Ideation of the transnational joint curricula

Talentjourney Report 2.3

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AI – Artificial Intelligence

AR – Augmented Reality

Cedefop – European Centre for the Development of Vocational Training

CLIL – Content and Language Integrated Learning

CoVE – Centres of Vocational Excellence

CVET – Continuing vocational education and training

ECVET – European Credit System for Vocational and Education Training

EDUFI – Finnish National Agency for Education

EHEA – European Higher Education Area

EQAVET – European Quality Assurance in Vocational Education and Training

EQF – European Qualifications Framework

ESCO – European Skills, Competences and Occupations

EU – European Union

IeFP – Finnish Ministry of Labour's and the regions' and autonomous provinces' remit

IOT/IIOT – Internet of Things/Industrial Internet of Things

IVET – Initial vocational education and training

OECD – Organization for Economic Co-operation and Development

OREF – Observatoire Régional Emploi Formation

POF – Training Offer Plan (for VET schools in Italy)

RRSP – Regional Directory of Professional

SMEs – Small Medium Enterprises

SSCs – Sector Skills Councils

STEM – Science, Technology, Engineering, Mathematics

TEL – Technology Enhanced Learning

VET – Vocational Education Training

VR – Virtual Reality

WBL – Work-based learning

1.0 Introduction

The main goal of this report is to develop the idea and concept of the joint transnational vocational curricula Industry 4.0/IIOT in smart manufacturing that will be implemented in the four pilot countries of the project's partnership – Slovenia, Italy, Finland and Estonia.

The Talentjourney transnational joint curricula developed within the project partnership will ultimately be used as a catalyst to roll out the concept across the EU vocational education and training (VET) system. The EU manufacturing industry skills shortages are well documented in the Talentjourney report 2.1 on skills gaps in Industry 4.0/IIOT in smart manufacturing. Forecasts of smart manufacturing Industry 4.0/IIOT future skills challenges are similarly defined by industry as an anticipated barrier to success during interviews and questionnaires within Talentjourney. There are several reasons for this, all with regional variations, as set out in report 2.1. However, a common theme is industrial digitalisation or Industry 4.0/IIOT, as it is changing industry's requirements of a future skills base and shifting the nature of smart manufacturing work and job roles.

"It has been made clear from the previous Talentjourney study report 2.1 that the rapid pace of technological change demands more modular and flexible training curricula that can be used to upskill and reskill the existing workforce, in addition to full-time learners within the VET system."

The transnational joint curricula development undertaken by the Talentjourney partnership with a variety of relevant stakeholders to produce highly modularised courses, organised with a responsive teacher training system, will ensure that innovative content and pedagogy can adjust to changes in skills needs for Industry 4.0/IIOT in smart manufacturing.

In addition, there are two sub-goals of the report:
- Identify which knowledge/skills/competences will be included in designing the transnational sector-wide vocational curricula so as to deliver the learners the excellence.
- Identify which knowledge/skills/competences will be included in life-long trainings at the regional level, according to the regional labour market needs and at international level, the specialised trainings that are needed globally.

The result will be a framework (idea/concept) for transnational Industry 4.0/IIOT in smart manufacturing transnational joint curricula consisting of the following parts:
- Ideation of transnational Industry 4.0/IIOT (in smart manufacturing) vocational curricula
- Indicators that are crucial for the excellence of joint curricula
- Reasons for entering into joint curricula collaboration
- Added value and wider relevance of the intended learning outcomes
- Inclusion in the involved partners' strategy and internationalization policy
- Assurance of involved partners' support (strategic and practical) and flexibility
- National and institutional/employers' regulations of involved partners regarding implementation of joint curricula
- Involved partners' strategic commitment, mutual trust (through open communication and a shared understanding)
- Considering (draft planning) budgeting for implementation
- A clear definition of target learners
- Benefits for the main end users: learners, VET teachers/tutors, company trainers, employers, other stakeholders.

An additional result will be identified knowledge/skills/competences that will be included in designing the transnational sector-wide vocational curricula and life-long trainings.

1.1 Introduction to Design Thinking in VET

The digital explosion of the 21st century has brought great emphasis of Design Thinking, which has had significant impact on the EU Industrial economies. Design Thinking is now prevalent across many industrial sectors, often working hand in hand with technological advancement. New digital technologies/IIOT are giving rise to new varieties of products and services which in turn are putting new pressures on businesses and society. Design Thinking is now often used to determine solutions to increasingly complex problems which are diverse. Design Thinking is also changing the way businesses operate. At present, Design Thinking informs the strategies of major organisations and is being used to create innovative services, address societal issues, and even shape better public operations and policy making.

In addressing the skills challenges faced by the manufacturing sector in its transition towards Industry 4.0/IIOT and its associated connected devices, Talentjourney will consider a completely new approach to a VET educational service design and provision. For this purpose, Talentjourney will embrace a Design

Thinking methodology applied to VET. Design Thinking is a human-centred approach to innovation, allowing a rapid understanding and adaption to learners' needs.

Design Thinking is a solution-based approach used for practical and creative problem-solving. Design Thinking aims to generate and develop innovative ideas and solutions. This is much required in the modern technologically based environment, such as manufacturing, so it should also be in an educational environment. It is based heavily on the procedures and processes that designers use in industry, hence the name, but it has actually evolved from a range of different sectors—including architecture, engineering and business.

Design Thinking carries many potential benefits when applied within the scope of Talentjourney. First, by accounting for their needs, it can support Generation Z in approaching the labour markets and the smart manufacturing industry. Secondly, Design Thinking can help in shaping innovative educational curricula capable to cope with constantly changing industrial skills requirements due to technological advances and uncertainties. Thirdly, in an educational setting, Design Thinking can provide learners with an adequate toolkit to approach the workplace, including the latest technological competences that incorporate the essential meta skills. Design Thinking will assure the user-centricity and, ultimately, the sustainability of the Talentjourney transnational joint curricula and platform.

A strong element of Design Thinking is creativity. According to the early studies on Design Thinking[1], drivers of creativity are the following: problem sensitivity (inquiry and questioning), fluency of new ideas, flexibility, originality in combining separated ideas, daring, enthusiasm and creative confidence. Design Thinking has been further defined by adding a requirement in terms of adaption to the environment[2]. Rittel[3], by defining the term "wicked problem", set the stage for notion of Design Thinking, which should be applied whenever a problem "is difficult or impossible to solve because of incomplete, contradictory, and changing requirements that are often difficult to recognise". From the 90s, thanks to the work of Buchanan[4], Design Thinking has been associated with the notion of innovation and started to be applied in industrial management context in order to design services and products. Indeed, according to Tim Brown, the CEO of IDEO, Design Thinking is capable to define a viable business strategy in order to create customers value. Hence, this last definition introduced the element of human-centricity in Design Thinking.

Design Thinking possesses the right features to be applied in an educational context. Design Thinking is essentially human-centred, multidisciplinary, collaborative (co-creation), constructive, optimistic and experimental[5]. It has the potential to improve the learning experience and training provision. The School of Design Thinking in Potsdam and Stanford University have been the first to provide teaching by successfully adopting the notion of Design Thinking. This will be much required soon given the necessity to adapt the

VET curricula to a new generation's needs and expectations, and the necessity to integrate meta skills in order to easily adapt to new environments, such as smart manufacturing, with all of the influences of Industry 4.0/IIOT.

1.2 Solution Finding vs Problem Solving

Design Thinking is a solution-based approach to problems; hence it focuses on finding solutions rather than solving problems. Solution finding is considered a more practical approach when working within human complex systems (such as leadership, management, communication, etc.) compared to problem solving.

As an illustration, when working with machines, the focus is on the problem because this is easily identifiable. Hence, problem solving technique is applied. After the problem is identified, alternatives are considered, evaluated and selected, then solutions are implemented. For example, a machinery component can be replaced, more resources added, or an adjustment can be made to fix the problem.

On the other hand, when considering human complex systems, the problem is not always easy to identify. The complex interactions within such systems make decision making more difficult. Hence, the focus should be to identify solutions to make the system functioning properly. To summarise, focusing on the problem makes expert in what is wrong; but, on the other hand, focusing on the solution makes expert in what is right[6].

1.3 Design Thinking Process - applied in the context of Industry 4.0/IIOT

The process of Design Thinking described below can shape an educational curriculum capable to satisfy current and future skills needs in smart manufacturing, indeed could be considered beyond this particularly to other sectors that are affected by Industry 4.0/IIOT:

- *Observing and understanding*. The first step is to search the problem and observe its context. It also involved developing an understanding of humans' needs by showing empathy.
- *Synthesis.* All the information collected in the first step must be analysed and filtered.
- *Ideation*. It is the crucial step of Design Thinking. By the adoption of various ideation techniques, ideas are generated, shaped and amplified.
- *Prototyping*. This step refers to making ideas concrete and tangible. The goal is to share the idea in order to test it and to create a viable solution to the initial problem.
- *Testing*. This step aims to receive feedback from experts and end users in order to improve the idea. Inputs from users are considered fundamental to achieve a human-centred approach and solutions.
- *Refine*. Here, the feedback received in testing is considered to further improve the proposition – it is a highly iterative process.
- *Launch*. This step is about implementing/delivering the proposition and properly measuring and monitoring its success.

An alternative approach, similar to the one above, can be considered having the following steps: discovery of problem, interpretation, ideation, experimentation and evolution. Each step involves similar tasks with the first approach.

1.4 Ideation and its Role in the Design Thinking Process

Ideation is the third stage of the Design Thinking process. Ideation is the creative stage for generating, developing and communicating new ideas, where an idea is understood as a basic element of thought that can be either visual, written, concrete or abstract. Ideation comprises all stages of a thought cycle, from idea conception to real-world application and implementation.

To maximise the outcome of the ideation process, some guidelines should be followed. For instance, ideas are reverse engineered to fit emergent problems. It is thus critically important to initially clearly define the problem and understand its key underlying factors. Ideation should follow a human-centred approach as

well. This means understanding humans' needs and providing adequate solutions benefitting end users. For instance, in the context of Talentjourney, it would be necessary to identify barriers in current learning methods and shortcomings in the curriculum in order to seek innovative solutions to construct co-creational educational provision. It is vital for these barriers to be identified from the learner perspective in order to assure user-centricity and thus the longevity of the Talentjourney joint curricula and platform.

Many problems require both creative and pragmatic approaches to cultivating viable solutions. Hence, the ideation process is conducted through sessions such as Sketching, Prototyping, Brainstorming, Worst Possible Idea, and a wealth of other ideation techniques.

This can be conducted through online forums, seminars, team-building exercises, surveys, and social media platforms. These instruments allow to collaborate in collecting ideas. They should invite open, unrestricted and unencumbered dialogue, creating a safe space for flows of ideas. Each idea from each participant should be embraced with enthusiasm, without judgment, and treated with fairness and open-mindedness. This collaborative stage should lead to the choice of one prevailing idea that is commonly accepted as the most promising in undertaking future actions. When this idea is chosen, the Design Thinking process can continue with prototyping and testing.

There are different styles of ideation. First, ''problem-solution'' refers to an individual identifying a problem that he or she subsequently solves. Second, ''derivative-idea'' involves making improvements to an existing idea. Third, ''symbiotic-ideas'' are a collision of several incomplete ideas that combine to create a fully baked, holistic idea.

1.5 Design Thinking use in VET

When Report D-Think[7] compared their quantified results from the literature review in the search for relevant articles about Design Thinking applied in education with the ones obtained in the search for Design Thinking applied in training/VET education, a very different reality was observed. In the conducted research, very few peer-reviewed publications were found about Design Thinking applied in Training. In total, five publications with relevant interest were identified. After verification, D-Think found it clear that even those publications applied the word Training as a substitute for the development of skills and competencies in Design Thinking, and thus not directly addressing it as a methodology applied in vocational education training. Recommendations advised there was a need to improve the training/learning process suggesting the use of innovative methodologies.

The report of D-Think went further to indicate that Design Thinking has the potential of being a successful tool in this context, but it is not yet being applied. There was no research found of any case studies about that subject reported in peer-reviewed publications. This demonstrates that there is an unrestricted area of study to explore for the Talentjourney project, using the Design Thinking methodology in the specific development of curriculum creation in the VET context.

1.5.1 Talentjourney Design Thinking Workshop

Further on Design Thinking methodology in the specific development of curriculum creation in the VET context, PARK GmbH, a Talentjourney partner based in Germany, hosted a virtual Design Thinking workshop on the 12th of November 2020. The aim of the workshop was to prepare the leadership, as one of the key actors of VET creators, for system transformation into a user-oriented system, and to be able to respond to the challenges of the modern society and economy, behaviours of new generations, and at the same time became co-creators of the Talentjourney Platform for VET excellence.

For the establishment and sustainability of Talentjourney, one of the crucial factors was to train the key actors among which the partnership considers to be VET providers and company leadership, to understand why the changes are necessary, to be able to design and support new educational/training processes and to be able to deliver curricula with knowledge flows and according to new era economy and society demands by introducing new approaches, ways and methodologies into educational/training processes towards VET excellence. Of course, it must be mentioned that the Talentjourney partnership—although diverse in experience and fields— do not represent the entire ecosystem, especially in regards to policy; for example, representation from local authorities, ministries, NGO (i.e. 3rd sector organisations), funding bodies, etc. should be addressed on another level to assure successful rollout and sustainability of the platform.

This being said, VET leadership were challenged to put themselves in the shoes of the learner throughout the full-day Design Thinking workshop in an effort to address the previously identified seven key challenges of learners in using the digital platform, outlined on the following page.

Figure 1: Challenges for users of the Talentjourney Platform (from the perspective of the learners)

Talentjourney challenges

1 **Discover your talent!**
How to establish a VET system that will help the learner to discover what are they good at, what are their potentials and help them develop their talents/potentials?

