GIST

28/02/2022

O1-A2: Learning outcomes definitions

Project:
Fostering diGitalisation and bIonic transformation of SMEs through the **development of a novel and innovative Training material for overcoming COVID-19 crisis**

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Version	Date	Short description	Author(s)
1	28/07/2021	Preliminary draft	STP
2	21/10/2021	Following the preliminary results of Key Study	STP
3	05/11/2021	Learning outcomes definitions	STP
4	28/02/2022	Added harmonisation with EQF and ECVET	STP

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1. Introduction

Industry 4.0 takes the emphasis on digital technology with the help of interconnectivity through the Internet of Things (IoT), access to real-time data, and the introduction of cyber-physical systems. It offers a comprehensive and interlinked, one can say a holistic, approach to manufacturing, connecting the physical with digital. This allows for better collaboration and access across departments, partners, vendors, product, and people, thus empowering business owners to better control and understand their business venture, allowing them to leverage instant data to boost productivity, improve processes, and drive growth.
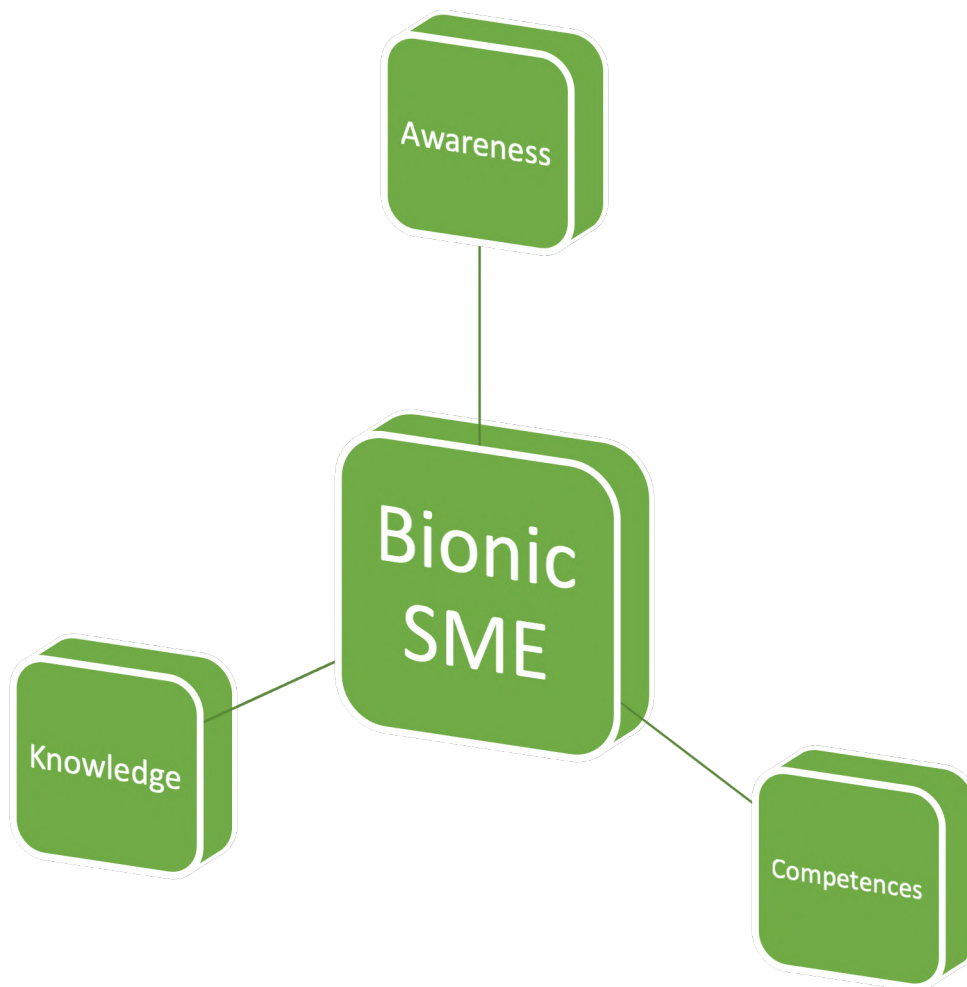
Image 1: Bionic SME (Source: STP)

2. Evidence based learning curriculum

In order to foster digitalisation and bionic transformation of SMEs, the partnership of the GIST project will prepare innovative training material, based on the identification of the needs and expectations of the SMEs. For this purpose, a study was prepared to identify the needs and barriers SMEs are facing in the process of bionic transformation. Based on the study, the learning outcomes will be set up (this document) and the curriculum will be prepared.

