Sustainability of data collection

Talentjourney Report 2.2

TALENTJOURNEY

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1.0 Introduction

The main goal of this report is to outline a detailed methodology for sustainable data collection required for the development of a transnational vocational curricula/joint curricula for Industry 4.0/IIOT (Industrial Internet of Things) in smart manufacturing. Piloted in four Talentjourney countries (Slovenia, Italy, Finland, Estonia), the Talentjourney transnational joint curricula will ultimately be used as a catalyst to roll out the concept across the EU VET system.

Centres of Vocational Excellence (CoVEs) are developing into an important component of EU vocational education and training (VET) policy, and therefore the Talentjourney transnational joint curricula will incorporate all aspects. 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. This report will reflect this, and therefore will consist of a description of developed methodology, including the process of implementing the methodology with the exact steps; i.e. identifying how, when, where and by whom will be implemented (collecting and data analysing). This report aims to include what data will be provided, who will provide data and where the data will be published; i.e. what/who will be data source and at which level (regional, national, EU, global). Also explored in this report are the responsibilities of the project's partnership in the process of methodology implementation as well as key performance indicators for data collection.

"A main question of this report is how Talentjourney VET provider partners would come to the information about skills needs in their regions."

To address how Talentjourney VET provider partners would obtain information about skills needs in their regions, we have posed the following key questions: Do they go mainly to the companies and have interviews with HR or leadership every year or in another way? Is this the task of VET providers or does

Talentjourney have other supporting institutions that could provide a steady flow of information to VET providers? Have the VET providers developed any sustainable methodology of collecting data, or is this carried out by the regional/national chambers or associations of employers and then forwarded to VET providers? Supported by extensive desk research, these questions were posed in questionnaires and interviews with Talentjourney partners and stakeholders, especially those partners who are VET providers themselves, to provide answers regarding the sustainability of data collection within Talentjourney.

This report explores how well Talentjourney partners are prepared for collecting, analysing and managing large data sets to augment the quality of the learner experience through evaluation, monitoring, target-setting and planning for improvement in the creation of the Talentjourney transnational joint curricula and used as a blueprint for the transformation of the vocational education and training system towards centres of vocational excellence (CoVEs). It examines and evaluates methods used in local/regional/national and EU contexts, in which Talentjourney can prepare to use data sets/data analytics to provide commonly agreed key performance indicators and approaches to improve quality and the learner experience.

1.1 What is Talentjourney?

Employer research points to a perceived skill set that sits beyond traditional education models across the VET sector. In some spheres these are called meta skills or universal skills, and they are linked to academic and competency skills. Employers lack in many of these skill sets when looking at workforce planning.

The problem to be solved is that manufacturing companies have to increase their Industry 4.0/IIOT (Industrial Internet of Things) knowledge and skills to apply new technologies and capture the potential of Industry 4.0 to remain competitive in a globalising economy, essentially the transition to smart manufacturing. Simultaneously, digital technology will transform our future. Data driven innovation through intelligent use of data is already exploding, tied into the growth of AI and automation. VET

institutions need to address the oncoming 'Fourth Industrial Revolution' through education and skills to equip future employees whilst re-equipping the current workforce. In reality, employers report that their futures are very much fixed on the present, with shortages due to a lack of staff with sufficient technical knowledge in the emerging smart manufacturing sector. In order to face these challenges and look to the future, it is necessary to make the most of the current workforce and bring them through this transition period. Understanding and responding to the evolving skills needs of business is critical to increasing economic growth and productivity in the EU.

Talentjourney is an EU-funded Erasmus+ project that brings thirteen project partners from across Europe (Slovenia, Italy, Finland, Estonia,

Germany) with the same idea and goal to bring VET provision to the excellence in manufacturing sector. Specifically, the international consortium is focused on Industry 4.0/IIOT in smart manufacturing, which lays its focus on solutions that are user-oriented or learner-centred, user-friendly and eco-friendly and become as such a world example for the excellence in that field. The name of our platform for Industry 4.0/IIOT in smart manufacturing VET excellence is Talentjourney, as our vision is to design a collaborating and engaging ecosystem where everyone can grow into a contented and confident people and successful professionals. The Industry 4.0/IIOT smart manufacturing field deals with the ability to connect services and devices to central controlling applications or a remote operator and is important to run a cost-effective business operation, is transferable to other sectors and in many cases connected to artificial intelligence. The platform will build on excellence by providing leading skills in the Industry 4.0/IIOT smart manufacturing field and innovative approaches that will foster developing talents.

"Talentjourney will represent a network of inter-connected regional and EU stakeholder ecosystems with emphasis on sharing, networking, working in teams and providing information."

Talentjourney will:

- Place a strong emphasis on digital, international, user-centred, personalised and flexible in content and relationship for the user
- Utilise digital tools to allow flexibility in learning (''I as a student/teacher/employee can choose subjects/modules and projects that I'm interested in and the ones that are going to help me grow professionally'')
- Receive tutorship from tutor in any countries using digital tools
- Transform knowledge stocks into knowledge flows

Talentjourney will lead on innovative approaches to developing the smart manufacturing workforce of the future and develop flexible ways to address these challenges effectively. Talentjourney aims to future-proof industry in order to meet their needs to recruit staff, to upskill staff, to reskill staff and to help organisations in the EU to become globally competitive in the smart manufacturing sector. Training, Education and Recruitment of Industry 4.0 Qualified Staff is vital if small and medium size companies (SMEs) are to make a successful transition to smart manufacturing. Human Resources (HR) is a key asset in an SME's development and innovation activities and many manufacturing companies have difficulties with recruiting staff that have adequate professional qualifications and competent skills.

