as something measurable. It brings transparency to micro credentials and, apart from being a harmonised mechanism is also used and recognised all over Europe.

Besides ECTS being close to higher education, the European Commission (2020) expect that it can be expanded to other levels.

Another benefit of micro credentials using ECTS, is to facilitate the national and international recognition of short courses as independent modules or potential parts of a qualification.

According to the NESET Report (Orr, 2020), the flexibility of micro credentials stands by the possibility of micro credentials can be both credit-bearing and non-credit bearing. This will lead the students the possibility to choose and adapt their pathway according to their preferences or needs. Important to highlight is the fact that it is expected that the level of complexity and the autonomy required should be present in the micro credential according to this distinguish.

The definition of credits for micro credential framework is not consensual at the time (European Commission 2020), there are considerations that

“suggest that micro credentials should be based on a notional workload of 100-150 hours (including revision for, and completion of, the summative assessment). This equals 4-6

⁷ PR1 Report, page 19

ECTS credits. Others argued that even 1 ECTS credit could be accepted for the workload of micro-credentials. On the other end of the possible scale, 60 or 90 ECTS credits were mentioned, the latter of which would already be very close to the size of the short-cycle qualification” (European Commission 2020, pg. 16).

Also were referred that when limiting micro credentials to numbers of ECTS credits there were the risk of also limit the educational innovation and flexibility.

The European Commission report (2020) defined as key-points for the credits the following topics:

- The recommendation of the micro credentials linked with ECTS, as far as possible;
- In terms of a range of ECTS credits, or the volume of learning leading to micro credentials, the key-point is to do not setting a range to allow flexibility, despite the difficult when comparing micro credentials;
- To allow maximum flexibility, the recommendation is to imply a minimum of 1 ECTS credit (between 25 and 30 hours) and an upper limit of a full degree. Meaning, between 1 and 6 ECTS credits for a single micro credential.
- The possibility of combining several micro credentials into a macro-credential was also identified, although with no developments.
- The stacking of micro credentials was, also, point out, with the concern of not allowing that a combination of several micro credentials could lead to an automatic full degree.

The following tables summarises the allocation of credits in to Digigreen context:

CU DG1 Digital Transformation in Fabrication and Logistics	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC – Alignment with EQF 4	WC – Alingment with EQF 5 to 7
Digital data and digital information	3,5	4
Digital devices and equipment	6	5
Simulation of processes and products	0	4
Business ecosystem/innovative model & Digital Strategy	0	0,5
Health and Safety	1	0,5
Total	10,5	14
Workload	21	28
Micro credits	1	1

CU DG2 Greening Fabrication	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC – Alignment with EQF 4	WC – Alignment with EQF 5 to 7
Sustainable production	3	3,5

Resources consumption and measures to reduce	3	2
Scraps and Wastes	3	2
Reutilization and Recycling	2	1
Pollutant emissions and measures to reduce	3	2
Total	14	10.5
Workload	28	21
Micro credits	1	1

CU DG3 Transversal / Soft Skills	RECOMMENDED CONTACT HOURS	
SUBJECT TITLE	BC – Alignment with EQF 4	WC – Alignment with EQF 5 to 7
Communication – vertical and horizontal	2	
Ethics	1,5	
Total	3,5	-
Workload	7	-
Micro credits	-	-

Main conclusions

Once Digigreen reported the key findings obtained from the questionnaires analysis, summarized in the matrix (annex 1) and having in mind the revolution 4.0 in industry, the need of having agile and flexible learning solutions became a priority but keeping the quality standards.

Increasing lifelong learning, allowing companies and workers to keep up with digital and green trends in the fabrication and logistic process was the starting point for this training and assessment frame design.

The training frame was designed in terms of learning outcomes, pointing out the knowledge, skills and autonomy/responsibilities for each developed competence unit. The Digigreen competence units, three in total, cover the main needs identified by the query to industrial companies, in Project Result 1. Also each competence unit was designed, when identifying the detailed knowledge, the allocation of hours/credits, to keep in line with the recommendations for designing micro credentials.

Digital and green transformation is more than to transform the company vision, but most about support trainers and training providers who will be involved in the training of specialists for the digital and green transition, related to skills gaps.



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Annex 1

(Matrix)

Annex 2

Micro Credentials Features (Matrix)

CU DG1 Digital Transformation in Fabrication and Logistics

Identification of the learner	
Title of the micro credential	
Duration of a learning activity	
Provider of the course	
Identification of the content needed to achieve the Learning Outcomes	
Level of the learning experience leading to the micro credential (EQF or NQF);	
Learning outcomes	
Form of participation in the learning activity	
Prerequisites*	
Type of assessment	
Supervision and identity verification during assessment*	
Quality assurance	
Grade achieved*;	
Integration/ stackability options*	
Furter information	

(*) optional elements

CU DG2 Greening Fabrication

Identification of the learner	
Title of the micro credential	
Duration of a learning activity	
Provider of the course	
Identification of the content needed to achieve the Learning Outcomes	
Level of the learning experience leading to the micro credential (EQF or NQF);	
Learning outcomes	
Form of participation in the learning activity	
Prerequisites*	
Type of assessment	
Supervision and identity verification during assessment*	
Quality assurance	
Grade achieved*;	

Integration/ stackability options*	
Furter information	

(*) optional elements

CU DG3. Transversal / Soft skills

Identification of the learner	
Title of the micro credential	
Duration of a learning activity	
Provider of the course	
Identification of the content needed to achieve the Learning Outcomes	
Level of the learning experience leading to the micro credential (EQF or NQF);	
Learning outcomes	
Form of participation in the learning activity	
Prerequisites*	
Type of assessment	
Supervision and identity verification during assessment*	
Quality assurance	
Grade achieved*;	
Integration/ stackability options*	
Furter information	

(*) optional elements