2.1. Analysis

Within the GIST project, a survey was conducted (IO1-A1) among the 71 respondents, who defined as originating from 15 different nationalities, falling into 3 categories of target groups, for which the questionnaires were prepared (see Image 2).

The survey for each target group was structured in a way, that would allow identifying the certain technologies, which the target groups recognised as the drivers transforming the traditional companies within the (mostly) furniture sector into I4.0 companies, as well as to identify the barriers hindering the bionic transformation.

SMEs

30 representatives of SME answered the survey.

Students & unemployed people

17 students and unemployed people answered the survey

Other organisations

24 people representing VET providers, High Education providers and consultancy organisations (such as employment office or public administration) answered the survey.

Image 2: 3 survey target groups (Source: STP)

2.2. Knowledge about I4.0

The survey results showed that within all three target groups there is a consensus about the importance of I4.0, with over **97% answers confirming** that 4.0 technologies are important for the development of SMEs in the sector. However, the level to which they are familiar with I4.0 is lower (see Image 1).
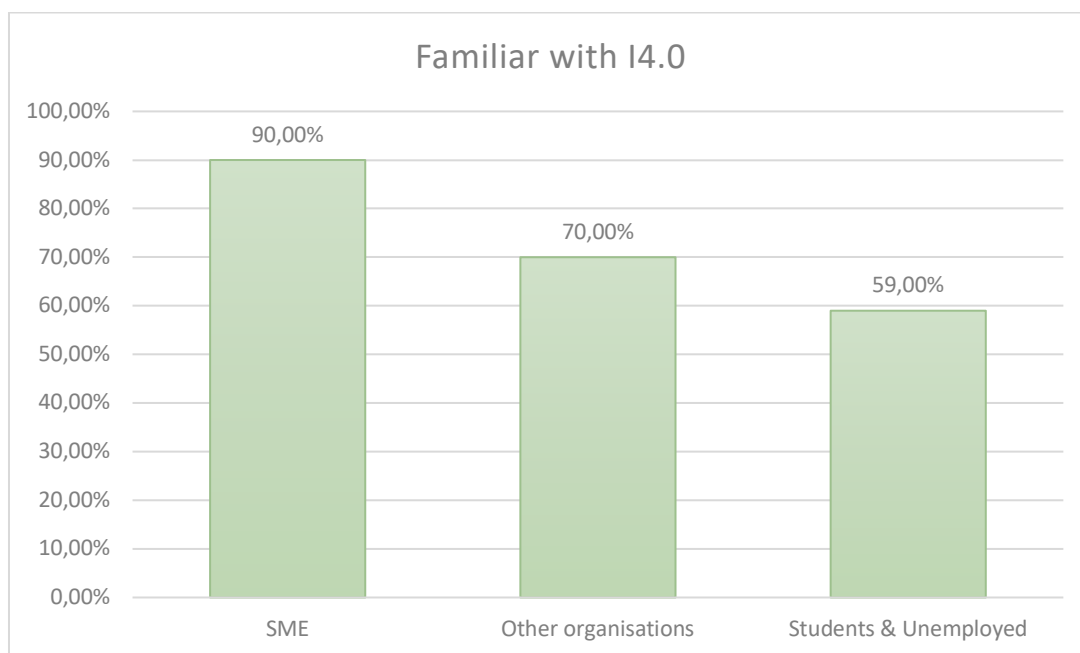
Image 3: Familiarity with industries 4.0 among target groups (Source: STP)

2.3. Key technologies

Out of the 9 specific technologies offered to the target groups to choose from, the following 5 (see Table 1) have been considered important by 50% of SME respondents. The was one noticeable discretion, as Internet of Things has received overall more votes (47,88%) than Big Data (46,48%). However, as the total number of answers was not so much higher, the results can be seen as comparable, thus positive discrimination for answers provided by the people from within the industry was applied.