The centre of Talentjourney will be the learner supported by tutors and other stakeholders to help him/her discover and develop their talents. Talentjourney will provide the manufacturing sector with an international talent pool of future employees and Industry 4.0/IIOT-fluid experts to foster innovation and capacity building to master the future of the manufacturing sector.

This study provides an overview of identified opportunities in smart manufacturing that will shape this global market in the coming years which, in turn, will drive the demand for skills. The challenge to be addressed later in this report is the extent to which these global opportunities and skills needs will be accessible to Talentjourney and its ecosystems. It is clear from our analysis that there a large number of globally significant opportunities in Smart manufacturers markets and will drive a demand for skilled resources for many years to come. It is clear from our analysis that there a large number of globally significant opportunities in Smart manufacturers markets and will drive a demand for skilled resources for many years to come.

The challenge for Talentjourney, therefore, is not whether there is a need for skills in smart manufacturing that is to be pursued, but rather how does Talentjourney do this. Success will require Talentjourney to add something to the mix that makes the offer more attractive than companies can present on their own. In addition, in order to push beyond the immediate opportunities, Talentjourney needs to be cognisant of their global— not local—competitors.

Finally, it is important to note that the various Talentjourney regions have different needs – these needs should be taken into account before designing common outputs and ultimately the transnational curriculum, especially the data collection requirements of the programme. In the context of data collection, a common result agreement should be collectively established by the Talentjourney ecosystem; this agreement should identify the skills needs in a local/regional location of the Talentjourney partnership, as laid out in report 2.1 and solutions to address them through work packages 3, 4 and 5. In each Talentjourney location, VET providers, employers and Government/agencies should come together to agree the priorities for that location, the results that need to be achieved, and the roll that each member of the Talentjourney ecosystem will make to achieve those results. Where there are any exceptional circumstances to commonly agreed results, these should be addressed and approved. Talentjourney ecosystem members should be held accountable for delivery of their contribution, through a formal agreement.
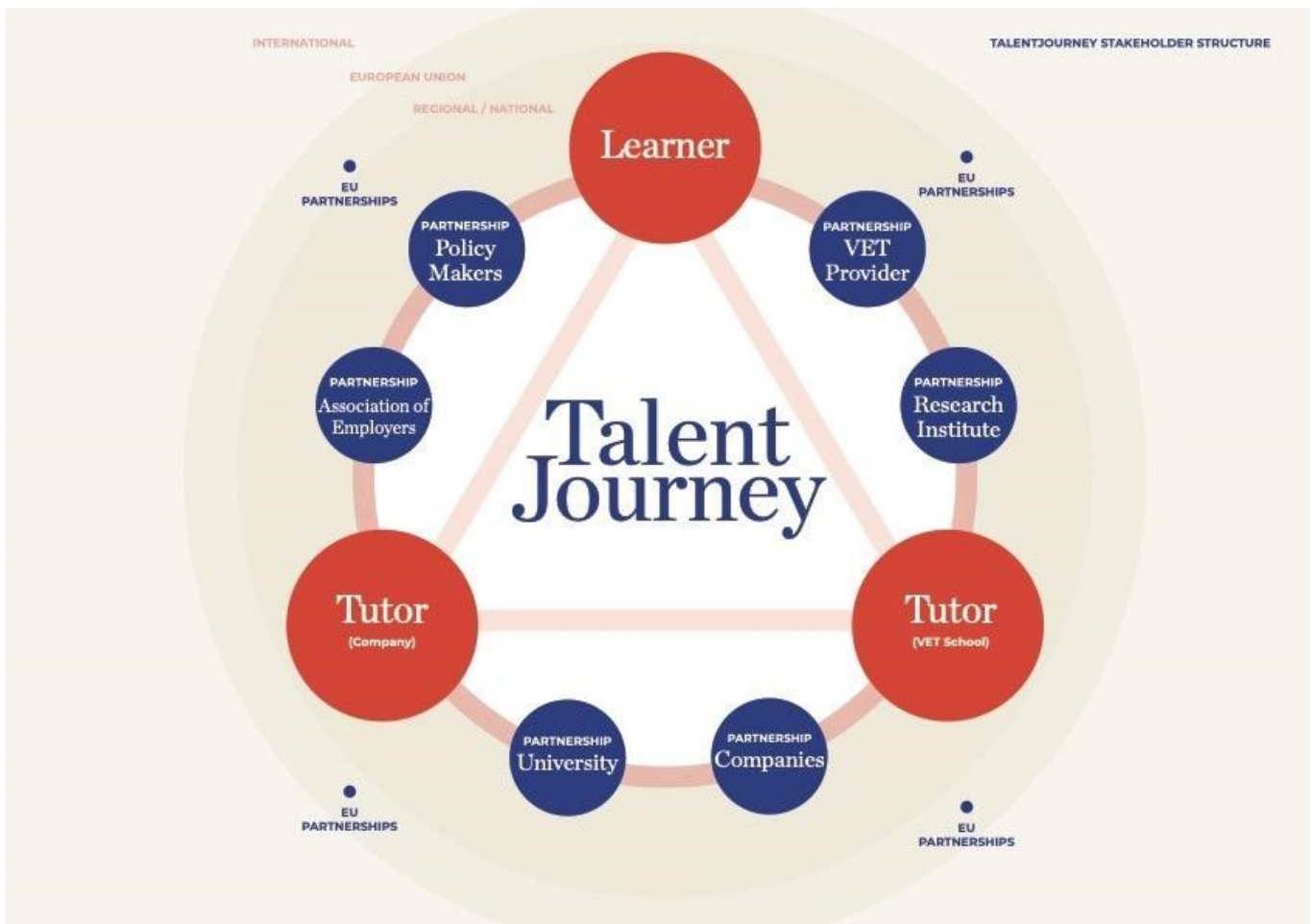
Figure 1. Strategic and Collaborative Partnership Structure of Talentjourney