2 **Co-ownership of the learning process**
How to establish and introduce into the system the co-ownership of learners?

3 **Better insight for learners on labour market and education offers**
How to provide learners a holistic overview of education offers and the labour market to help them make an informed decision for their future?

4 **Problem-solving-oriented learning and teaching processes**
How to design educational processes that provide learners the capability to solve everyday challenges in private life as well as at work?

5 **Establishing a culture of life-long learning**
How to advocate and facilitate pathways for learners to upskill soft and hard skills throughout their lives for an economy in constant change?

6 **From delivering content to guiding learners**
How to provide and assess a support system to the teacher in order to ensure they can properly guide learners in their journey?

7 **Holistic perspective of the industry**
How to provide learners deep knowledge and competencies while ensuring they can navigate the many different areas in the CDS/IoT in Smart Manufacturing industry?

In the context of Design Thinking workshops for the development of the transnational Talentjourney joint curricula, group members assessed each other on co-creation, iteration, prototyping and validation. They also challenged each other on relevancy for region and management and leadership application. Finally, group members assessed outcomes on the quality level of Talentjourney acceleration. Design Thinking plays a vital role in ensuring long-term rollout of the joint curricula and platform, ensuring user-centricity at its core.

Finally, workshops within the Talentjourney projects—such as the ''Designing Talentjourney regional stakeholder ecosystem workshop'', which took place within the Talentjourney project at the Nova Gorcia School Center premises in Slovenia—were all designed with Design Thinking concepts and co-creation in mind. The ''Designing Talentjourney regional stakeholder ecosystem workshop'' co-creation workshop, for example, involved Slovenian stakeholders such as VET and company leadership, teachers, school management and learners, with the specific goals of designing the contents, implementation process and piloting one part of the transnational vocational curricula and life-long trainings. By engaging target stakeholders on all levels, the co-creation workshop was able to implement design thinking methodologies in the design and implementation planning of a user-centred joint curriculum and platform.

Figure 2: The Design Thinking Talentjourney "Designing Talentjourney regional stakeholder ecosystem workshop" with Slovenian stakeholders

2.0 Inclusion

2.1 Partners strategies how to include curricula in existing strategy

In a questionnaire targeting the transnational Talentjourney partnership, VET institutions were asked how they intend to integrate the Talentjourney joint curricula into their institutions' strategies/policies. Each school was required to describe how is it going to plan its implementation, which must take into account structuring long-term collaboration, e.g., each learner has the possibility to attend international courses, work-based learning (WBL), etc. each year in at least one module. Partners were also prompted to comment on how they were going to plan sustainable international collaboration regarding learners, tutors, digital collaboration, and so on.

As an illustration, the Šolski center Nova Gorica (Nova Gorica School Centre) in Slovenia has laid out a detailed strategy for including the Talentjourney joint curricula existing strategies. They intend to include the joint curricula implementation in all their official documents, including their: international strategy, development plan, yearly plans of schools and teachers, yearly plan of higher VET and yearly plan of Intercompany training centre. The implementation for EQF 4 will be, at the beginning of the joint curricula rollout, possible only in the frame of 20% of open curricula, since Šolski center Nova Gorica is a public school, and the curriculum is determined by the "Expert council of RS". For EQF 5 (higher VET), is much easier to alter the curriculum because the legislation to implement international joint curricula was adopted in 2016. The Šolski center Nova Gorica notes that they must be aware that they will no longer be able to teach everything (content on a large scale), so it is better to focus on the basics; in other words, ''the foundations, without going too far in detail''. From investigation, it is understood that many of the Talentjourney partners have restrictions in respect to implementing joint curricula due to national rules and regulations. However, as Talentjourney progresses, it is anticipated that more flexibility will be offered.

The 20% of flexibility regarding curricula design represents the lack of autonomy of Slovenian VET institutions in curricula development; this is a restriction and could be investigated by the emergence of regional stakeholder groups that demonstrate the ultimate benefits of the joint curriculum.

The Šolski center Kranj (Kranj School Centre) in Slovenia has already a formed council in which there are representatives of approximately twenty key companies. They have the interest and possibility to involve partners' strategies and internationalisation policies in development of the joint curriculum. This goal is already a part of the centre's strategy for internationalisation. In addition, involved partners' strategic commitment and mutual trust in establishing a sustainable joint curriculum (which requires sustainable data collection) has been written out in a memorandum, or cooperation agreement, for Talentjourney pilot partners. As pointed out by the Šolski center Kranj, the very signing of the agreement is binding, and continuous communication and ongoing evaluation and monitoring of the joint curriculum (i.e., sustainable data collection) will be required. Outlined in this memorandum will be the implementation of the curriculum, the responsibilities and tasks of the partners (i.e., school, company), funding, responsibilities and tasks of the learner. In such an agreement, it is also necessary to write what the responsibilities and possibilities are when the process does not go according to plan, e.g., the Covid-19 pandemic.

Representatives from Tallinn Polytechnic School, an Estonian VET institution, expect to receive input from different partners and adapt it based on local law and needs as much as possible. They hope to receive a better understanding of partners' local strategies within the project and take the best part of it to make curricula even more competitive. Further, senior management representatives of the Italian I.S.I.S. A. Malignani VET school have stated that if they are to implement a joint curriculum with international partners, they consider it a priority to ensure they are aligned on the objectives and that they are conscious of the respective differences by partner country, which are to be integrated effectively for successful outcomes. Flexibility of the joint curricula is considered to be fundamental. In all participating VET institutions' cases, flexibility of the joint curricula is absolutely vital, taking into account the national and institutional/employers' regulations regarding implementation of joint curricula.

Representatives from the Finnish organisation, SAMK Oy, are able to include the joint curriculum in the open curriculum and work-based learning (WBL) and implement it as an extracurricular activity. They plan to finance the training of teachers and students on WBL from Erasmus+ projects, and they intend to include the joint curriculum modules in the open curriculum. In this case, the module is integrated into the curriculum of the programme and is funded by the state—in the Finnish case, the Ministry of Education, Science and Sport. Modules of the joint curriculum could also be implemented as extracurricular activities – here, funding is on the side of the individual and the school. SAMK will also obtain a mentor from a local company to implement the joint curriculum. Companies will be actively involved in the implementation, especially in the preparation of practical tasks and learning situations. SAMK envisions the joint curriculum to be a team effort by the students on projects that will be prepared and selected in cooperation between the school and the company. The task of teachers is mentoring; thus, students become more independent in the process.

ECIPA S.C.a R.L., the Service and Training Agency of CNA Nordest (Confederation of SMEs and Craftsmen, covering three regions in North East Italy: Veneto, Friuli Venezia Giulia and Trentino Alto Adige), is not a VET institution; however, ECIPA is open to possibilities of: a) developing the network of Talentjourney platform users and contributors; and b) further expanding the platform itself after the "testing phase", which will be performed during this project, and to keep it alive and updated through future international collaborations and partnerships. The establishment of a partnership with close ties to industry that will benefit from the implementation of a joint curriculum after the project lifetime allows for the sustainability of the data collection (from continuous access to platform users and contributors). Furthermore, ECIPA may not be a VET provider as such, but they have suggested that the Talentjourney joint curriculum as part of Talentjourney digital platform for VET excellence could be included in their strategies, so long as emphasis is put on using virtual learning environments and digital tools to allow flexibility in learning/training/teaching, ultimately allowing the learner to grow professionally. ECIPA is open to discussion about this with VET providers that are part of the partnership, as representatives from ECIPA understand that it would be important to link it to existing initiatives to ensure they are recognised and sustainable. Also, the establishment with links with the other CoVEs would be fundamental in the sustainability of data collection and the Talentjourney platform.

Talentjourney partners (VET institutions) were also prompted to national regulations that could hinder the joint curricula implementation. ECIPA (Italy) reported that regulations depend mostly on what is considered as VET in Italy. That is to say, there are different regulations according to the definition of VET put in place. In Italy, the term ''VET'' tends should, technically speaking, be ''reserved'' for programmes primarily under the Ministry of Labour's and the regions' and autonomous provinces' remit (IeFP), while technical and vocational school programmes are considered to be part of the ''educational system'' under the Ministry of Education's remit.

Italian VET provision also offers opportunities in adult education (Section 2.7) and CVT. Regulations, therefore, differ. This lack of autonomy, as in Slovenia, poses a restriction to the Talentjourney joint curriculum and platform that must be addresses in further ideation and realisation of the platform. Furthermore, in Italy, regional VET institutions have been very heterogeneous in the past. To address this issue, the Italian State-Regions Conference agreed on minimum education and training standards, which are valid at the national level. These are linked to national occupational profiles and the corresponding qualifications and programmes included in the qualifications register created in 2011. Such a distinction helped to make the wide variety of VET managed by the regions more transparent and more flexible, allowing learners to switch between different types of VET and from general education to VET – and vice versa.

For what concerns schools, on the other hand, since 2000, even though they are part of the national school system, Italian schools have had their own administrative, didactic and organisational autonomy. Each school has its own Training Offer Plan (POF), which represents the school's educational and educational action plan. On the basis of autonomy, educational institutions can modify the annual hours of teaching disciplines/subjects for a share equal to 20%, as in Slovenia. This 20% allows schools to compensate between teaching disciplines, i.e., fewer hours in a discipline are balanced with hours assigned to another discipline, or the introduction of a new study discipline. The certificate awarded at the end of technical and vocational school programmes mentions the branch and length of the studies, the final marks, the points assigned through 'school credit', the points assigned through training credits and the additional points given by the examination board (if applicable), the subjects included in the curriculum and the total number of teaching hours dedicated to each subject. The certification models are drawn up by the Ministry of Education (MIUR). Diplomas and certificates are written in four dialects so that they can be understood in the different Member States in Italy. For what concerns Continued Training and Adult Learning, regulations differ in the context of: training provided and financed by the private sector; CVET for skills upgrade or new qualifications financed by regions and/or joint inter professional funds; IVET (initial vocational education and training, post-secondary) offered by regions; adult education for compulsory and upper secondary certificates – CPIA). Again, Talentjourney has provided evidence that increased autonomy would allow for acceleration of the joint curricula concept, and that limited autonomy poses a risk for successful implementation.

It is important to note that some governing bodies across the Talentjourney partnership are also restrictive, and Talentjourney would of course lobby to allow for benefits for the joint curriculum.

Participating Talentjourney partners have suggested electing a person from their institution to handle such interactions to ensure the successful rollout of the joint curriculum and platform for VET excellence.

2.2 Internationalisation policies of Talentjourney partners

According to research conducted within Talentjourney by PARK GmbH, there were some significant findings regarding internationalisation, mobility, collaboration and economy. These key findings related to the Talentjourney pilot countries have been extracted from their report. Each region raised different topics that together, helped understand a bit better their international context.

Slovenia attracts some international talent in smart manufacturing, with some international companies and engineers. Along the Italian border, as well as in other areas, there is expressive foreign investment. The current ministry of industry and business seems very open to internationalisation - 1.6% of foreign companies that are incorporated in their business system provide 25% of GDP. It is important to note that usually in more remote regions, human resources can comprise a challenge, with local workforce moving to Ljubljana and abroad due to economic reasons.

Meanwhile, approximately 75% of Estonian export is related to the industrial sector, and a quarter of that is related to the electronics industry; as the local market is small, Estonia is highly dependent on export. Because workforce is progressively becoming expensive, the country cannot compete on cost; therefore, it needs to compete on quality and technology offerings.

Beyond international cooperation on an industry level, Finland has strong international cooperation for mobility and research. Besides that, around 10% of international students in the VET system are people who first come to the country to learn the language and then decide to stay further and fully establish themselves there.

Finally, Italy has different cooperation projects for digital transformation/innovation hubs on an EU level, with the intent to improve and strengthen their EU-wide ecosystem and influence smart specialisation strategies considering market needs. They have collaborations on the fields of digital transformation, sustainable tools, energy efficiency (smart building). Internationalisation and mobility still have space to grow in VET.

In terms of planning a sustainable international collaboration regarding learners, tutors, digital collaboration, and so on, the Šolski center Nova Gorica intends to offer international modules, in addition to the Talentjourney joint curriculum in Slovenian, that will be implemented in the frame of mobility, work-based learning or online courses. The teachers of the Šolski center Nova Gorica have reported seeing no obstacles to perform the modules in English. The plan will need to be carried out by the following team: the Director of Šolski center Nova Gorica (ŠCNG), headmasters of ERŠ and higher VET, involved teachers, mobility coordinator(s), the Head of Intercompany Training Centre and representatives of involved companies (this may change from year to year or join more companies every year).

The situation is different in Italy. In regard to teaching in English language in Italy, a key component to a VET institution's internationalisation policy is Content and Language Integrated Learning (CLIL). It is a methodology that provides for the teaching of content in a foreign language. In Italy, schools of all types and levels have initiated pilots for conveying contents in a foreign language, based on didactic autonomy.

The teaching of a subject in a foreign language is compulsory in the final year of high schools and technical institutes. However, the Italian Talentjourney VET institutions have no concrete data to say how much this is indeed happening – and it must be noted, as pointed out by the Italian Talentjourney partners, that the general level of knowledge of English in Italy is currently not very high.

Within the scope of this report, a questionnaire to the senior management of VET institutions was distributed across the Talentjourney joint curricula pilot countries (SL, IT, FI, EE). Representatives from senior management of VET were asked how they would ensure inclusion in the involved partners' strategy—specifically the *internationalisation policy* for the joint curriculum developed within Talentjourney. Representatives from the Tallinn Polytechnic School in Estonia expect to get input from different partners and adapt it based on local laws and needs as much as possible. They hope to receive a better understanding of partners' strategies within the project and extract meaningful and applicable aspects of such to make curricula even more competitive.