	SME	Other organisations	Students & unempl.	Total
Robotics	**66,67%**	**70,83%**	**70,59%**	**69,01**
3D printing and custom manufacturing	**63,33%**	**58,33%**	**82,35%**	**66,19**
Cloud services	**63,33%**	**45,83%**	**29,41%**	**49,29**
Augmented and virtual reality	**53,33%**	**41,67%**	**47,06%**	**47,89**
Big Data	**50,00%**	**45,83%**	**41,18%**	**46,48**

2.4. Skills needed

In addition to the technologies, all three target groups were also asked about the skills (see Table 2) that are crucial for achieving bionic transformation.

Table 2: "3 key skills" (Source: STP)

	SME	Other organisations	Students & unemployed	Total
Communication	**66,67%**	**70,83%**	**70,59%**	**69,01**
Creativity	**63,33%**	**58,33%**	**82,35%**	**66,19**
Solution oriented	**63,33%**	**45,83%**	**29,41%**	**49,29**

2.5. Barriers identified

In regard to barriers, there were several identifies (lack of skills, cost of technology, lack of digital strategy, reluctance to change, insufficient finances, etc.). However, there are some upon which the project can have no effect (such as lack of finances, or the cost of technology).

However, the following two barriers were identified and can be addressed by training courses:

- Preparation of digital strategy,
- Changing the mindset.

2.6. Conclusion

The learning outputs must be set in a way to provide the following knowledge, skills, and competencies to meet the needs of the industry reflected through the findings of the study:
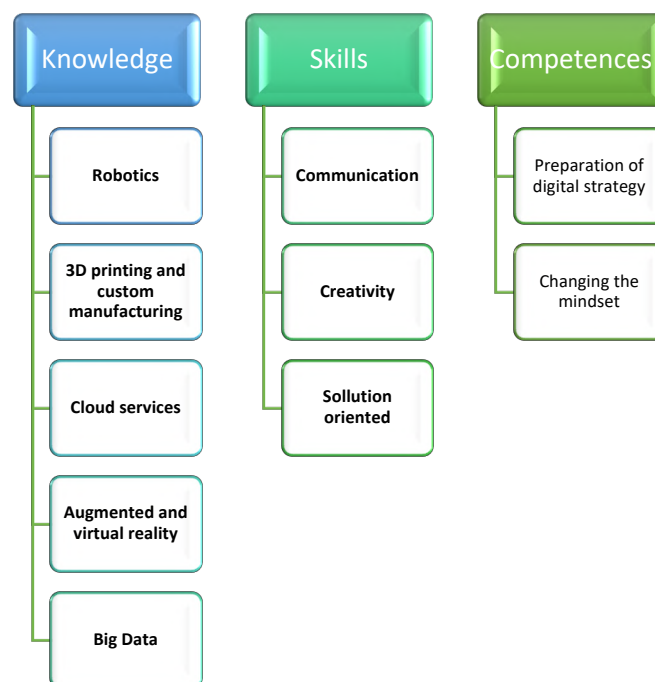

Image 4: The overview of identified needs (Source: STP)

3. Learning outcomes

For the understanding of the learning outcomes, we will use the definition provided by the European Qualifications Framework (EQF)[1]:

1) Knowledge: in the context of EQF, knowledge is described as theoretical and/or factual.
2) 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).
3) Responsibility and autonomy: In the context of the EQF responsibility and autonomy are described as the learner's ability to apply knowledge and skills autonomously and with responsibility.

Upon analysis of the identified needs, it was determined that a job profile of a facilitator achieving EQF level 4 (as defined by Europass – see Table 3) was most suitable for the learning outcomes.

Table 3: EQF level 4 – learning outcomes[2]

KNOWLEDGE	SKILL	RESPONSIBILITY AND AUTHONOMY
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

This is a general description of the job profile of a facilitator as found at Betterteam[3]

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[1] https://europa.eu/europass/en/description-eight-eqf-levels
[2] Right there

[3] https://www.betterteam.com/facilitator-job-description

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Facilitator Job Description

The facilitator should elucidate participants' existing knowledge, prepare pertinent, meaningful training material, and subsequently steer discussions thereof. The facilitator should also monitor participants' performance to discern potential learning-related challenges within the cohort.

Invariably, a superb facilitator will skilfully traverse the line between facilitating and teaching, contingent on the subject matter.

Facilitator Responsibilities

- Highlighting needs pertaining to capacity development.
- Perceiving which requirements are amenable to facilitation.
- Pinpointing existing programs or formulating bespoke courses for use.
- Selecting accompanying test materials.
- Encouraging respect for ideas voiced during facilitation.
- Steering conversations about the learning material.
- Extracting varied insights from participants.
- Administering and reviewing progress on assessments.
- Tracking and conveying attendees' engagement to applicable figureheads.