1.2 Project Partners

The combined Talentjourney partnership has the same vision to "Design a collaborating and engaging ecosystem where everyone can grow into a contented competent and successful professional" inside smart manufacturing, focused on Industry 4.0/IIOT. All partners work in collaboration with the manufacturing sector with the majority of partners working and developing common strategies for a longer period of time. VET providers bring together in the selected sector various expertise and the best examples needed for Talentjourney: e.g., educational innovation, capacity and excellence in establishing very cooperative networks and partnerships with stakeholders across different levels. The Talentjourney partnership provides the much-needed engagement, providing industry-specific insights; providing life-long training Industry 4.0 competencies; and developing ecosystems with state-of-the-art resources for excellence in learning and teaching.

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 CDS VET excellence, developing and testing trans-national CDS 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.

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.

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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, or IIOT, in 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 European Skills, Competences and Occupations (ESCO), applying European Quality Assurance in Vocational Education and Training (ECVET) and principles of European Credit System for Vocational and Education Training (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.

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 CNA, 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.

"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."

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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.

2.0 Involvement of stakeholders

The Talentjourney partnership will work with public/private sector organisations 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.

Through an analysis conducted within Talentjourney, senior management of VET institutions were asked how their organisations fulfil student expectations by designing curricula in partnership with learners/industry. Most responses related to involving students in partnership projects with industry, through which the students can choose specific companies to cooperate with. Other VET institutions within the Talentjourney partnership aim to offer real-life tasks in a school environment after essential theory lessons are taught – and after practicing within an in-school environment, all students must go work directly with companies, which takes at least 25% of their learning time.

To serve as an example of in-school 'hands-on' learning provided by a VET institution surveyed within Talentjourney, Šolski center Kranj provides students with opportunities to work with companies on practical research projects in addition to offering access to their 'FabLab'. This innovative centre of technology allows students to explore modern technologies, such as 3D printing, CNC, robot and automation and the development of electrical circuits.

VET teachers surveyed within Talentjourney were asked what the main reasons are for them to consider entering into joint curricula collaboration (i.e. added value and wider relevance of the intended learning outcomes). Various responses included broadening their world view or networking, identify synergies between fields, acquire more adaptable teaching materials, to ensure better collaboration with industry, to find a common (better) direction for their efforts, and to ensure the integration of practical topics and themes (e.g. environmental sustainability.

These same VET teachers also were asked what their role would be in the implementation of a joint IIOT/smart manufacturing curriculum, to which most responded that they would oversee the technical implementation (e.g. hardware engineering) or simply the delivery of the learning materials, in addition to participation in working group meetings. Others replied that they would serve as their school's connection with the companies, or even would play a role in designing the teaching materials. One teacher replied that they would ensure the usability and implementation of the joint curriculum in a smart manufacturing curriculum at their specific school.

Ensuring inclusion in the involved partners' strategy and internationalisation policy for a joint curriculum is a more difficult task for VET teachers across the Talentjourney partnership. Most responded that they were unsure how they would ensure the joint curriculum's inclusion in involved partners' strategies or internationalisation policies. Another teacher responded that this would be possible by following ECVET principles; partners suggest the competences to be reached and working methods for open curriculum (20% of the programme in schools). Another teacher suggested the joint curricula's implementation would be possible through open discussions in workgroup meetings. A teacher from I.S.I.S. A. Malignani in Italy will implement the guidelines that the management and the partners will provide in order to achieve the objectives of the joint curriculum, knowing it will be necessary that each partner might work with autonomy and flexibility.

2.1 Regional Stakeholder Groups (RSGs)

Regional Stakeholder Groups (RSGs) in the context of the joint curricula are important bringing together a triple helix demonstrating how VETs can best meet the changing social and economic needs of their regions, reflecting a changing and increasingly diverse profile of the learner. It is seen that RSGs are an important part of the Talentjourney in which it ensured that the triple helix make best use of public funds and exercise good governance, but ultimately deliver excellence relevant to society and economy.

"Working in partnership through a triple helix provides many benefits, cuts duplication and accelerates progress of the Talentjourney objectives."