3.0 Regulations relating to Talentjourney partners

When ideating a joint curriculum to be piloted in four countries across Europe, it is of course necessary to provide country-specific and even regional context. Building upon limitations in Talentjourney partners that have already been highlighted in this report, it is important to identify early on any national regulations that could hinder the joint curricula implementation—or even some that could support such implementation that have not been taken advantage of thus far.

3.1 VET curricula

The findings of Talentjourney research within this scope, overseen by PARK GmbH, have been extracted and written out below. Each region/country has their own mechanisms for schools to adapt their curricula to industry needs and to innovate, with varying degrees of freedom.

In Slovenia, 80% of the curricula is tied to the national base, while the other 20% is open curricula. In the open curricula each school can provide the needs of the local industry according to their own wishes. Although it takes around 5 years (depending on the urgency and the needs) for the national base curricula to be reviewed, schools are allowed to review their open curricula more often.

In Estonia, through strong collaboration with the company, IPC, which is an association connecting and supporting electronics industries, VET providers can use their resources to offer trainings and certifications

to the industry. This helps them respond to industry needs in their standard VET education. In Estonia, there is also the "Kutseõppeasutuse seadus", or the Vocational Education Institutions Act, that addresses autonomy in VET curricula development. The Vocational Education Institutions Act provides the bases for the establishment, maintenance, transfer, reorganisation and termination of activities of a vocational education institution, such as the right to conduct studies, management, organisation of studies, state training orders and financing, school functions, school family rights and obligations and state supervision over school activities.

The Finnish educational policy is characterised by the decentralisation in decision-making. Although VET providers need to follow a national core curriculum, they have considerable freedom to focus education and training according to local and regional needs.

3.2 Industry (focus on Industry 4.0/IIOT in smart manufacturing)

Although there are similarities regarding challenges and needs concerning Industry 4.0/IIOT (in smart manufacturing), each region has their own history, focus and maturity level. These findings have been extracted by a supporting Talentjourney report conducted by PARK GmbH.

In Slovenia, industry is rapidly developing, although a considerable part of it is composed of suppliers for other EU industries, such as the German automotive industry. However, the country is also trying to take the lead with their own organisations, large (e.g.: Gorenje, Adria Mobil) and SMEs (there are a lot of small entrepreneurs who try to find a niche in the market). The development of Industry 4.0/IIOT (in smart manufacturing) in Slovenia is mostly led by large companies or small local producers, highly specialised and advanced.

Italy has a diverse industry. The region of Veneto is very industrialised and known to be highly entrepreneurial, with big organisations and also several micro and SMEs, either operating on a more traditional industry (focusing on "made in Italy" products) or on a highly innovative one (start-ups). Taking into consideration the local culture and needs, the industry is putting efforts in undertaking digital transformation and implementing automation where possible.

Estonia is an industrialised country highly dependent on export. Their stakeholders in industries such as IT, industrial engineering, and electronics are very well-connected, and trying to move towards an alignment with IPC standards. Estonia can be characterised by having strong industrial IT solutions offerings; small, specialised companies using AI and automation; and a very advanced forestry industry with modern machinery.

Finally, Finnish companies in the region of Satakunta operate in subcontracting chains and in the international market. Internationalisation is a priority for the country, and they focus on developing strong international connections (with countries such as China, for example). Although they are relevant players in the industry, they could still have more international recognition.

3.3 National regulations of Talentjourney partners

Furthering on the subchapter 3.1 on VET curricula policies on the national level, this section will illustrate the complexity of regional and national regulation in the Talentjourney pilot regions. Occupations in the traditional sense no longer follow the dynamics of the labour market. Instead, they express the complexity of the tasks that workers are required to perform, something that is constantly changing in the labour sphere. The document that serves as a basis for the development of different pathways to qualification is known as the occupational standard.

The Slovenian VET system relies on occupational standards, which have the intention of responding rapidly to the requirements of the labour market and the modern ways of organising work in enterprises and small business activities. The occupational standards involve progressive employers from the industrial sectors and entities from small business/service sectors. By considering development trends in the sectors in question, they define current occupational standards and help with the early identification of needs for new qualifications.

On a national level, occupational standards are approved by sectoral committees, which are made up of recognised experts appointed by the minister responsible for labour at the proposal of trade chambers, professional associations employers' associations, trade unions, non-profit organizations and other competent ministers. The presence of the representatives of enterprises and other social partners on sectoral committees for occupational standards is important to ensure transparent, up-to-date and high-quality qualification structure in a variety of professional fields.

Sectoral committees propose the preparation of an occupational standard and appoint a group a working group of recognised experts for this task. The sectoral committee examines the draft occupational standard, draws up a proposal to accept or reject them and submits an opinion to the national Expert Council for VET. It is a social partnership structure and includes representatives of trade chambers, employers, trade unions and ministries.

The preparation of the occupational standard begins with the preparation of an occupational profile, which includes:

- analysis of work processes,
- detailed description of jobs and tasks covered by the occupational profile,
- study and confirmation of the occupational profile against a representative sample of enterprises.

Key activities in the structure of preparation of occupational standard are:

- preparation of the technical knowledge and skills necessary to perform the jobs and tasks defined in the occupational profile,
- formulation of competences in the occupational standards that are given in the form of actual abilities to master a wide range of tasks in various professional environments,
- determination of the level of difficulty of jobs covered by the occupational standard and
- preparation of rationales for the occupational standard for the processes of their adoption by the sectoral committee and the national Expert Council for VET.

Based on the adopted professional standard, a group of experts prepares a proposal for an educational program. In the context of Talentjourney, work conducted surrounding skills need research in the manufacturing sector focused on Industry 4.0/IIOT in smart manufacturing could be used to form such an occupational standard – this should be considered when further developments are made with respect to the transnational joint curricula.

In Slovenia, the VET educational programme includes a modular structure of the professional part of the syllabus. The minimum number of hours of practical work of the modules and the scope of practical training with work at employers are determined. The proposal of the educational programme is approved by the expert council for vocational and professional education of the Republic of Slovenia. Once the educational programme is adopted by the professional council, schools can start implementing it.

About 20% of the national education programme is the so-called open curriculum, which is not unambiguously defined, but is determined by each individual school in cooperation with employers in its local environment. In the open curriculum, the school itself designs the modules and determines the competencies and goals of these open curriculum modules. An open curriculum is the element of an educational programme that allows for rapid adaptation to the labour market, as the whole procedure of preparing new educational programs is a lengthy process that finds it difficult to achieve a rapid pace of change.

The Slovenian Ministry of Education, Science and Sport lays down general rules and common principles for the education and training system. The state therefore lays down general rules and lays down the basic principles of education and has legislative power over vocational and technical education. With the transition of VET towards COVE, 20% appears not to be much independence from the prescribed curricula. It would be encouraged to hopefully have integrated members of the occupational standards group into the Talentjourney ecosystem, thus providing the opportunity for greater autonomy for centres to provide innovative vocational, education and training opportunities through the development of CoVEs.

In Italy, the "regional repertoires of professions / professional qualifications'' differ per region. The Veneto Region, for example, has launched a series of actions to introduce a set of rules useful for guaranteeing skills identification, validation and certification services since 2009. Among the operational tools introduced by the Veneto Region in 2015 was the Regional Directory of Professional Standards (RRSP). The directory contains 261 professional profiles belonging to 24 professional economic sectors and serves as a dynamic tool that can be adapted to include new professional profiles that emerge from the continuously evolving Veneto labour market. As of May 2020, the Veneto Region has redefined the procedure for updating the RRSP with the aim of making the qualifications "usable"—through facilitating the matching of supply and demand of the labour market and making the training credit system viable. This in turn enhances the skills acquired by the person, linking the programming of the training offer to the world of work, favouring the processes of identifying the skills acquired in non-formal and informal learning paths, and, finally, allowing the construction of assessment tests of learning for the purpose of validating and certifying the skills acquired.

The Italian context in terms of VET is characterised by the presence of multiple institutional players at national and regional levels, in addition to the relevant role of the social partners. Title V of the Constitution provides for ownership either by the State, the regions or mechanisms for cooperation between the different institutions, in relation to the type of training supply:

- The State establishes general rules and determines the fundamental principles of education.
- The regions have legislative power over VET.
- Education falls under the scope of concomitant legislation, except for the autonomy of education institutions.

To conclude this illustration in terms of internationalisation policies of Talentjourney partners, in Italy, each regional qualification is correlated with the European Qualification Framework (EQF) through a grid divided into levels, which correspond to more or less complex learning outcomes. At the moment, it appears that there is no specific regulation for accreditation of transnational, joint VET curricula at EQF 4 and 5 levels in Italy. A more defined regulation can be found at a higher educational levels[8], i.e., at the university level (within the European Higher Education Are - EHEA). This also depends on the fact that VET in Italy is characterised by multilevel governance, with broad involvement of national, regional and local stakeholders. Ministries of education and labour lay down general rules and common principles for the education and training system, but regions and autonomous provinces are in charge of VET programmes and most apprenticeship-type schemes.

Examining and adapting to the Finnish national regulations in relation to VET is also necessary to ensure the implementation of the Talentjourney joint curricula. Finland's educational policy objective is to guarantee equal educational opportunities for each individual. The aim is that everyone will complete at least a secondary level qualification. Around half of the students completing their basic education continue to VET and half to general upper secondary education; some students will carry this out as double degree, which combines VET (*ammattikoulu*) and upper secondary school (*lukio*). Nevertheless, these are significant figures. Finnish vocational education and training is competence-based and customer-oriented. Students are assessed and credited for previously acquired competence and only acquire the missing competence during their studies. This point is valuable in terms of Talentjourney and asks the question if there should be credit provided for the transnational joint curricula; this would not be done in the pilot phase but rather should be considered for future transnational joint curricula.

International cooperation and mobility are encouraged in all of the Finnish vocational education and training centres. This is done both at home within the qualifications and through international mobility, which is quite popular in Finland with every seventh student in initial VET spending some time abroad as a part of their studies; hence the Talentjourney is a feasible initiative for the Finnish system. The aim of international mobility and cooperation is to enhance the competitiveness and quality of the Finnish

working life, education and training and to develop students' personal skills and outlooks from a global perspective – all of the attributes that Talentjourney aspires to implement.

The Finnish system is based on trust and shared responsibility. The Finnish Parliament decides on the legislation and the annual budget allocations to VET, and the government decides on the development of VET in the Government Programme. The government also makes decisions on the structure of vocational qualifications. The Ministry of Education and Culture prepares legislation related to VET and steers, regulates, finances and monitors the industry. The Finnish National Agency for Education (EDUFI) prepares the national qualification requirements for vocational qualifications and preparatory education and training for VET. The EDUFI also develops education and training through funding projects, increases the productivity of education and supports internationalisation of the Finnish society; hence it is suggested that bodies like this are regionally/transnationally connected to the Talentjourney, as their objectives can be clearly met through Talentjourney.

The Finnish VET funding system rewards providers for their outcomes, efficiency and effectiveness of their activities. This method is interesting to Talentjourney and has been discussed further in the Talentjourney report 2.2 on sustainability of data collection.

The vocational education system in Estonia is regulated by the Vocational Educational Institutions Act, which provides: the basis for the establishment, maintenance, transfer, reorganisation and closure of vocational educational institutions; the basis for the right to provide instruction, management, organisation of studies, state-commissioned education and financing; the rights and obligations of members of schools; and state supervision over the activities of schools.

The status of the curriculum at a given qualification level is determined by the positioning of the curricular professional standards within the Estonian Qualifications Framework – which has been verified as the same as EQF. Professional standards that serve as the benchmarks of vocational education are positioned between levels two to five, meaning that vocational training stages are differentiated between levels two, three, four and five. With this levelling system, it has been observed that the transnational joint curricula should be easily integrated into the Estonian framework. Furthermore, the joint curricula could also be easily provided with credit, which would be such an advantage for learners.

It has been interested to note that level 5 vocational training, also known as specialised vocational training, was established in Estonia during the 2013-2014 academic year; there was no equivalent level of vocational training available previously. This finding may suggest that conclusions made previously in Talentjourney reports recommending that smart manufacturing skills are one level higher are vindicated.

National curricula are drafted in co-operation with social partners and by making allowances for pertinent professional standards, vocational education standards and the national curriculum for upper secondary schools. It is very interesting that social partners are used in the drafting of national curricula, this should be considered for the Talentjourney ecosystem.

School curricula are compiled for every individual vocation or profession that can be acquired at the school. The schools' formal study curricula (excluding vocational secondary education curricula) are compiled based on vocational education standards and associated vocational standards. In cases where no vocational standards exist, the schools must apply for recognition of the curricula by social partners. Talentjourney should be aware of this, as it appears that some formal arrangement is required in the implementation of the transnational joint curricula, unless the social partners become part of a transnational Talentjourney ecosystem. A very relevant part of the Estonian vocational education system is the prerequisite for beginning studies under continuing training within the system. Students need the same qualification level or the corresponding competencies and level of education, essentially you cannot continue unless you are progressing through the levels. Continuing vocational training takes place only in level 4 and 5 of vocational training, in Estonia.

Workplace based studies constitute a specialised form of vocational education where the ratio of practical assignments undertaken in companies or institutions encompasses at least two thirds of the curriculum. The student achieves the learning outcomes described in the curriculum by fulfilling working tasks at the company. The remainder of the studies will be undertaken at school.

Workplace based studies are conducted upon signing an intern contract between the school, student and employee, which stipulates the rights and obligations of parties as well as the exact details of the learning process. The employee has to recompense the student for tasks performed to the amount agreed upon in the intern contract. The number of students is growing, and in January 2018, already 1700 students study in vocational education institutions were under workplace study arrangements. Expanding workplace-based study form in Estonia is one of main goals for vocational education training system in 2020.