Facilitator Requirements

- High school diploma.
- Completion of a recognised facilitators program.
- Accredited qualification in a pertinent stream.
- Demonstrable and relevant facilitation experience.
- Capacity to formulate relevant, memorable curriculums.
- Knowledgeable routine assessment and moderation operations.
- Ability to drive critical, student-led dialogs about learning material.
- Excellent verbal and written communication skills.
- Respectful, astute, and accommodating.

For the purpose of bionic transformation, a modified profile is suggested:

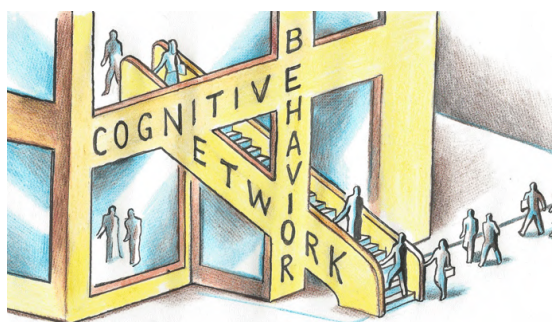**Bionic Transformation Facilitator**

Image 5: Illustration by David Suter[4]

The facilitator should elucidate participants' existing knowledge, prepare pertinent, meaningful training material, and steer discussions of implementing the following technologies: Robotics, 3D printing and custom manufacturing, Cloud services, Augmented and virtual reality, and Big Data.

The facilitator should exhibit zeal and confidence in order to bolster attendees' participation. Invariably, a superb facilitator will skilfully traverse the line between facilitating and teaching, contingent on the subject matter.

Facilitator Responsibilities

- Highlighting needs pertaining to capacity development.
- Perceiving which requirements are amenable to facilitation.
- Pinpointing existing programs or formulating bespoke courses for use.
- Encouraging respect for ideas voiced during facilitation.
- Steering conversations about the learning material.
- Extracting varied insights from participants.
- Administering and reviewing progress on assessments.

Facilitator Requirements

- Competences in preparation of digital strategies,
- Competences to expand the mindset of company management,
- Base knowledge about technologies considered to be the drivers of Industry 4.0, with special emphasis on Robotics, 3D printing and custom manufacturing, Cloud services, Augmented and virtual reality, and Big Data.
- Creative and solution-oriented mindset.
- Potent verbal and written communication skills.

Based on the selected EQF level and the activities foreseen for the BT Facilitator, the following sets of Learning Outcomes have been identified.

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[4] https://www.strategy-business.com/article/The-Bionic-Company

3.1. I4.0 technologies

KNOWLEDGE	SKILLS	COMPETENCES
Have knowledge about the fundamental bionic transformation.	Distinguish the main steps of BT methodologies, identify specific barriers and impact.	Autonomous ability to develop a strategy for bionic transformation.
Have an overview of all 9 technologies considered to be drivers of bionic transformation.	Basic understanding of technologies and theoretical knowledge to present added value of technologies for SMEs.	Autonomous ability to present a roadmap for transformation of an SME by hypothetical implementation of any of these technologies.
Have the basic knowledge about I4.0 technologies: 3D printing and custom manufacturing, Robotics, Cloud services, Augmented and virtual reality, Big Data.	Recognise potential for implementation of I4.0 technologies in SMEs to initiate bionic transformation.	Autonomous ability to present the benefits of implementing any or several of these technologies.

3.2. Soft skills for BT

KNOWLEDGE	SKILLS	COMPETENCES
Understand the benefits of effective communication and pitching of BT benefits.	Explain the benefits derived from applying technologies I.40 to stakeholders.	Ability to pitch BT and instruct stakeholders on how it can benefit their businesses on different levels.
Have knowledge about entrepreneurial mindset, strategies of design thinking,	Ability to develop an entrepreneurial mindset and identify the most appropriate	Autonomous ability to apply entrepreneurial mindset, strategies of design thinking, strategy for digitalisation and

strategy for digitalisation and methods of co-creation.	strategies of design thinking, strategy for digitalisation and methods of co-creation.	methods of co-creation for the formulation of innovative solutions in BT.
Have knowledge about models of collaboration to facilitate inter-companies' teamwork, brainstorming and decision-making.	Ability to identify most appropriate models of collaboration.	Autonomous ability to organise and efficiently manage inter-companies' teamwork.