It is suggested that such improvements would be equality of access to VET provision and improvements in the learner pathways, with the opening of new routes to higher education and the expansion of opportunities for extension into employment. This approach should also encourage VETs to respond faster to the broader skills agenda with more work placement opportunities and increasing opportunities in STEM related activities as a foundation, as well as developing relationships between VET/Knowledge institutions and industry to support innovation that create useful and productive offerings.

VETs provide a local/regional context in which the demographic and economic needs of the region should be analysed. This will include information about the population, deprivation rates, economic profile including characteristics of the local economy and employment/ unemployment rates, skills and qualifications, all of which requires data collection. Data should indicate how the VETs will help to contribute to economic development and growth in the region, hence it is in tune with policy drivers. This will involve identifying key industries and the ways in which the VET can provide support, including training and lifelong learning to meet the needs of existing workers for retraining and upskilling,

Talentjourney is focusing on smart manufacturing and IIOT-related industries. Given the emphasis in each of the respective four pilot areas' (Slovenia, Finland, Estonia, Italy) national policy on addressing issues associated with social and economic deprivation it can be expected that VET will indicate the ways in which they will promote social inclusion and help widen access to education and training.

VET institutions within the Talentjourney consortium were asked if they currently work with local and regional authorities to align skills with smart specialisation and regional development strategies. All partner companies had responded that they were, in similar ways. Tallinn Polytechnic School in Estonia had responded that they are working closely together with local companies and industry association and occupational authorities in regards to smart specialisation and regional development. The Šolski center Kranj (Kranj School Centre) from Slovenia responded that they work with local and regional authorities as often as possible. The Italian school I.S.I.S. A. Malignani responded that they work with local and regional authorities as much as possible, particularly in regards to the topics of smart specilisation. Members of the senior management group of Sataedu in Finland are participating in several regional developing groups and Smart Specialisation is part of their agenda.

VET teachers themselves, rather than senior management representatives, were then surveyed within the scope of Talentjourney, having been prompted to provide information on

organisations and stakeholders with which their VET institutions currently work, in respect to the development of a transnational IIOT / smart manufacturing "joint curriculum". Answers varied drastically across the partnership. A few teachers were completely unaware of any sort of external partnerships or work being carried out to ensure a transnational joint curriculum. Some teachers had responded that they are working with some external partners, but that they are not sure on what level exactly. Other teachers listed out specific local companies (e.g. Polycom, Iskra ESV, Domel, Iskraemeco, Hennlich, Chemets, Danieli Spa, Eurotech Spa, etc.), and another respondent had exclaimed that they work with other VETs and universities in this realm. Only one teacher from the Kranj School Centre in Slovenia had responded that they were aware of current work with local companies and well as 'social partners', such as the regional development agency and municipality.

2.2 Determination of the role of stakeholders/project partners in data collection

Learners are the main users and the focus of establishing the Talentjourney joint curricula. Therefore, they will be included in most activities, since the project focuses on the learner through user-centred approach: in curricula ideation, development, action plan for implementation, testing, prototyping, in designing the regional and EU stakeholder ecosystems, dissemination and exploitation activities.

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Talentjourney will be one of the mechanisms to support development and innovation in the manufacturing sector, focused on Industry 4.0/IIOT in smart manufacturing. For this purpose, the project partnership, in which the partners' main preoccupation is relevant to the field of smart manufacturing, was established. Talentjourney will unite partners from several different regions who are interested in joining forces with specific stakeholders in the provision of relevant in demand training relating to smart manufacturing. The partnership is represented by relevant stakeholders (in collaboration with all partners' regional stakeholders) to be able to establish the sustainable Talentjourney Digital Platform.

Tutors as VET teachers and company trainers as well as VET provider/company leadership are the crucial factor to consider in the development of a joint curricula in response to challenges of modern society and economy. Talentjourney considers them to be co-creators of the Talentjourney Platform for Industry 4.0/IIOT in smart manufacturing VET excellence and motivators for learners and innovations. They will be actively included in majority of activities in all work packages, same as VET providers. VET providers will be actively included in designing, developing and testing trans-national Industry 4.0/IIOT vocational curricula and life-long learnings, thus enabling the professional development for modern VET teachers, VET provider/company leadership and company trainers/experts.

Companies and SMEs are a main driver of the economy but can only be so with specifically educated and competent employees. Thus, they will be involved in activities such as research on job related skills and the influence of new era society on working people. Companies and SMEs will also be involved in the development of a sustainable stakeholder's ecosystem with their regional and international connections, the development and testing of transnational curricula and life-long trainings and the development of network of tutors.

Associations and chambers of employers will have the role of creating a regional and EU-level stakeholder ecosystem driven by Talentjourney. In addition, they will be involved in the same activities as companies, outside of testing the joint curricula.

Startup parks, fab labs, technological parks and incubators, universities and research centres and smart specialisation chains will serve as innovative partners that contribute vital knowledge and expertise to the creation of the Talentjourney joint curricula and ultimately the Talentjourney Platform. They are highly important in data collection on needed skills, development of trainings and network of tutors, inclusion in designing EU and regional stakeholder ecosystems, dissemination and exploitation activities, and so on.

"Talentjourney will unite partners from several different regions who are interested in joining forces with specific stakeholders in the provision of relevant in demand training relating to smart manufacturing."