3.4 Talentjourney Regional Employers' Regulations

When surveyed within the context of this report, companies were asked if they were aware of relevant national and institutional/employers' regulations of involved Talentjourney partners regarding implementation of joint curricula. All companies surveyed responded that they were completely unaware of any relevant national and institutional/employers' regulations of involved Talentjourney partners regarding implementation of joint curricula.

When surveyed within the context of this report, companies were asked to elaborate upon how they envisage a joint curriculum that would most effectively prepare vocational education and training students to work in their companies. Representatives from the company Sermatech Oy in Finland have provided that basic knowledge and know-how coming from the vocational education is needed; many training projects are coming from the companies themselves, and it is important these projects are extracted from real-world delivery projects, simplified suitably to fit the curriculum phase. Teaching basic programming skills at schools in courses which have been developed in collaboration with our company is a suggestion from another Finnish company, Dyme Solutions Oy. After this, they added, would be a 3–6-month internship period, in which the taught techniques are used in real programming projects.

From ELSI di Zappone Giovanni in Italy, base curriculum should be on up-to-date knowledge and target it to research of innovation projects. A representative from Brovedani Group in Italy has offered that based on their background and education in mechanics, they strongly suggest that VET should focus on mechatronic teaching subjects, AI and software development. Seminars, in-company trainings and workshops were suggested by EURO 2000 SRL, a company from Italy.

Although user-centricity in the case of the Talentjourney joint curriculum and platform refers mainly to the learner, it is absolutely vital to integrate the needs of industry leaders into the ideation of the joint curriculum and platform to assure long-term rollout and success of the Talentjourney concept. Therefore, the abovementioned ideas should be accounted for in the design of the joint curriculum and platform.

4.0 The flexibility of Talentjourney project partners in providing a strategic approach

The Talentjourney partnership is a combined effort with the same vision to "Design a collaborating and engaging ecosystem where everyone can grow into a satisfied person and successful professional" inside

smart manufacturing, focused on Industry 4.0/IIOT in smart manufacturing. All partners work in collaboration with manufacturing sector and majority of partners work and develop together common strategies for a longer period of time. VET providers bring together in the selected sector various reach expertise and the best examples needed for Talentjourney: for example, by offering capacity and excellence in establishing very cooperative networks and partnerships with stakeholders at different levels, or by introducing innovative approaches in VET provision to foster innovation. The goal of Talentjourney is also to transform VET into human-centred experience, offering social communities and workspace to provide expertise on technology trends, innovations and industry-specific insights, and providing life-long training to minder the skills in Industry 4.0+ online courses. Modern, well-equipped labs and international experience in VET provision support this aim to support learners in becoming industry- and workplace-ready in fields related to Industry 4.0/IIOT in smart manufacturing.

Šolski center Nova Gorica (Slovenia) takes the lead on Talentjourney project management. The main objective of the project management work package is to ensure the successful realisation of the project goals on time within the limits defined by the financial framework and quality standards. Šolski center Nova Gorica oversees the administrative and financial management, and it will ensure financial and technical coordination and managing, project planning and evaluation of the project progress.

In addition, the Slovenian VET institutions of Šolski center Kranj, Šolski center Velenje and Center Republike Slovenije za poklicno izobraževanje (CPI) offer valuable input for the development of the skills in IIOT/smart manufacturing reports—as well as the Talentjourney curricula and platform—bringing new skills in curricula framework, contacting peers in EU, organising national focus groups and interviewing/completing questionnaires. Supplying some perspective from Estonia is Tallinn Polytechnic School, a professional VET centre that offers their experience and active support in the designing the Platform for VET excellence, developing and testing transnational Industry 4.0/IIOT vocational curricula and life-long learnings, professional development for modern VET teachers, VET leadership and in-company trainers/company experts. The Italian VET institution, I.S.I.S. A. Malignani, is a school that provides scientific, technical, vocational education to learners ages 14-19 as well as adult learners to develop employability skills in meaningful contexts, allowing students to be as competitive as possible on a constantly changing labour market. I.S.I.S. A. Malignani provides the Italian context in the development of Talentjourney reports, curricula and platform. The expertise of senior management and VET instructors of these VET institutions serves as vital data to be fed into the various Talentjourney outputs, including this report on sustainable data collection methodology.

Furthermore, SAMK (Finland) is the lead for the work package on professional development for modern VET teachers, VET leadership and company trainers/experts. SAMK provides experts and developers, uses new learning methods to foster innovation among learners, trainers, in the companies and promotes

internationality, entrepreneurship and expertise in automation, robotics and artificial intelligence. For the establishment and sustainability of Talentjourney, one of the crucial factors is to train the key actors (VET teachers and company trainers/experts as tutors and VET providers' leadership) to be able to understand why the changes are necessary. With support of the partners, SAMK will design and support new educational/training processes and to be able to deliver curricula with knowledge flows and according to new era economy and society demands by introducing new approaches, ways and methodologies into educational/training processes- towards the excellence.

Within the Talentjourney project, SATAEDU (Finland) is overseeing the transnational vocational curricula and life-long trainings in the manufacturing sector with the special focus on Industry 4.0/IIOT in smart manufacturing that provides user oriented, user friendly and eco-friendly solutions. SATAEDU has experience in training young people for more than 20 professions, enhancing professional competence for adults and offering tailored training events for entrepreneurs and enterprises. Therefore, they will manage designing and implementing the transnational Industry 4.0/IIOT smart manufacturing vocational curricula/joint curricula as well as life-long trainings that will be implemented in the countries of the project's partnership in line with EQF and informed by ESCO, applying ECVET and principles of EQAVET.

The service blueprint for "Platform for Industry 4.0/IIOT VET excellence" at the regional and EU level will be overseen by PARK GmbH (Germany), a design company that enables organisations to build actionable service strategies and new services, finetunes and boosts the performance of existing services and helps organisations align themselves around their customers' needs. A significant benefit PARK brings to the Talentjourney consortium is their stakeholder network, e.g., LEGO group, Adria, BMW, Mars, etc. PARK has also extensive experience in education through their digital educational spin-off, Grow – the world market leader in educating/developing designers into leaders.

Collaboration with industry is absolutely vital in the establishment of excellence in VET in the field of Industry 4.0/IIOT in smart manufacturing that provides user oriented, user friendly and eco-friendly solutions and becomes as such a world example for the excellence in that field. Within the Talentjourney project, ECIPA (Italy), adds value to the strategic partnership, for example, as the organisation deals with training, networking with SMEs and business studies in order to foster innovation and business competitiveness of SMEs regionally, nationally and internationally – it is the Service and Training Agency of CAN, which is the regional representative of National Confederation of Craftsmen and SMEs with more than 30,000 SMEs. The Estonian Electronics Industries Association (Estonia), on the other hand, promotes cooperation between member companies, and VET schools to increase competitiveness of Estonian electronics industry – the association represents interests of 60 members and the sector to government bodies. This combination of industry experts and VET providers and teachers will ensure that the joint curricula established by Talentjourney will set the stage for excellence in VET for smart manufacturing.

MAHLE is a large company involved in the Talentjourney project that is actively involved in research on job related skills, research about the influence of new era society on working people, the development of a sustainable "Platform ecosystem" and network for tutors, and the development and testing of transnational curricula and life-long trainings for professional development of in-company trainers and other company experts.

Finally, the lead for the research on skills need research in the manufacturing sector, focused on Industry 4.0/IIOT in smart manufacturing, that provide user-oriented, user-friendly and eco-friendly solutions is the European Institute for Innovation–Technology (EIfI-Tech), based in Germany. The EIfI-Tech manages the delivery of project work programmes working in partnership with national/EU agencies, learning institutions, the private sector and people – the so called "Quadruple Helix". Through its broad networks, EIfI-Tech is currently used to build up regional connections to early-stage business proposals in RIS3 sectors. The reports produced on Industry 4.0/IIOT in smart manufacturing provide the main basis for establishing and designing the Talentjourney Platform for Industry 4.0/IIOT in smart manufacturing VET excellence, as in-depth research on the skills needed in the manufacturing sector with the special focus Industry 4.0/IIOT in smart manufacturing is needed.

4.1 Strategic commitment

The Talentjourney project partnership has the goal of realising their strategies together with their regional stakeholders, ultimately benefiting end users. The consortium has produced many common results in different projects' cooperation and initiatives. The consortium will build on the following outcomes of previous collaboration: innovative work-based learning and innovative pedagogy; continuous professional training for VET teachers; company trainers and VET/company leadership; improving start-up and business incubator opportunities and bringing them to innovation in smart manufacturing; spreading and deepening stakeholder partnerships regional/international to engage more active in VET; digitalisation of teaching and learning processes; sharing equipment and data collection on skills needs and supply; and developing transnational curricula and trainings in selected sectors and implementing them by means of virtual environment or Erasmus+ mobility. Next to project lead coordinator and lead partners of work packages, each partner is responsible to fulfil obligations and achieve results as a common success.

To bring our Talentjourney Platform of Industry 4.0/IIOT (in smart manufacturing) VET excellence and its ecosystems to the sustainable, most efficient and world known network of expertise, each partner is responsible to collaborate, which is clearly laid out in the project application.

4.2 Collaborative trust

In a questionnaire to VET institutions within the Talentjourney partnership, representatives from VET senior management were asked how they intend to assure strategic commitment and mutual trust within the design, development and implementation of the Talentjourney joint curricula. Responses from VET senior management ranged from showing support for your team members, even when they make mistakes, balancing the need for results with being considerate of others and their feelings and working hard to win over people by being respectful of their ideas and perspectives.

VET senior management from across Talentjourney partner countries agreed that a detailed work plan with clear tasks, directions and deadlines is fundamental; at the moment, it is not really possible to plan activities ahead and determine how big the workload ahead is going to be, as there isn't a shared and clear work plan—or in other words, there is currently no clear transnational strategy or approach for the implementation of the joint curricula. Finally, as strong involvement is expected from external stakeholders, VET senior management representatives all agreed that external stakeholders need to be well informed about the advantage of their participation in the development and the implementation of the joint curricula and have them commit to dedicating time to project activities and the joint curricula rollout beyond the project lifetime.

VET senior management representatives of the Šolski center Kranj in Slovenia mentioned in their questionnaire responses that open communication and a shared understanding and mutual trust should be listed in the cooperation agreement (e.g., Memorandum of Understanding, or MoU). The very signing of such an agreement should be binding. Continuous communication and ongoing evaluation and monitoring of the joint curriculum will be required. In such an agreement, it is also necessary to write what the responsibilities and possibilities are when the process does not go according to plan, i.e., the Covid-19 epidemic.

However, it must be noted that when Talentjourney partners were asked if they intend to introduce some new organisational models for the leadership of the involved Talentjourney partners to enable and support such commitment and trust, responses were very limited. All participating partner representatives responded that they have yet to propose such organisational or business models, even though such a proposal was recognised to be eventually necessary. It is therefore recommended within this report that such organisational planning take place immediately. Such responses might imply that Talentjourney partners themselves lack mutual understanding and trust, which shall be addressed and overcome in future Talentjourney work. Such responses could also be explained by Talentjourney partners' explanations of if signing a ''Memorandum of Understanding'' (MoU) is enough to assure the commitment.

It must be understood that an MoU is not a legally binding agreement, but it is an official document to signify an agreement in the form of *memorandum*—to define and express involved partners' strategic commitment for implementation of the common services. The document will include agreements of Talentjourney partners to participate in the delivery of the joint curriculum and platform and will be elaborated upon through a service blueprints design.

Nearly all Talentjourney partners agreed that merely signing an MoU is not enough to assure successful implementation of the joint curriculum and platform. Success also depends on how much the partners trust each other, which the entire partnership agreed upon in a series of questionnaires. One participating Talentjourney partner added that this all depends on the workload foreseen, which in turn depends on the development of the platform and its services (at the moment, this is still not clearly defined). If the workload is going to be solid, "good will" won't be enough: a clear and detailed strategy on how to proceed after the Talentjourney project lifespan will be necessary. The MoU is not an insurance for commitment; the commitment will only take place if the joint curriculum will actually be an answer to the market needs and it will be able to provide professionals who will be able to fill the existing gaps.

Figure 4: Signing a Memorandum of Understanding

Do you think that signing Memorandum of understanding is enough to assure the commitment?
5 responses

Legend:
- Yes
- No
- Depending on how much the partners trust each other. It is very good to have another legally more binding document (contract).
- Not clear what is meant by this question. Is it a Memorandum of understanding between us partners to commit ourselves to contribute to TalentJourn…
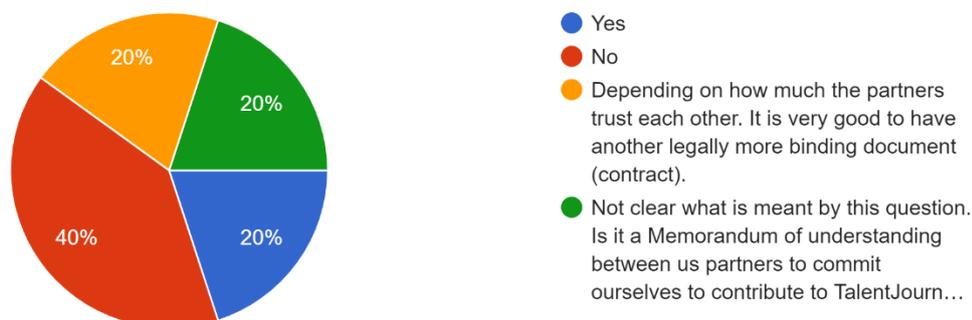
4.2.1 Sustainability of Talentjourney

Talentjourney partners need to recognise the importance of maintaining effective communication with all parts of the Talentjourney ecosystem to provide clarity, maintain trust, sustain commitment and motivation and allay any anxiety. It is recommended that the following are implemented.