3.3. BT Management

KNOWLEDGE	SKILLS	COMPETENCES
Understand the benefits deriving from effective application of system-thinking.	Apply successful system-thinking approach.	Autonomous ability to carry out systematic analysis.
Have knowledge about available platforms for implementation of I4.0 technologies and subjects of support environment that can help in the process of bionic transformation.	Ability to identify most appropriate platforms and subjects of support environment for bionic transformation.	Independently conduct cross-sectorial and multi stakeholders' analysis by using BT platforms.
Have theoretical knowledge about EU funding programmes, schemes, and relevant national entities.	Ability to identify appropriate financial incentives and funding opportunities on the EU level and relevant national entities.	Autonomous ability to inform about relevant financial opportunities and to evaluate outsourcing for legal and financial advice.

KNOWLEDGE	SKILLS	COMPETENCES
Have knowledge of how BT is applied in practice (know of good practices of Bionic transformation).	Ability to identify applied BT principles and methodologies.	Ability to autonomously plan BT projects based on real cases.
Have the knowledge to prepare the plan for a bionic transformation of a company.	Ability to prepare the analysis of a company to identify their path towards the bionic transformation.	Ability to implement the bionic change within a company.

Each outcome will correspond to specific learning units, which will be defined in different terms (objective, pedagogical approach, duration, assessment methodology and ECVET).

Learning units will be gathered together in the following 4 different Modules, therefore building up the GIST Training Path:

1. **I4.0 technologies**, a module encompassing basic knowledge around Industrial Symbiosis, including history, concepts of industrial ecology and symbiosis, legal framework, key barriers, and advantages. A more detailed description of the role of industrial facilitator will be provided.
2. **Soft skills for BT**, a module providing a detailed explanation of the circularity of resources with three major focuses on waste materials, water resources and energy.
3. **BT Management**, a module providing a step-by-step managerial approach to IS implementation via data collection, resource flow analysis, available circular economy and IS platforms. It includes an overview on the financial opportunities in order to finally build a sustainable business model.
4. **BT Case Studies**, a module providing a concrete view on successful cases of industrial symbiosis. Each unit focuses on different approaches adopted: territorial, industrial park and company.

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4. Harmonisation with the European Qualification Framework (EQF) and European Credit System for Vocational Education and Training (ECVET)

4.1. What is EQF?

The European Qualifications Framework (EQF) is a common European reference framework whose purpose is to make qualifications more readable and understandable across different countries and systems.

For the purpose of the GIST project learning outputs and training path, the EQF level 4 was agreed upon within the partnership, already described in Table 3: EQF *level 4 – learning outcomes*. A comparison to the national frameworks will be provided in the Training path document.

An overview among the partner countries EQF and NQF is included in Annex I and Annex II.

4.2. What is ECVET?

ECVET allows learners to accumulate, transfer and use their learning in units as these units are achieved. This enables building a qualification at learners' own pace from learning outcomes acquired in formal, non-formal and informal contexts, in their own country and abroad. The system is based on units of learning outcomes as part of qualifications that can be assessed and validated.

The amount of ECVET points allocated to a learning unit depends on the time needed to acquire the learning outcomes in the specific unit and relevance of the learning outcomes within the particular unit. Based on the assumptions of the ECVET Secretariat and several national authorities, ECVET credits are assigned on a system of 1 ECVET = 25 hours of total learning.

For the purpose of GIST project, the entire training course will be worth between 4 and 5 ECVET points. A further overview will be provided in the Training path document.

5. Further recommendations

To ensure that the Learning Outputs are defined according to the needs and expectations of the stakeholders, this following document should be validated by the respondents, who have participated in the survey.

The Learning outputs will be validated if at least 20% of participants, who have participated in the survey, provide feedback on this document, and all the relevant comments (if any) are included in the document.