To support national and EU policy in providing initiatives for better responsiveness of VET, Talentjourney has engaged with 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

It should be noted that the Talentjourney joint curricula is being developed to serve the following categories of learners:

- learners at EQF 4
- learners at EQF 5
- trainers/tutors
- leadership
- employees
- companies
- other: pupils (primary education)

Key to the development of a joint curricula and platform and thus ensuring excellence in VET training is user-centricity. Interactions that occur within regional and EU-wide ecosystems in the area of Industry 4.0/IIOT in smart manufacturing have a significant impact on the learner and on their education. Therefore, questionnaires completed by Talentjourney partners with regional VET providers (management and teachers), as well as with companies, as well as desk research conducted on national and EU levels provide the basis of this report. The use of this design thinking methodology has played a vital role in exposing insights in the development of the joint curricula.

2.3 Design Thinking in sustainable data collection

Many vocational, educational and training organisations are calling notice to the need for urgent changes in curricula and learning methods demanded by the continual technological and social changes that are facing the entire EU. Design Thinking is seen today as a method and a process for investigating open and ambiguous problems, acquiring and analysing information, identifying opportunities for innovation, experimenting with new perspectives and imagining new concepts. Design Thinking is an essentially learner-centred, multidisciplinary collaborative, positive and experimental process that importantly brings together all facets of the VET systems and its stakeholders. Its thinking style is characterised by dualistic reasoning, creative thinking, playfulness, reframing and a holistic view. For these reasons it is suitable for a 21st century VET provision.

"The Design Thinking model with its emphases on empathy, creativity and a learner-centred approach, is a valuable tool in doing just that."

The Design Thinking approach will provide VET regional stakeholder groups with the necessary guidelines and support to develop strategies and programmes with the goal of improving learning, skills competences in smart manufacturing. In the much of the traditional educational system, information and knowledge transfer were all focused on one protagonist, namely the teacher. This style of learning was a rather passive process with much learning left essentially to the learner themselves. However, at the beginning of the 20th century and through constructivism approaches on education philosophy, responsibility for the learning process shifted towards the learner. Changing existing educational programs and redesigning them for personal improvement of each individual learner is an extremely difficult and costly process, one which could be said is economically unviable. The Design Thinking model with its emphases on empathy and a learner-centred approach can be a valuable tool in improving the VET system, providing a VET provider with the necessary guidelines and support to develop strategies and programmes which the goal of improving learning and skills competences not only in smart manufacturing but an entire VET curriculum. Furthermore, an objective of the Talentjourney project is to be able to provide the methodological recommendations to assist teachers and learners to develop

strategies, processes or which will support their pursuit for positive experiences and life-long learning, the Design Thinking process can cascade its way from curricula to classroom equally as well.

Research conducted within Talentjourney shows that senior management of VET institutions have the topic of ideation on their minds in the development of curricula in general. When asked to respond how they would implement the concept of ideation into the curricula development of their VET institution (thus assuring user-centricity and sustainable curricula), representatives from senior management responded, in large, that such design and implementation of the curricula would have to be carried out in unison and collaboration with industry.

For example, the Tallinn Polytechnic School (Estonia) are using continuous improvement process in which all members of the institution can provide input to curriculum development; at least once in a year all content is reviewed and new ideas can be implemented. The Italian VET school, I.S.I.S. A. Malignani, implements the concept of ideation into the curricula development through exchange of ideas among members of the middle management, who in turn have previously brainstormed with groups of teachers and/or external stakeholders. The learners themselves are regularly invited to provide insights and ideas into curricula development. Sataedu from Finland has reported that the core of the curriculum comes from the Ministry (government), and local aspects of the curricula are developed by an internal committee composed of teachers, principal(s) and learners. Companies and the student union are also regularly invited to give feedback.

In Slovenia, on the other hand, design thinking in VET curricula is possible only in the so-called open curriculum, which amounts to 20% of the curricula. The Šolski center Kranj (Kranj School Centre) develops and implements this open curriculum together with companies to assure it is relevant to industry. This being said, the school does not implement the concept of design thinking into the creation of the curriculum as much as they would like, as the school system is rather rigid in the way of implementing new strategies. The Šolski center Kranj has already led some projects in this field, however, so they do have basic knowledge of establishing user-centred curricula, but this must then be translated to teachers and implemented in the school work. The biggest responsibility, therefore, is on teachers and they require more training in the field of design thinking.

The feedback of VET providers has led to another interesting finding from this research, which is that the role of the teacher should be reconsidered in the development and implementation of the curricula. Senior management representatives had suggested that teachers themselves should undergo design thinking processes, even if they are responsible for the delivery of such curricula.

Finally, Design Thinking workshops, taking form as digital workshops with aspects of physical meetings, such as breakout rooms and collaborative work on digital platforms, have contributed to the concept of sustainable data collection within Talentjourney, which can be observed from two approaches. Because a digital space is used in place of physical meetings, such intensive digital workshops offer a low carbon solution to traveling great distances to meet face-to-face – yet with enough planning and engagement, they allow for the core outcomes of the workshops to be achieved. From another approach to this concept of sustainability within data collection, digital design thinking workshops that incorporate the learners themselves – the centre of the Talentjourney curricula and platform for VET excellence in IIOT/smart manufacturing – which confirms user-centricity of the platform from the early stages of its development. This, in turn, ensures the needs of the users are at the very basis, or core, of the platform throughout the entirety of the development and its implementation on a transnational scale, ultimately safeguarding the sustainability of the Talentjourney curricula and platform well beyond the project lifetime.