- Ensure all communications within the Talentjourney ecosystem are inclusive, honest and timely, employing effective and pervasive media

- Provide effective communication mechanisms to enable partner and stakeholders to contribute to constructive suggestions for service improvements and engage in effective consultation

- Implement a model of shared governance to accommodate the Talentjourney transnational joint curricula collaborative arrangements.

The sustainability of Talentjourney should be taken very seriously. This report found that much of the activity of the project is driven by funding incentives. Given some responses in the research conducted there is often a danger that the collaborative activity ceases when the initial funding and/or initiative ends; therefore, partners require to find an economical model upon which to structure Talentjourney decisively. While funding is important for Talentjourney to commence collaborative activity and the development of the transnational joint curricula, the challenge is to establish a sustainable relationship and associated systems that will endure over the long term, beyond EU funding initiatives and policy drives that initiated the Talentjourney. It is important to create a cost-effective, sustainable structure focused on the transnational joint curricula. It is recommended that a Talentjourney transnational steering group is established that meets regularly to drive forward the development process, giving direction to working groups that will be formed in each Talentjourney pilot partner location to review progress against agreed KPIs.

5.0 Identified needs of regional, national and global labour markets

The high demand for STEM skills is reflected in a relatively low unemployment rate (2% in 2013, around 400,000 unemployed people) and in a relatively strong wage premium and wage growth. In the period between 2013 and 2025, CEDEFOP has estimated to be 3.4 million job openings in the field of STEM, respectively 1 million new jobs and 2.4 million replacements for the retiring workforce[9].

Accounting for this increasing demand and for the large share of retiring workforce, in order to avoid a future skills shortage, the number of STEM graduates will need to increase, at least at the current annual growth rate of 3.8%[9]. As an example, the supply of ICT specialists cannot keep pace with demand: it is estimated that there will be over 500,000 unfilled vacancies for ICT professionals by 2020[10]. In parallel, the mobility of young graduates should be encouraged across EU Member States.

Figure 5: ICT Specialist Jobs and Demand in EU (2016-2020 Projected Forecast)[10]
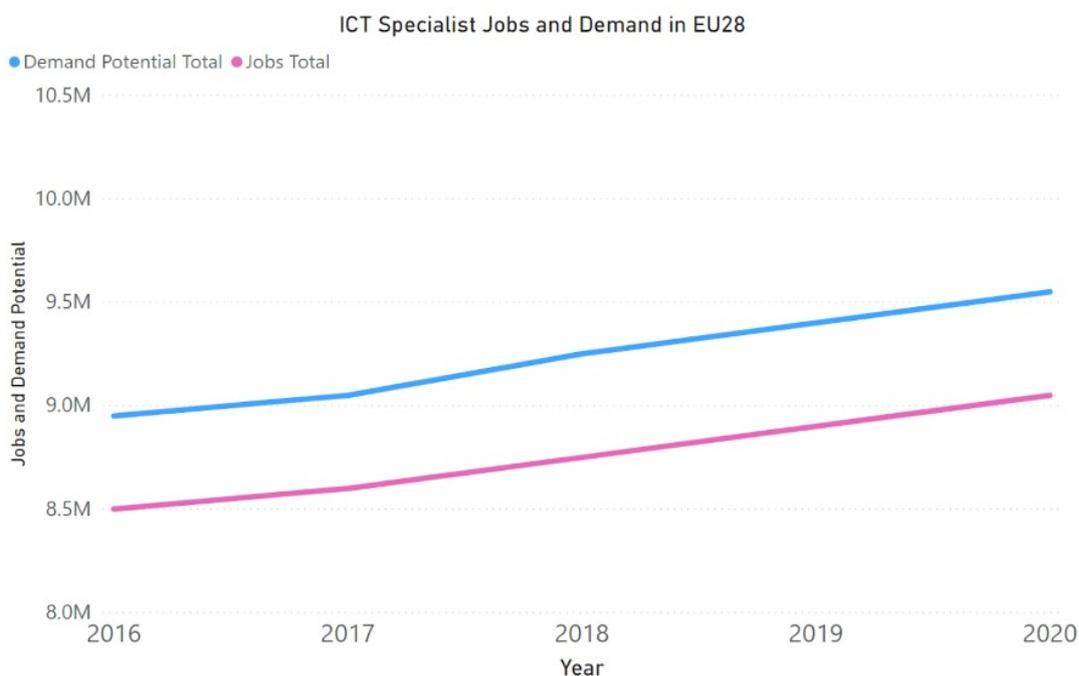
As exhibited by the figure above, the demand potential of ICT specialist jobs in the EU has increased by approximately 6% between 2016 and 2020[10]. To illustrate, if this steadily increasing growth rate were to persist – not to mention, increase – roughly half a million new job positions within the ICT sector are needed to be fulfilled each year, moving forward.

Some projections are optimistic, even expecting oversupply of STEM skills. However, due to a high level of uncertainties and labour market heterogeneities, skills shortages are not excluded for specific STEM profiles or for specific regions in the EU[11]. In order to address skills shortage, private businesses have an important role in structuring educational training/curricula and in increasing the attractiveness of STEM job opportunities.

5.1 Are employers filling the skills gaps?

It was found from investigation that employers from the five participating Talentjourney countries that do fund and arrange trainings for their employees provide different types of training, over different skills levels and for different stages of employees' careers. Nearly three-quarters of employers interviewed as part of this report organised health and safety training for members of staff. Just under one-third of employers offered training to supervisors and managers, with approximately the same percentage organising supervisor training. These figures indicate that much of the training being done is providing employees with the skills to do their current roles effectively and safely, rather than necessarily providing training to develop beyond their role. To encourage employers to adopt a higher-skill business model, it important to persuade businesses that investing in employees' skills beyond the needs of their current role can yield dividends in productivity, and success, particularly in smart manufacturing and similar fast-changing industrial environments. Anecdotal evidence through discussion with employees found that some businesses had a highly skilled workforce, but their skills were clearly not being utilised effectively. Encouraging and enabling employers to fully utilise their employees' skills and allowing roles to grow/improve with employees' skill levels are crucial to better connecting increasing skills levels to increasing career progression and productivity. From literature and interviews the majority of employers that do not provide training believe their workforce do not need additional training, with most being isolated from the education and skills development. Considering the role of the skills system in each of the partners countries identified clear gaps, particularly for mid-career provision, and clear overlaps within and between schools, VET institutions and universities.

Indeed, in order to shape "demand-led" skills development systems, businesses must be more proactive in this process by articulating and communicating their current and future skills needs to VET providers. For instance, companies should work closely with VET providers in developing, iterating and validating pilot curricula.

Simultaneously, educational institutions need to adopt effective skills anticipation systems, providing accurate and real-time labour market intelligence[12]. Often companies are not capable of articulating their skills needs—for example, in relation to green skills. Hence, VET providers must take the lead in skills development systems in order to be capable to provide those skills at the time industry realises this demand[13].

However, this is still not enough. Businesses, together with vocational education training (VET) providers, need to deliver attractive STEM learning experiences to attract young people by clearly communicating benefits and rewards—such as scholarships, wage premium, wage growth, career pathways, job security, etc. Increasing those benefits—for instance, allowing flexibility—and introducing STEM subjects at secondary school level could help in increasing awareness around the industry. Indeed, the general low level of understanding surrounding career opportunities in the field of STEM, together with poor career guidance and communication, are considered major barriers for graduates when considering a career in the field of STEM[14]. A targeted communication strategy and better workforce planning can take advantage of further unexploited talents in demographic groups such as females and migrants[15].

Previous studies highlighted the presence of a talent shortage that is hindering IOT development. This shortage could persist through 2025. This does not exclusively refer to a lack of IOT workforce, but a combination of IOT skills, hence also skills gaps[16].

According to a survey study conducted by the EU Commission[10], IOT skills shortages are most prominent in the areas of business development, strategy making, machine learning, interoperability network engineering, hardware engineering, software and application engineering. The survey respondents indicated critical mismatches between supply and demand for the following occupations: data scientists, software engineers, algorithm developers, programmers, data engineers, data structurers, data architects, data administrators, AI developers, product owners and security specialists. These jobs are considered relevant for frontrunners and developers; hence the above skills shortages could hinder EU industrial innovation and competitiveness[10].

In the realm of Big Data, today the EU is facing a severe skills shortage[17]. Data scientists account for far less than 1% of total employment in most Member States[18]. For instance, in the UK, the demand for big data professionals was expected to increase by 160% between 2013 and 2020, adding 346,000 jobs[19]. The major skills shortages are identified in the activities of programming, system architecture, data analysts, data storing and warehousing[10].

Furthering on the need for data scientists is the current and projected skills gap within the subject of AI, which is supported by the combination of desk research and survey findings of the Talentjourney consortium. During the research period of the Talentjourney project, it was found that several new roles would be required to undertake the transaction towards an IOT/smart manufacturing environment, some of which are set out in the subsequent section.

5.1.1 Skills Provision of Talentjourney

A summary of skills needs, gaps and shortages in Industry 4.0/IIOT in smart manufacturing across Talentjourney partner regions exposed the top six priorities to be included in trainings at the regional, national and international level in the creation and implementation of an EQF level 5 joint curriculum:

- AI/AR
- Cybersecurity
- Robotics engineering
- Production process development
- Data science
- IIOT (EQF level 4)

Although the Talentjourney consortium has selected six modules to be prioritised, it is clear from further desk research that demand from industry requires there to be an increase in the level of VET curricula for smart manufacturing that is currently being offered. Response from industry has also led the Talentjourney partnership to include the final module of IIOT (EQF level 4) as a prerequisite, due to the increasing relevance of IIOT skills/knowledge in the job market.

The seven prioritised Meta Skills required for smart manufacturing across partner regions identified through Talentjourney are:

- Decision making
- Responsibility
- Problem solving / Critical thinking
- Communication
- Curiosity and Creativity
- Emotional intelligence
- Teamwork

Although the Talentjourney consortium has selected seven meta skills to be prioritised, it is clear from further desk research that demand from industry suggests further meta skills should be integrated into an entire curriculum.

5.1.2 T-Skills and Talentjourney

Further, T-shaped skills are an imperative for not only the success of the smart manufacturing sector, but also the EU's competitiveness now and in the future. The Talentjourney approach to necessary T-shaped skills is focused on education and training offers that combine practical skills with specific complementary meta skills, with clear mapping so that useful assessment and analysis of these skills is made possible. As outlined clearly in report 2.1, there are a number of meta skills required for the transition into and future of smart manufacturing, all of which cover a spectrum of vocations and professions. As outlined in the report, these skills—most significantly, responsibility, decision making and problem solving—are required at nearly all levels of smart manufacturing. More specifically, decision making in particular is a meta skill that has been identified within the report as most significant to the fields of engineering management, production process development, cybersecurity, project management, next-gen machine-learning engineers and scrum masters and agility coaches.

The implications of the future of smart manufacturing are that developing STEM skills alone is not the answer—developing STEM skills does serve, however, as the foundation to the future of smart manufacturing, in conjunction with developing the necessary meta skills and attributes. Talentjourney research demonstrated that employer demand is likely to be skewed toward highly specialised employees, limiting the opportunities for educational transfer even within a field such as smart manufacturing. As a caveat, special attention should be paid to the age and level of the learner, as STEM does provide a generic, transferable foundation for those looking to gain entry into the IIOT/smart manufacturing sectors. From a

training perspective, STEM represents too broad a field to guide choice of study and direct labour market entry.

5.1.3 The Co-creation of Talentjourney Skills

A key finding from this report is that technical skills requirements should be co-created with industry with the accompanying STEM/meta skill enhancements coming from Centres of Vocational Excellence (CoVEs), the following necessary Industry 4.0/IIOT in smart manufacturing skills represent the literature and the research findings of the report:

- Skills relevant to researching and developing production technologies
- Skills relevant to researching and developing digital technologies such as electronics, artificial intelligence, coding, IOT design
- Skills relevant to researching and developing cybertechnologies such as digital security and connectivity
- Basic digital technology skills, such as digital user skills, as described by DigComp Framework
- Advanced digital technology skills, such as skills relevant to IT professionals' occupations, as described by the European e-Competence Framework
- Green skills relevant to a low carbon economy, such as upskilling of vocational occupations such as electricians, plumbers, mechanics for the installation of solar photovoltaic/thermal systems, wind and other renewable energy sources (RES) at both micro and macro generation.

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Based on findings from report 2.1 on skills gaps in Industry 4.0/IIOT in smart manufacturing, the five most important green skills required for smart manufacturing across Talentjourney partner region are:

- Lean manufacturing
- Technology and process development for natural resources protection
- Risk management and assessment
- Installation of energy efficiency measures
- Green technology development

The implication of a shortage of IOT/IIOT skills and STEM skills at national, regional and local levels has caused employers and companies to consider appropriate strategies to reach a balance between demand and supply of skills. A combination of desk research and survey findings of the Talentjourney consortium have led to identify the main causes of IOT/IIOT skills gaps in smart manufacturing to be standardised (rather than tailor-made) learning programmes, lack of qualified trainers within VET programmes and larger companies, fast-paced changes in working methods, fast-paced technological changes and lack of strategic direction.

6.0 Defining impact

Centres of Vocational Excellence (CoVEs)[20] are developing into an important component of EU VET policy. During late 2018 and early 2019, an exercise was conducted to delineate CoVEs in terms of their main characteristics, with a view to informing the concept and the development of EU support plans.

Talentjourney will work in the respected triple helix method adopting a "demand-led" approach for skills development. This approach has proved to be not always adequate, in particular in relation to green skills, since businesses are not always aware of their green skills needs. Hence, VET providers often need to take the lead in skills development systems. Because of this, Talentjourney will adopt an approach based on a large collaborative partnership with a variety of stakeholders responsible for policies for regional development, innovation and smart specialisation, taking due consideration of social needs sufficiently, as many policies neglect societal issues[20].