Image 6: Technology (source: www.pixabay.com)

ANNEX I: Comparison of EQF and NQF

EU level	Belgium	Croatia	Germany	Poland	Slovenia	Spain
EQF 4	NQF 4 Upper secondary general education school leaving certificate (Algemeen Secundair Onderwijs – ASO) Upper secondary technical education school leaving certificate (Technisch Secundair Onderwijs – TSO) Upper secondary artistic education leaving certificate (Kunstsecundair Onderwijs – KSO) / Certificate of a specialisation year (7th year) in upper secondary vocational education (BSO) Adult education Professional qualifications	NQF 4.2 Upper secondary general education school leaving certificate (gimnazijsko srednjoškolsko obrazovanje) Upper secondary VET certificate – four years / Upper secondary VET certificate – five years (četverogodišnje i petogodišnje strukovno srednjoškolsko obrazovanje) NQF 4.1 Upper secondary VET – three years (trogodišnje strukovno obrazovanje)	NQF (DQR) Upper secondary general education school leaving certificate (Allgemeine Hochschulreife (AHR)) Qualification entitling holder to study particular subjects at a higher education institution (Fachgebundene Hochschulreife (FgbHR)) Qualification entitling holder to study at a university of applied sciences (Fachhochschulreife (FHR)) Dual VET (three-year and three-and-a-half-year training courses) Full-time vocational school (regulated under Länder law) (Berufsfachschule) Full vocational qualification (full-time vocational school) (Berufsfachschule)	NQF 4 Maturity certificate (Matura) (Świadectwo dojrzałości) Certificate of professional competence in the profession (Dyplom potwierdzający kwalifikacje zawodowe/Dyplom zawodowy*) Certificate of professional qualification in the profession (Świadectwo potwierdzające kwalifikację w zawodzie/Certyfikat kwalifikacji zawodowej*) Non-statutory qualifications Regulated qualifications	NQF 5 Vocational matura certificate (Secondary technical education, four years) (Spričevalo o poklicni mature) General matura certificate (Spričevalo o splošni mature) Master craftsman's examination certificate (Spričevalo o opravljenem mojstrskem izpitu) Foreman's examination certificate (Spričevalo o opravljenem delovodskem izpitu) Managerial examination certificate (Spričevalo o opravljenem poslovodskem izpitu) NVQ certificate (level 5) Certificate of supplementary qualification (SQF level 5) NQF 4 Final examination certificate (Secondary vocational education, three years) (Spričevalo o zaključnem izpitu, Srednja poklicna izobrazba) NVQ (level 4) Certificate of supplementary qualification (SQF level 4)	NQF level 4 Level 4A includes programmes with academic and vocational validity leading to qualifications at Level 5. access to education at Level 5: -Bachelor's degree. -Vocational Training Technician Diploma. -Professional Music Education Technician Diploma. -Diploma of Technician in Professional Dance Education. -Plastic Arts and Design Technician Diploma. -Sports Technician Diploma. Level 4B includes programmes with professional validity and no academic value, which do not allow access to Level 5: Certificate of Professionalism Level 2. Level 4C includes programmes with academic and vocational validity for the completion of which it is required to hold an The Level 4C includes programmes with academic and professional validity which require the possession of a Level 4A qualification: Specialisation Courses in Vocational Training of the educational system.

Annex II: Comparable job profiles to BT facilitator

Country	Similar existing profile	Description	National qualification level – equivalent to the EQF 4
Belgium	Production manager	Planning, coordinating and controlling the different phases in the production process and directing one or more production teams to guarantee a smooth course of this production process, and to monitor the well-being of the employees	EQ5
Croatia	Mini MBA Leadership 4.0 programme Digital transformation and disruptive business models	The goal is to provide participants with insight into business skills and knowledge needed for personal development, and to provide direction through the challenges of dynamic change brought by the dramatic development of the digital age. Students learn about the features and concepts of digital transformation; learn to assess trends, identify opportunities and adopt the processes of digital business transformation that are necessary to operate in today's market.	Mini MBA certificate 120 ECTS credits
Germany	Digitalisation manager	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.	DQR 4
Poland	Production organization technician	Preparation of documentation on the conduct of planning works, production management (within the systems: Lean Manufacturing	Certificate of professional qualification in the profession
Slovenia	Manufacturing team leader	Interdisciplinary educational activities/outcomes, mainly engineering, production technologies and construction	Certificate of supplementary qualification (SQF level 5)
Spain	Agile Coach	A professional who is in charge of implementing the "Agile philosophy" in an organisation, regardless of the stage of digital transformation it is in. The Agile Coach can even be part of a traditional company, since its function is to transform it into an Agile organisation. In this way, the Agile Coach guides the change in the way the team works in order to improve the results of the company and to facilitate the cultural transformation.	Certificate of supplementary qualification (NQF level 4). Educational programme with academic and professional validity.