2.3 Design Thinking and data

Data and education go hand in hand, especially over the last generation.

However, in regards to design and vocational education and training, understanding the connection is not so instinctive. The Talentjourney report 2.3 on the ideation of a transnational joint curricula provides a detailed analysis of Design Thinking; it is important to firstly consider how it is possible to use data in the design of a new transnational joint curricula in smart manufacturing.

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The process of Design Thinking can vary depending on what model you consult, but Design Thinking generally fits into something like the framework outlined below:

1. Empathise. Work to understand the Talentjourney audience - who the Talentjourney audience is, what are their pains, problems, attitudes, and what they want to accomplish at an emotional level beyond the transnational joint curricula and data collection.
2. Define. Define the problem that Talentjourney is going to solve in the context of the pains and challenges uncovered in the empathy discovery. This leads to a problem/challenge statement for Talentjourney.
3. Ideate. Come up with a bunch of different ways to solve the problem.
4. Prototype. Turn the ideas into the lowest possible reliability test that Talentjourney can execute and still get clean data. This stage usually cuts the ideas down as problems are discovered.
5. Test. Get the Talentjourney prototypes in front of leaners and vital stakeholders and see what feedback they provide.

"Understanding the learner cohort is not a new suggestion."

As demonstrated by research conducted within Talentjourney, VET providers have always tried their best to understand the learner and their needs. This has helped providers of vocational education and training to create curricula that their communities and learners would enjoy – but are the needs of industry and other stakeholders taken account of in this construct? Design Thinking, in the context of Talentjourney with its regional stakeholder centricity, is a natural fit with new developmental VET concepts.

2.4 Determine capacity for sustainable data collection

Through multiple partner meetings, it was made clear that all Talentjourney partners were responsible for completing or overseeing the completion of multiple tailored questionnaires were developed for three main target groups of the Talentjourney joint curricula: senior management of VET institutions, VET teachers/instructors and companies involved in smart manufacturing. Representatives from VET institutions and relevant companies involved in smart manufacturing were prompted to answer specific questions related to the implementation of the joint curricula in their various contexts. These questionnaires were distributed across the Talentjourney partner countries (SL, FI, EE, DE, IT) and provided data that supports the intensive desk research conducted in relation to this report.

Is the Talentjourney joint curricula for your institution only one project or do you intend to include its implementation in your strategies/policies?

5 responses

- Yes
- No
- We are offering many of our on going trainings for Talentjourney. So kind of YES
- Although we are not a VET provider as such, we think that TalentJourney joint curriculum as part of TalentJourney digital Platform for CDS VET excellence could be included in our strategies. W…
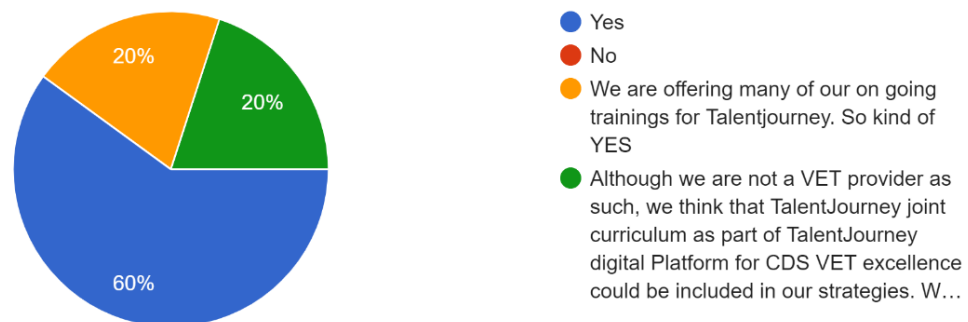
Figure 2. Inclusion of the Talentjourney joint curricula in VET institutions' (Talentjourney partners') strategies

In a tailored questionnaire conducted within Talentjourney, representatives from senior management of VET institutions were asked how they would assure inclusion in the involved partners' strategy and internationalisation policy for the joint curriculum developed within Talentjourney. 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.

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 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. The module can be then 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.

"How will you assure inclusion in the involved partners' strategy and internationalisation policy for the joint curriculum developed within Talent-journey?"

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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 curricula 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.

''How do you envision the implementation of a joint curriculum, i.e. collaboration with vocational education and training providers?''

In 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 a structure for sustainable data collection and joint curriculum implementation should be established.

Further, when representatives from companies in partner regions were asked if they were aware of relevant national and institutional/employers' regulations of involved Talentjourney partners regarding implementation of joint curricula, all companies responded that they were unaware. While most companies surveyed clearly value the development and implementation of a Talentjourney joint curriculum, through which open discussion and collaboration with VET to ensure relevance to industry needs, there still appears to be a disconnect between VET providers and companies involved in Talentjourney; e.g. some companies were unaware entirely of their role in the development and implementation of a joint curriculum. Only through open and clear communication between the Talentjourney consortium and industry leaders can an effective joint curriculum be established. This is an important finding to be implemented in future work by partners within Talentjourney, especially in the long-term rollout of the Talentjourney Platform.