Figure 6: Triple helix relationship of Talentjourney ecosystem actors
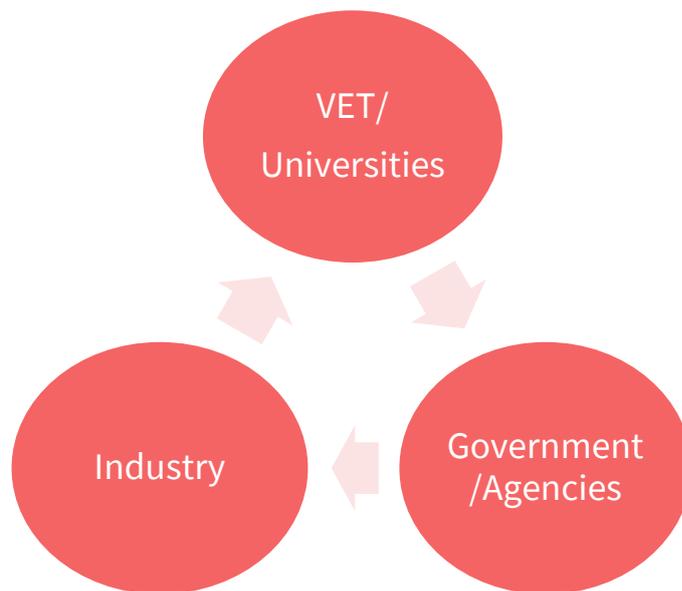
6.1 Indicators for VET excellence

Planning and implementing a successful transnational joint curriculum will depend upon ensuring all within the Talentjourney ecosystem are informed, involved, valued, rewarded and developed within appropriate roles to meet the challenges. Given the ultimate ambitions of Talentjourney effective people and transformation management strategies will therefore need to be deployed to achieve the innovative transnational joint curricula objectives of providing excellence within the curriculum.

Centres of vocational excellence (CoVEs), according to the expectations of the European Commission, can act as:

- engines for vocational training development – beacons for vocational training reform;
- examples of high commitment to change and improvement;
- examples of good partnership between relevant stakeholders.

The European Commission expects CoVEs to focus on eight themes regarding excellency:

- Lifelong learning in vocational education and training – from initial to continuing training and adult education
- Education-business collaboration and cooperation

- Pedagogy and professional development
- Smart specialisation – Mobilising Innovation, ecosystems and SMEs
- Smart specialisation – Mobilising Innovation, ecosystems and SMEs
- Industry 4.0 and digitalisation
- Going green – supporting sustainable goals
- Autonomy and Institutional Development (financing, leadership, governance)
- Social inclusion

It is a recommendation that Talentjourney participating partners permit greater ability to release staff to specialise and take forward key developments and initiatives of Talentjourney, especially with the implementation phase.

6.2 Definition of target learners

The Talentjourney partnership will work with public / private and academic sector partners across the EU to support individuals into training or employment and to help employers to achieve their ambitions within this globally competitive environment. The development of regional stakeholder groups shall ensure there is shared ownership of goals and activities, and a common commitment to achieving them, by pooling and sharing resources. Talentjourney is aware that coordinated networks of similar themes should be explored allowing division of tasks and reduce duplication. Sharing is clearly a benefit of Centres of Vocational Excellence (CoVE) networks that is probably not available to individual VET providers currently.

It is the conclusion from the Talentjourney report on ''Skills Data Collection for Connectivity Devices and Services/IIOT in Smart Manufacturing'', which was based on a combination of a literature review and the analysis of in-depth interviews with relevant stakeholders, that in creating an effective, future-proof curricula, there needs to be collaboration between vital stakeholders – such as VETs, government agencies, universities / research institutions and industry – using innovative co-creation models. To ensure a high quality of skill being produced, there requires an equally high-quality curriculum offering, which provides practical real-life settings that are measurable against competency criteria. It is inevitable that in doing so, there shall be specific adjustments of the VET system according to industrial developments; this work shall be undertaken in a later piece of the Talentjourney work.

Learners are our main users, and our focus why are we establishing Talentjourney. So, they will be included in most activities, since the project focuses on human-/user-centred approach: this remains the case
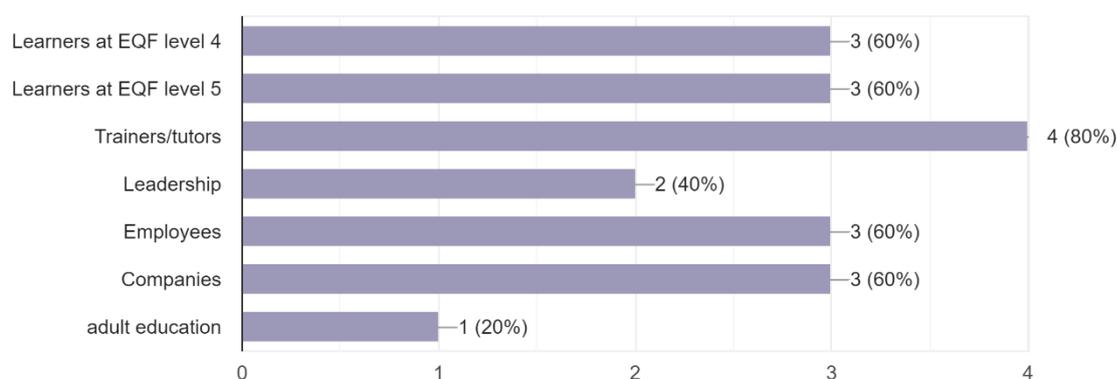
throughout curricula ideation, development, action plans for implementation, testing, prototyping, designing the regional and EU stakeholder ecosystems, dissemination and exploitation activities.

However, as exposed through a questionnaire to all VET institutions within the Talentjourney partnership, the definition of target learners may not be so clear to all Talentjourney partners, demonstrated through Figure 7.

Figure 7: Defining target learners of the Talentjourney joint curricula

For which target of learners do you intend to offer Talentjourney services:
5 responses

Target	Count (%)
Learners at EQF level 4	3 (60%)
Learners at EQF level 5	3 (60%)
Trainers/tutors	4 (80%)
Leadership	2 (40%)
Employees	3 (60%)
Companies	3 (60%)
adult education	1 (20%)

Deciding on a clear definition of the target learners for Talentjourney is therefore highly important prior to the further development of the joint curricula.

Talentjourney will be one of the mechanisms to support development and innovation in the manufacturing sector, focused on Connectivity devices and services (IOT in smart manufacturing). For that purpose, we established the project partnership, inside of which all partners' main preoccupation is manufacturing sector, especially in the form of smart manufacturing. We united the best partners with the best expertise in the field of manufacturing, as well as in Industry 4.0/IIOT (in smart manufacturing) specifics. They are the best and most relevant stakeholders (in collaboration with all our regional stakeholders) to be able to establish our Platform.

To support national and EU policy in providing initiatives for better responsiveness of VET, Talentjourney has engaged regional, national and EU level stakeholders.

I.   Targets on local / regional level are:

Individual users:
- learner, VET teacher/tutor
- company trainer/expert
- researcher
- leadership
- HR staff

Other stakeholders as organisations:
- VET providers,
- Companies and SMEs,
- chambers/associations,
- centres and universities etc.

II.   Targets on national level:

Individual users:
- learners, VET teacher/tutor
- company trainer/expert
- researcher
- leadership
- HR staff

Other stakeholders as organisations:
- relevant EU associations (EUproVET, EfVET, EVBB, EVTA, EURASHE, EUCEN, other relevant)
- Sectoral skills alliances on EU level
- EU companies and industries
- European Commission and its bodies

Talentjourney partners offering the transnational curricula shall enrol with integrity—that is to say that the learner will be fully aware of the expected level of qualification and or experience, of course this will depend on a younger learner of a lifelong learner. All Talentjourney pilot partners shall make sure that learners have the relevant information and advice about the transnational joint curricula, to make sure it meets their capabilities and more importantly needs. Hence, it is obligatory for all Talentjourney pilot partners to review the learner's prior abilities and/or experience to consider whether their persona shows that they

have the potential to achieve. For learners with disabilities and any specific needs, this evaluation will need to take account of the support available to the learners during the learning and teaching as well as the assessment of each module. Important to note is that in each Talentjourney pilot partner centre a common and consistent methodology is adhered to with regards to recruitment of the target learner(s).

6.3 Benefits for the main end users

It is important to get the right skills, in the right places, at the right time and in the right quantities. This is a key objective of Talentjourney. Through a strategic collaborative partnership and engagement with partners (as outlined in diagram below), the following goals will be achieved:

- Enable people, especially young people, and particularly more young women, to meet their potential that will develop capability and capacity for the future of Industry 4.0/IIOT in smart manufacturing.
- Provide transition paths to meet immediate need, with existing employees.
- Make skills work for employers by making them industry specified programmes.
- Enable complementary / collaborative working to improve the smart manufacturing sector skills system.

Figure 8. Strategic and Collaborative Partnership Structure of Talentjourney
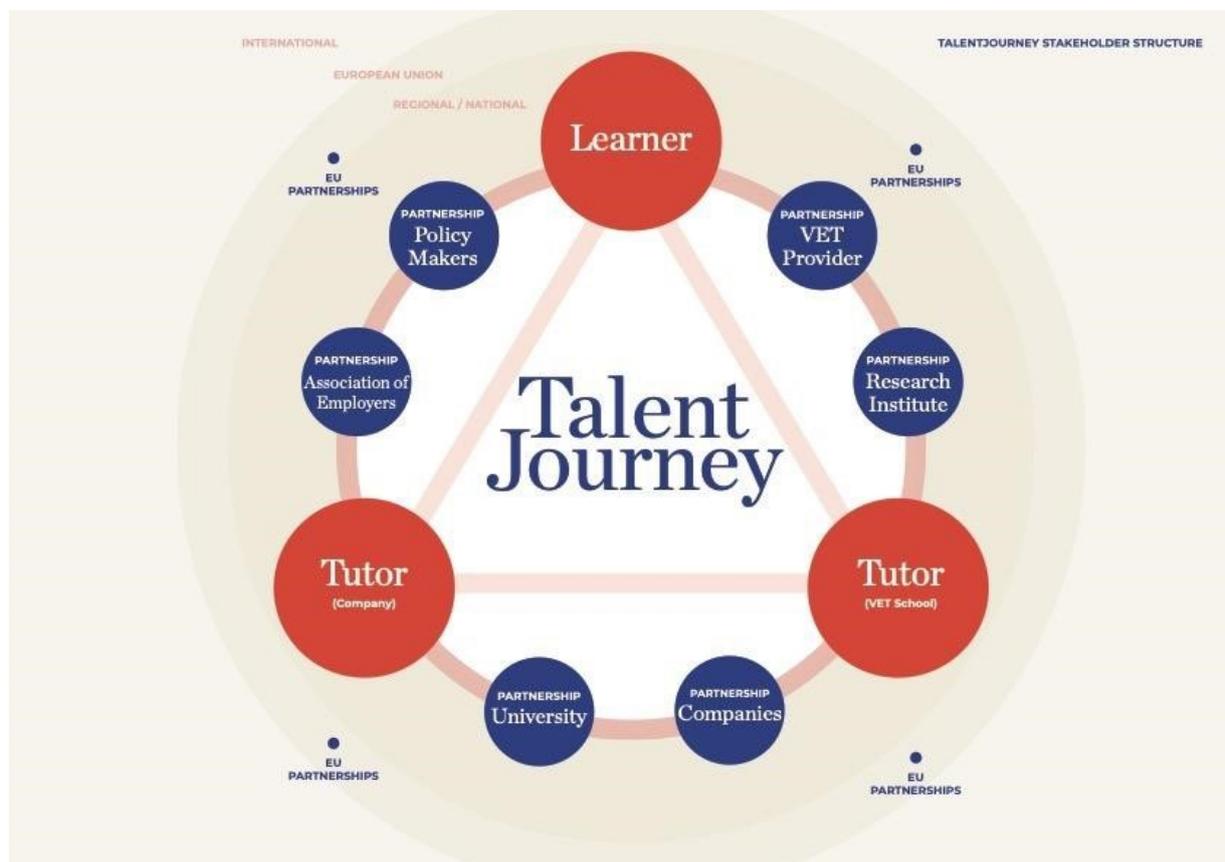
7.0 Draft planning of the implementation of the transnational joint curricula

7.1 Timing of development

Certain regional/national factors must be taken into account regarding the rollout of a pilot joint curriculum, well before the Talentjourney joint curricula can be implemented outside the Talentjourney pilot regions. According to research conducted within Talentjourney, in Slovenia the level of cooperation needed to implement the joint curriculum is, at least at the secondary school level, currently non-existent. Therefore, Slovenian Talentjourney partners suggest there will be some ambiguity in establishing clear organisational structures to implement the transnational joint curricula in the beginning – they will need the help of national institutions (CPI-Center for Vocational Education, MIZŠ-ministry for education, science and sports).

Given the proposals of the structure of the Talentjourney ecosystem, this report acknowledges that their maybe uncertainty also in other pilot regions of the transnational joint curricula. It is the conclusion from the Talentjourney report on ''Skills Data Collection for Connectivity Devices and Services/IIOT in Smart Manufacturing'', which was based on a combination of a literature review and the analysis of in-depth interviews with relevant stakeholders, that in creating an effective, future-proof curricula, there needs to be collaboration between vital stakeholders through the formation of regional stakeholder groups and governed by a transnational Talentjourney ecosystem. To confirm a high quality of skill is being produced, there requires an equally high-quality curriculum offering. It is inevitable that in doing so, there is required to be specific adjustments of the VET system according to industrial developments or policy changes through government and its agencies. It is recommended that an initial transnational steering group is developed initially with partners and identified stakeholders in each pilot area, with selective support from other partners from the Talentjourney consortia.

It is recommended that the following objectives are considered in a transnational Design Thinking workshop, attended by the identified transnational Talentjourney governing body in the first instance. It is encouraged that outcomes are then a point of reference for further regional Design Thinking workshops, as outlined in this report.

- To create a world class transnational joint curriculum, by creating a Talentjourney structure that supports the delivery of a more dynamic, entrepreneurial and globally competitive EU with high levels of skills, employability, innovation and competitiveness in respect of IIOT and smart manufacturing

- To build upon the individual strengths of current participating partner centres and create high quality national and international Centres of Excellence (COVEs) with specialist facilities in IIOT smart manufacturing becoming recognised as a provider of global standing for high quality learning and teaching through increased use of technology enhanced learning (TEL)
- To provide a learner centred experience by placing equal value on vocational, academic and work-based learning curricula and developing comprehensive access routes for participation, achievement, employment and progression
- To provide direct support for regional/EU key economic sector, in respect of IIOT smart manufacturing
- To be a beacon for improvement and socio-economic transformation, developing new and flexible approaches to the curricula offered and learning delivery capable of meeting both the short-term skill needs of the economy and longer-term socio-demographic demands.

The outputs of this transnational Design Thinking workshop should be implemented no more than two months from the publishing of this report. Findings of this transnational Design Thinking workshop should be taken forward and aligned to other recommendation and conclusions within this report.

Figure 9: Transnational government bodies' collaboration with Talentjourney Regional Stakeholder Groups (RSGs)

7.2 Budgeting for implementation

This report found that when asking or discussing costs for implementation of the Talentjourney transnational joint curricula, the subject matter became very subjective. The findings from this report demonstrate that while one partner may think the transnational joint curricula is worth the investment and is within their means, another can consider it too expensive to implement in the long run. Of course, this depends on the situation a particular partner is in, and what other budgetary constraints they are under.

Figure 10: How do you intend to assure the financing of the Talentjourney joint curricula implementation?

How do you intend to assure the financing of the Talentjourney joint curricula implementation? Through:

5 responses
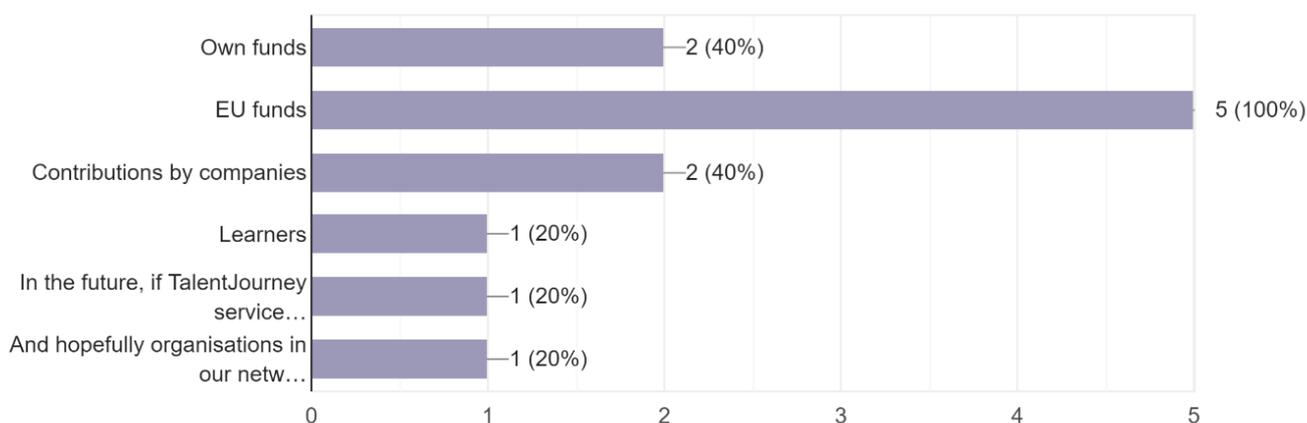
Additionally, in a survey based on previous questions outlining essential skills, companies involved in smart manufacturing within Talentjourney partner regions were asked how they envision the implementation of a joint curriculum, i.e., collaboration with vocational education and training providers. Responses indicated that communication between the Talentjourney partners and local companies around the joint curriculum was lacking.

Although few companies were open to collaboration with VET, especially in terms of defining the essential skills related to industry needs (and thus supplying the future workforce with future-proofed skills relevant to industry). MAHLE, for example, is a leading international development partner and supplier to the

automotive industry as well as a technology driver for mobility. According to a digital questionnaire, representatives from MAHLE have reported that they will rely entirely on EU funds to implement the joint curriculum—this concept does not imply sustainable data collection and poses a major risk for the Talentjourney project. Therefore, a clearly defined structure for sustainable joint curriculum implementation should be established.

To assist the implementation, integration and to enable sustainable financial health of the Talentjourney transnational joint curricula EU funding assistance is recommended. It is advised that the funding assistance is solely for the purpose of funding the essential costs associated with the initial implementation. Once established, the Talentjourney transnational curricula should be financially structured through the established Talentjourney ecosystem. It is recommended that formal discussions on the financial sustainability of Talentjourney are undertaken with a financial subgroup to undertake the efficient and effective financial management functions of Talentjourney. The following are recommended topics for initial discussions:

- A financial planning process, which reflects the constituent parts of Talentjourney ecosystem
- Agreed financial objectives
- Agreed accounting procedures and annual financial statements, agreed best practice
- An agreed resource allocation model, which fairly and openly allocates resources across participating centres
- An agreed financial forecasting model to assist in forecasting financial control
- Agreement of how Talentjourney meets its tax and related reporting obligations

This report recognises that Talentjourney will introduce new ways of working to benefit learners and in time services offered. The following should be considered as recommendations in the context of prudent financial management.

- Agreed Talentjourney Web based financial facilitating services
- Agreed Talentjourney financial system to be integrated
- Agreed transnational ideation workshop with pilot accounting staff during the implementation process to assist in developing financial systems
- Agreed transnational integration of financial system with other pilot partners IT systems such as learner records, HR, etc.
- Agreed Talentjourney financial services data sharing arrangement – this could be an addition to the DSA of report 2.2 on data collection sustainability

VET provision in the Talentjourney partner regions is well understood by this report. However, as Talentjourney seeks to facilitate a greater responsiveness to the labour market needs of IIOT and smart

manufacturing, the new educational innovation will require more agile provision. A recommendation for Talentjourney and its developed ecosystem is to what extent does industry or the private sector play in delivering the demanded training as set out in the previous reports.

This report found that there were high levels of satisfaction from industry when using private sector training organisations for specific training. Given this, and also the responses from this report's questionnaires it is highly recommended that Talentjourney provides an ideation workshop to engage further with industry to satisfy the following questions that have been identified as a result of the aforementioned.

- Should Talentjourney treat private provision and state funded provision separately?
- How policy makers enable the private sector to engage in the Talentjourney?
- In what areas might private and state funded provision be better suited to meeting the needs of learners and employers?
- How does Talentjourney measure outcomes from both a social and economic perspective?
- How does Talentjourney enable collaboration between providers in a competitive marketplace?

The questions addressed in this ideation workshop will allow for an improved knowledge and understanding of effective practice in private sector/VET provision into policy settings and implementation model(s) of the Talentjourney transnational joint curricula in the medium to long term.

8.0 Conclusions

The Talentjourney literature review highlights that the place of educational technology in relation to modern skills requirements such as those in smart manufacturing should be considered in two dimensions. While technology is embedded in the enhancement of modern skills development across various competencies, it is also regarded (and taught) as a skill set in its own right[21].

This report found that there are a number of organisational challenges that impact on the use of technology for the development of smart manufacturing skills, namely the lack of capabilities among teachers, inadequate mechanisms for teachers' continual professional development, and low levels of leadership support for innovative use of technology enhanced learning (TEL) and teaching practices. However, there are also examples where a clear and consistent approach within the vocational education and training sector is seen to have a positive impact on overcoming such challenges, leading to models for the effective use of (TEL) in the development of skills and competencies in international contexts.

Talentjourney understands the common challenges associated with the use of (TEL) for the development of a smart manufacturing joint curricula within a transnational ecosystem, these in essence being teacher capabilities, teacher training, VET infrastructure and resourcing, VET leadership, digital and blended pedagogical approaches. Talentjourney recommends that the following should be implemented into the development phase of the transnational joint curriculum.

- Obligatory professional development for the basic proficiency among teachers delivering the joint curricula
- Provision of adequate time for teachers to learn (TEL) and integrate it within learning and teaching plans of the joint curricula
- Provision of equal access to common (TEL) across the transnational Talentjourney partnership
- Provision of (TEL) MOOC on the Talentjourney platform for self-study, transnational mentoring peer learning and best pedological approaches – allowing "real-time exchange"
- Shared resources including virtual transnational shared resources

The following knowledge/skills/competences shall be developed in the design of the transnational joint curricula. A list of the agreed Talentjourney modules is listed below. These modules not only provide high quality, relevant, learning opportunities that have value in the workplace, but the overall skills development can be considered as transferable providing greater prospects to learners.

- AI/AR
- Cybersecurity
- Robotics engineering
- Production process development
- Data science
- IIOT (EQF level 4)

In the development of the Talentjourney transnational joint curricula, it is important to define the learning outcome of each of the modules. Learning outcomes are the measurable skills, abilities, knowledge or values that the Talentjourney learner must demonstrate as a result of completing any given module of the transnational joint curricula. Effective learning outcomes should be communicated through all stages in the learning and teaching process, including lesson, course, program, certification, pathways etc. The Talentjourney learner outcomes shall be completely learner centred and shall describe what both the teacher/trainer/facilitator shall teach/train/provide, and what the learner will ultimately learn, consequently developing skills and competencies that are in demand from the smart manufacturing or IOT related industries. The Talentjourney learning outcomes shall follow S.M.A.R.T. characteristics and utilise behavioural verbs that are measurable and based on Bloom's Taxonomy. Below is a framework that set out the learning outcomes for the Talentjourney transnational joint curriculum, that modules shall be built upon on these guiding principles.

1. The transnational joint curricula modules should be presented for validation in terms of intended learning outcomes.
2. Credit is awarded for the successful achievement of learning outcomes at a specified level, in the case of the Transnational joint curricula this has been agreed and is set at EQF5 with the exception of IIOT which is set at EQF4, serving the purpose of a pre-requisite or foundation module
3. Learning outcomes should express what it is intended the learner will have learnt and therefore be able to do in order to successfully pass each module.
4. All learning outcomes should be assessable and must be assessed as part of each module.
5. Learning and teaching methods and activities should be designed to support students towards demonstrating their achievement of the learning outcomes through completion of the module and hence assessment.
6. The learning outcomes of the transnational joint curricula should include reference to knowledge and understanding, intellectual or cognitive skills and meta or transferable skills as well as subject specific skills expected of a learner successfully completing the module.
7. Learners should be provided with explicit information in the form of assessment criteria and/or grade descriptors about what is necessary to obtain grades above the pass threshold.
8. Module and assignment specific assessment criteria/grade descriptors should be benchmarked commonly across all Talentjourney partners generic grade descriptors

The implementation of this pioneering initiative shall deliver excellence based on the following framework:

- Lifelong learning in vocational education and training – from initial to continuing training and adult education
- Education-business-Government collaboration and cooperation
- Pedagogy and professional development
- Smart specialisation – Mobilising Innovation, ecosystems and SMEs
- Industry 4.0 and digitalisation
- Going green – supporting sustainable goals
- Autonomy and Institutional Development (financing, leadership, governance)
- Social inclusion

Collaboration is an important aspect of not only the development of the Talentjourney but also the process of learning. It is the intention that Talentjourney learners who complete their smart manufacturing program will work within a smart IOT environment and progress to a more senior role or advance to a higher level of study. It is vital that Talentjourney develops the transnational joint curricula in close collaboration with industrial experts, Government agencies and International VET providers, who will be delivering the program initially. The purpose of the Talentjourney smart manufacturing joint curricula, needs to be truly understood. The purpose is to develop learners as qualified individuals who contain the essential technical and meta skills who will be able to meet the demands of industry in the rapidly evolving IIOT smart manufacturing sector and adapt to a constantly changing world. The qualification should also aim to widen

access to higher education and enhance the career prospects of those who undertake it, hence HEI should be part of the Talentjourney ecosystem also. The core objectives of the Talentjourney smart manufacturing transnational joint curricula are set out below. This learner-centric list is not an exhaustive list and shall be further developed in the implementation phase of the project:

- To provide learners with technical and meta skills, core knowledge and techniques that all engineers/professionals within 4.0 smart manufacturing operations require to achieve high performance in the industry.
- To focus on specialist knowledge, transferable skills and techniques in order to be successful across a variety of careers in IIOT, smart manufacturing.
- To develop necessary skills to be resilient solving problems in a timely, professional manner, collaboratively contributing to a smart manufacturing process and environment.
- To understand the responsibilities of the engineer/professional within society, and prepare Talentjourney learners to work with sustainability, resource efficiency, financial accountability and integrity in the fast-changing environment of smart manufacturing.
- To provide opportunities for learners to enter, or advance in, employment within the smart manufacturing industry, or progress to university education qualifications in related engineering/technology or a closely related area, by balancing employability skills with academic attainment
- To allow international mobility and flexibility of study and to meet local/regional European IIOT smart manufacturing needs.