To combat lack of engagement, sustainable support can be provided by the participation of mentors from companies in the process of teaching modules, which is a key finding of this report. According to the Šolski center Kranj (Kranj School Centre), their school has committed to meeting at least once a year at the local level with teachers and mentors from companies, and at least once a year at the global level, to refresh the curriculum. Throughout the process, they will monitor the quality of implementation at all stakeholders and make an action plan for improvements, which we will monitor and upgrade every year.

Partners from ECIPA S.C.a R.L. in Italy suggest that participation in the continuous updating of research about skills needs–especially job-related skills; Industry 4.0 and digitalisation skills–and digital opportunities would be their role in assuring sustainable data collection and thus support the development and implementation of the joint curriculum. They also suggest their contribution to the development of the platform ecosystem driven by the Platform for Industry 4.0/VET Excellence would assure sustainable support of the joint curriculum.

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Also proposed by ECIPA to assure the sustainability of the Talentjourney methodology was effective dissemination and promotion activities to key stakeholders; for example, initiatives to share the results of the new curriculum and to promote it among relevant SMEs, industry, VET and social partners. Updating of the Talentjourney Platform for VET excellence with relevant news and information will also be conducted.

If there are users of the joint curricula, it will sustain itself, according to the Tallinn Polytechnic School in Estonia. For an attractive curriculum, there will always be resources put into to further develop it and keep it up-to-date. This being said, the funds of the Talentjourney project will not suffice in terms of financing the implementation of joint curricula. Within Talentjourney, the partners will only pilot the curriculum; they must think in advance as to how they will follow up on the project.

The Šolski center Kranj (Kranj School Centre) in Slovenia notes that they will use a combination of their own funds, EU funds, contributions from companies and contributions from the learners themselves to finance the implementation of the Talentjourney joint curriculum. SAMK in Finland hopes companies will join the joint curriculum initiative pro bono, in addition to using their own funds and EU funds. The Tallinn Polytechnic School in Estonia plans to utilise only EU funds as well as contributions from companies.

2.5 Data Collection – Use for sustainable programme design

When used effectively, data can have a profound and positive impact on an educational system. Data can support teachers to teach through novel technologies such as AR/AI. Data can improve VETs' abilities to focus on the right issues, or help ministries and governments to understand how the VET system is performing in providing relevant skills to industry. Too often, however, the collection of data becomes the emphasis itself, divorced from the core purpose of improving skills development provided by the VET system. Data for data sake, however, can increase the workload of VET leaders and staff for little obvious benefit.

Interviews and desk research conducted by Talentjourney suggest that data collection should have a clear purpose, that in providing a sustainable, relevant transnational joint curricula, the collection of data should use a process that is as efficient and efficient as possible.

This report found that partners from the Talentjourney consortium would rather not focus on what is possible in collecting data, but rather challenge themselves on what data will be useful and for what purpose, collected with the minimum amount of data required to help them evaluate how they are doing. Decisions about the identification, collection and management of data should be grounded in sound robust educational principles. In this way VETs can have greater freedom to balance professional autonomy and agency against the demands of the accountability system.

During the creation of this report authors looked at how data is collected, analysed, interpreted, and presented throughout the VET system, from the individual teacher in the Talentjourney, through to the national and EU data systems.

This report outlines some common overarching principles that should apply to all data systems; however, the below is in the context of the sustainable transnational joint curricula:

1) Be streamlined: eliminate duplication – collect once, use often
2) Keep simple: only collect what is needed to support outcomes for learners
3) The amount of data collected should be proportionate to its usefulness. Always ask why the data is needed, does it have a real output?
4) Focusing on key performance indicators (KPIs) reduces the burden of assessing every module objective. This also provides the basis of next steps: are learners on the transnational curricula secure and can they move into employment, are they deemed competent?
5) Collect data that is purposeful, valid, and reliable in the context of sustainability of the transnational joint curricula – this should be done by consensus across the partnership
6) Ensure that all members of regional stakeholder groups and system commit to the principles in this report

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3.0 Identifying common data needed

A summary of skills needs, gaps and shortages in IIOT/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
- Industrial IOT (IIOT)

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.

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 demonstrated through research conducted within report 2.1 on skills gaps in Industry 4.0/IIOT in smart manufacturing, 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 – it does serve, however, as the foundations 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 for highly specialised employees, limiting the opportunities for educational transfer even within a field such as smart manufacturing3. 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.

Therefore, technical skills requirements should be co-created with industry with the accompanying STEM/meta skill enhancements coming from CoVEs, the following necessary IIOT/ 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 cyber-technologies 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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3.1 Data-driven labour market intelligence

Automation, in tandem with the COVID-19 recession, is creating a 'double-disruption' scenario for employees currently working in manufacturing. In addition to the current disruption from the pandemic-induced lockdowns and economic reduction, technological adoption by companies will transform tasks, jobs and skills in the very near future. Businesses surveyed indicate that they are set to reduce their workforce due to technology integration with some indicating that they plan to expand their use of contractors for task-specialised work, outsourcing. Other employers plan to expand their workforce due to technology integration. A significant share of companies expected to make changes to locations, their value chains, and the size of their workforce due to factors beyond technology in the near future.

"Skills gaps continue to be high as in-demand skills across jobs change in future years."