The creation of the transnational joint curricula must take into consideration a specific learning and teaching plan. Hence, it is of course necessary to consider the most appropriate learning and teaching approaches in the delivery of the Talentjourney transnational joint curricula. The Talentjourney program shall dynamically engage with learners' interactively utilising a reflective learning and teaching approach, in addition to other pedagogical approaches. This experience should effectively prepare learners to successfully engage in the assessments, which will measure depth, as well as breadth, of knowledge, in doing so shall develop skills and competencies sought by the smart manufacturing industry. The learning and teaching plan for Talentjourney should stimulate educational engagement, develop challenging yet constructive discourse and encourage learners to reflect on their own performance in preparation for professional careers in IIOT smart manufacturing or technology related industrial sectors. It is recommended that learners are exposed to a mix of collaborative and independent learning through the use of technology enhanced learning (TEL) provision, which will support the development of skills and competency. Furthermore, the use of TEL in the learning and teaching of the Talentjourney programme shall provide a deeper understanding of the topics where they are able to go beyond the fundamentals of explaining and describing. The delivery of the Talentjourney modules should expose learners to big data analysis and information, challenging them to critically evaluative and make judgements. To do so, leaners should be exposed to the relevant theories, concepts using real-life case studies – this can be provided from industry who are part of the Talentjourney ecosystem. Consideration should be given to the involvement

of regional smart manufacturing employers when creating the Talentjourney assessment strategies. Innovative assessment methods should be designed in a way that they are more related to what learners would be expected to do in the workplace.

The Talentjourney transnational joint curricula should show learners, teachers and employers what has been learnt and what you can do as a result of that Talentjourney learning. Across the EU there is a large variety of training and qualifications available, good educational and training programs are grouped together into levels to demonstrate how they compare and what other qualifications they can lead to – hence Talentjourney should level the joint curricula providing its learners with pathways to progression and employment, a clear path to positive outcomes.

To level the Talentjourney transnational modules, the following should be undertaken, different levels indicate the level of difficulty of a particular module. Each Talentjourney module level descriptor/specification shall outline the common learning outcomes at EQF levels under a number of broad headings, all based essentially on Bloom's taxonomy: The Talentjourney transnational joint curricula should consider the list of skills below as integral to the development of the Talentjourney transnational modules. Of course, it is understood that not all will be related to one individual module. However, it is imperative that these skills are contained across the entire Talentjourney transnational joint curricula:

- knowledge and understanding
- practice - applied knowledge and understanding
- standard cognitive skills e.g., evaluation, critical analysis
- communication, numeracy and IT skills; and
- autonomy, accountability and working with others

It was found in a previous Talentjourney report that all modules with the exception of IIOT shall be levelled at EQF 5, as it is this level that is required by industry. Without levelling modules there is nothing to measure, hence there would not be quality assurance. To support the development of the Talentjourney transnational modules a module checklist has been devised – this can be seen in annex 1.

8.1 Summary of main findings

- Ideation of transnational Industry 4.0/IIOT (in smart manufacturing) vocational curricula
  o The process of Design Thinking described in the report can shape an educational curriculum capable to satisfy current and especially future skills needs in smart

manufacturing, indeed could be considered beyond this particularly to other sectors that are affected by IOT/IIOT

- Indicators that are crucial for the excellence of joint curricula:
  o Lifelong learning in vocational education and training – from initial to continuing training and adult education
  o Education-business collaboration and cooperation
  o Pedagogy and professional development
  o Smart specialisation – Mobilising Innovation, ecosystems and SMEs
  o Smart specialisation – Mobilising Innovation, ecosystems and SMEs
  o Industry 4.0 and digitalisation
  o Going green – supporting sustainable goals
  o Autonomy and Institutional Development (financing, leadership, governance)
  o Social inclusion
- Reasons for entering into joint curricula collaboration
- Added value and wider relevance of the intended learning outcomes
  o Talentjourney modules not only provide high quality, relevant, learning opportunities that have relevance and value in the workplace, but the overall skills development can be considered as transferable, providing greater prospects to learners.
- Inclusion in the involved partners' strategy and internationalisation policy
  o Most VET institutions within Talentjourney responded that they are willing to participate, however, there was some hesitancy from partners to do so, which will be followed up in future Talentjourney work e.g., Design Thinking workshops, as proposed.
- National and institutional/employers' regulations of involved partners regarding implementation of joint curricula
  o Flexibility of the joint curricula is considered to be fundamental. In all participating VET institutions' cases, flexibility of the joint curricula is absolutely vital, taking into account the national and institutional/employers' regulations regarding implementation of joint curricula. However, it was found that in all cases employers were not aware of specific regulations, hence the need for policy makers to be an integral part of the Talentjourney ecosystem
- Involved partners' strategic commitment, mutual trust (through open communication and a shared understanding)
  o Some responses of this report might imply that Talentjourney partners themselves lack mutual understanding and trust, which shall be addressed and overcome in future Talentjourney work, which are mentioned in specific proposals. Signing a ''Memorandum of Understanding'' (MoU) is enough to assure the commitment. It must be understood that an MoU is not a legally binding agreement, but it is an official document to signify an agreement in the form of memorandum—to define and express involved partners' strategic commitment for implementation of the common services. The document will

include agreements of Talentjourney partners to participate in the delivery of the joint curriculum and platform and will be elaborated upon through a service blueprints design.

- Considering (draft planning) budgeting for implementation
    o Formal discussions on the financial sustainability of Talentjourney to be undertaken with a financial subgroup to undertake the efficient and effective financial management functions of Talentjourney, as per recommendations in the report.
- A clear definition of target learners
    o Deciding on a clear definition of the target learners for Talentjourney is highly important prior to the further development of the joint curricula. It is clear from desk research that demand from industry requires there to be an increase in the level of VET curricula for smart manufacturing that is currently being offered. Response from industry has also led the Talentjourney partnership to include a module of IIOT as a prerequisite at EQF4, due to the increasing relevance of IIOT skills/knowledge in the job market, hence all learners should have as a minimum level four qualification and of experience, as set out in the learner outcome specifications in this report.

8.2 Summary of recommendations

- Ensure all communications within the Talentjourney ecosystem are inclusive, honest and timely, employing effective and pervasive media
- Provide effective communication mechanisms to enable partners and stakeholders to contribute to constructive suggestions for service improvements and engage in effective consultation
- Implement a model of shared governance to accommodate the Talentjourney transnational joint curricula collaborative arrangements
- Talentjourney transnational steering group is established that meets regularly to drive forward the development process, give direction to working groups that will be formed in each pilot partner location to review progress against agreed KPIs
- Transnational steering group is developed initially with partners and identified stakeholders in each pilot area, with selective support from other partners from the Talentjourney consortia.
- Transnational design thinking workshop, attended by the identified transnational Talentjourney governing body in the first instance
- Formal discussions on the financial sustainability of Talentjourney are undertaken with a financial subgroup to undertake the efficient and effective financial management functions of Talentjourney
- Talentjourney provides an ideation workshop to engage further with industry to satisfy questions that have been identified as a result of this report
- Learners are exposed to a mix of collaborative and independent learning through the use of technology enhanced learning (TEL) provision, which will support the development of skills and competences.

TALENTJOURNEY

References

1   Von Thienen, J. P. A., Clancy, W. J., Corazza, G. E. and Meinel, C. (2017), *Theoretical Foundations of Design Thinking Part I: John E. Arnold's Creative Thinking Theories.* <https://thisisdesignthinking.net/2017/05/theoretical-foundations-of-design-thinking-john-arnold-creative-thinking-theories/>.

2   Simon, H. (1966) *The Sciences of the Artificial*. Cambridge, MIT Press.

3   Rittel H. W. J (1967) *Wicked Problems*. Management Science.

4   Buchanan R. (1992) *Wicked Problems in Design Thinking*. The MIT Press.

5   Canestraro (2017) *The impact of Design Thinking on education: The case of Active Learning Lab*. Master Thesis.

6   Cardus, M (2017) *Solution Finding vs Problem Solving*. <https://www.linkedin.com/pulse/solution-finding-vs-problem-solving-michael-cardus/>.

7   ERASMUS + KA2 Strategic Partnerships (2015) *Research Report D-Think, Design Thinking Applied to Education and Training*.

8   CIMEA (2020). Database. <http://www.cimea.it/it/index.aspx>.

9   CEDEFOP (2018) *Insights into skill shortages and skill mismatch: learning from Cedefop's European skills and jobs survey*.

10 European Commission (2019), *Supporting specialised skills development: Big Data, Internet of Things and Cybersecurity for SMEs.* Interim Report.

11 European Commission (2020), *High-tech Statistics* <ec.europa.eu/eurostat/statistics-explained/index.php/High-tech_statistics_-_employment>.

12 CEDEFOP (2014) *Terminology of European education and training policy.*

13 High Value Manufacturing Catapult and Gatsby Charitable Foundation (2020), *Manufacturing the Future Workforce.*

14 Draft Government STEM Strategy (2010), *Success through STEM*.

15 European Commission (2018), *Key Enabling Technologies (KETs).*

16 Zolkifli, H., Kamin, Y., Abdul Latif, A., Buntat, Y., & Awang, Z. (2016). Generic Green Skills: Industry and Perspectives on Technical Education and Vocational Training (TVET). In: TVET@Asia, 6, pp. 1-13. fwork

17 European Commission (2017) *Enter the data economy.*

18 OECD (2015), *Data-driven Innovation for Growth and Well-being*. Science, Technology and Innovation Policy Note.

19 SAS & The Tech Partnership (2014) *Big Data Analytics. Assessment of Skills for Labour and Skills 2013-2020.*

20 Mapping of Centres of Vocational Excellence, https://op.europa.eu/en/publ ication-detail/-/publication/566920f4-ee2d-11e9-a32c-01aa75ed71a1/language-en.

21 *Lewin, C., & McNicol, S. (2015). Supporting the development of 21st Century Skills through ICT. In Brinda, T., Reynolds, N., Romeike, R., & Schwill, A. (Eds.), KEYCIT 2014: Key competencies in informatics and ICT (pp. 181–198), <https://publishup.uni-potsdam.de/opus4-ubp/frontdoor/deliver/index/docId/7032/file/cid07.pdf>.*

Annex

Talentjourney Module Checklist

Module title and level	
Date of check	
Evaluator's name	

Essential Information			
	Key Questions	Y/N or N/A	COMMENT REQUIRED AGAINST 'NO'RESPONSES
Module title	Does the title of the Unit give a clear indication of what the module is about?		
	Does the title reflect the skills and / or knowledge covered?		
Module Summary	Does the module summary give the reader a clear idea of the content and objectives of the module?		
	Is it consistent with the module title and module outcomes?		
	Has the target audience(s) been identified?		
	Has the context for delivery been identified?		
Module Outcomes	Has due consideration must be given to the command verbs used in the learning outcomes of a module?		

Module Recommend entry	Has guidance on the level of skills, knowledge, experience, or the qualifications a learner should have achieved prior to starting the module been given?		
Meta Skills	Has meta skills been fully integrated into the module and is measurable?		

Guidelines			
	Key Questions	Y/N or N/A	COMMENT REQUIRED AGAINST 'NO' RESPONSES
Outcomes	Does each Outcome state clearly the skills or knowledge that must be demonstrated by the learner?		
	Are the Outcomes written in the order a learner will work through them?		
	Does each Outcome link to the module summary?		
	Do the Outcomes match the characteristics of the corresponding EQF level?		
	Do the outcome contain at 75% digital content?		
	Are you satisfied that the Outcomes do not present a barrier to the learner in terms of the safeguarded rights? Safeguarded rights are the following, it must be noted that this is not an exhaustive list - disability, race, age, religion or belief, sex, gender re-assignment, pregnancy and maternity or sexual orientation		
	Do the performances criteria (PC): • clearly describe the way the learner carries out the activity described in the Outcome, (process) or whatever is produced as a result of that activity (product)?		
Performance Criteria	• clearly indicate the standard or quality of performance expected?		
	• run in the order a learner will work through them?		
	• facilitate holistic assessment of the Outcome?		
	Is each PC an essential part of the definition of what it is to be competent in the Outcome?		

	Are you satisfied that the PCs do not present a barrier to learners in terms of the protected characteristics?		
	Do the Evidence Requirements clearly specify: • what the learner has to do?		
	• to what standard?		
Evidence Requirements for this module	• the type of evidence required?		
	• how much evidence is required?		
	• the number of assessment occasions ie different points throughout or in one assessment occasion		
	• the conditions in which the evidence must be produced? i.e., online, open/closed book, controlled conditions etc.		
	Do the Evidence Requirements cover the content of the module and relate back to the Outcomes and PCs?		
	Do the Evidence Requirements only relate to what is asked for in the Outcomes and PCs? ie-they do not ask for more		
	Has the choice of instrument of assessment been left open? Note: the instrument of assessment should not be specified in the Evidence Requirements		
	Do the Evidence Requirements encourage holistic assessment (within and across Outcomes) where possible, like an assignment or project?		
	Is the mode of assessment as open and flexible as possible e.g., if it is acceptable to submit evidence in electronic or online?		

	Are you satisfied that the Evidence Requirements do not present a barrier to candidates in terms of the protected characteristics?		

Heading	Key Questions	Y/N or N/A	COMMENT REQUIRED AGAINST 'NO'RESPONSES
Guidance on the content/ context	Does the information provided help the reader gain a better understanding of the module principles?		
Guidance on learning and teaching approaches	Does the information provided help the reader gain an understanding of how learning teaching/delivery might be organised? Note that at least 75% of the learning and teaching process should be based on TEL.		
	Have possible TEL delivery methods been identified?		
Guidance on approaches to assessment	Does the information provide the reader with a greater understanding of how the Outcomes will be assessed?		
	Is it consistent with the Evidence Requirements?		
TEL - assessment	Have opportunities been identified? Is there the opportunity to use AI in the assessment process?		
Development of Meta Skills	Have opportunities to develop aspects of Meta Skills been signposted?		
Overall	Is the module content technically accurate?		
	Is the content appropriate to the level and time allocated to deliver it?		