The top skills and skill groups which employers see as rising in prominence include groups such as critical thinking and analysis as well as problem-solving, and skills in self-management such as active learning, resilience, stress tolerance and flexibility, basically all fall into the meta skills, as outlined in the Talentjourney report 2.1.

Based on findings from report 2.1 on skills gaps in IOT/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 skills and STEM skills at national/regional/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 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.

A summary of skills needs, gaps and shortages in IOT / SM 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
- Industrial IOT (IIOT)

3.2 Matching skills that add value

In order to build capability in the labour market to meet future skills and labour needs in Smart manufacturing (and other engineering-intensive industries) the promotion of Science, Technology, Engineering, and Mathematics (STEM) education, learning and training will be fundamental.

Having a vocational education and training (VET) system that is attractive to the smart manufacturing industry and learners is important. If the VET is not attractive to industry and learners, it is unlikely to satisfy its societal and economic objectives; it must meet both current and future skill needs of industry and individuals alike. One of the major shifts in the early 1990s was the move to a competence-based model of VET provision1. This approach, allied to professions/occupations, potentially creates a tension between providing training that is related to one particular profession and makes the trainee/apprentice ready to work in that profession, and providing training that is less occupation specific but provides increased opportunity for mobility. The latter approach has a stronger focus on transversal skills and career adaptability (the ability to apply your skills, knowledge and understanding in a variety of contexts).

Research conducted by Talentjourney indicated a potential result of allowing industry to have a central role in design that it could lead to a creation of relatively narrow occupational standards with respect to smart manufacturing; this requires careful consideration. Such occupational standards required across the smart manufacturing sector may not provide the breadth of learning that will afford a degree of protection to the learner and/or the employer from the forces that lead to skills undesirability (for the learner) and skills shortages (for the employer). Some employers in standard-setting bodies may recognise the importance of the development of transferable skills, but they may also be concerned that this could increase the likelihood that too many learners choose another career direction—rather than staying in the smart manufacturing sector for which they initially trained.

It was recognised by employers interviewed that an attractions for industry of providing apprenticeships is the degree of influence they have over the training delivered; ultimately this will be a benefit to that industry and will make employers competitive in a global market. This is especially true in the smart manufacturing sector.

Although there are specific curricula to be followed, while an apprentice is in the workplace the employer has a degree of flexibility in deciding how skills are learned and used in practice. This might be regarded as an essential ingredient that will ensure an apprenticeship is tightly tied to the demand for skills in the labour market. It then relates to a wider set of issues about the extent to

which the social partners – particularly industry – are engaged in design and delivery of the Talentjourney transnational joint curricula.

The window of opportunity to reskill and upskill employees has become shorter in the newly constrained labour market. This applies to employees who are likely to stay in their roles as well as those who risk losing their roles due to rising recession-related unemployment and can no longer expect to retrain at work. For those employees set to remain in their roles, the share of core skills that will change in the next five years is 40%, and 50% of all employees will need reskilling.

3.3 Trends in smart manufacturing

The European Commission has defined six priority Key Enabling Technologies (KETs) for Europe[2]. The Commission has reported that mastering these technologies is regarded as crucial for ensuring the competitiveness of European industries in the knowledge economy. KETs enable the development of new goods and services and the restructuring of industrial processes needed to modernise EU industry and make the transition to a knowledge-based and low carbon resource-efficient economy[3].

IOT/IIOT and connected devices are the single most important drivers of innovation and growth for national and regional economies across all sectors. More than 75% of the value added created by the Internet is in traditional industries. Fifty-five percent of ICT practitioners work outside the ICT sector itself. Given the aforementioned evidence, the purchase of ICT equipment, software and broadband is not enough.

Attaining the objective of enhanced use of IOT and the associated connected devices in manufacturing requires a combination that includes measures to improve digital skills.

"Embracing the Fourth Industrial Revolution has become a defining factor for competitiveness. I foresee a new global divide between countries who understand innovative transformations and those that don't. Only those economies that recognise [its] importance will be able to expand opportunities for their people."

- Klaus Schwab, World Economic Forum's Global Competitiveness Report[4]

The manufacturing industry is a strong asset of the European economy, accounting for 2 million enterprises and 33 million jobs. Europe's competitiveness is highly dependent on the ability of this sector to deliver high-quality innovative products using the latest advances in ICT. Manufacturing accounts for 16% of Europe's GDP. The sector is responsible for 64% of private sector Research & Development expenditure and for 49% of innovation expenditure in Europe[5]. Industry 4.0-based solutions applied across the manufacturing value chain will help to make processes more efficient, but companies will require support in doing this. It is very apparent that the internet will enable the creation of more personalised, diversified and mass-produced products as well as flexible reaction to market changes; these changes will require a new set of skills in the transition phase. Smart manufacturing uses comprehensive digital innovations—such as AI, IOT, modelling and simulation and big data analysis, to name but a few—and many of these skills are emerging ones and are not plentiful in number. Therefore, Centres of Vocational Excellence will need to equip themselves appropriately in people and physical resources accordingly, in an effort to meet the demands of consumers and industry.

The flagship initiative of the Europe 2020 Strategic Policy[6] sets out a strategy that aims to boost growth and jobs by maintaining and supporting a strong, diversified and competitive industrial base offering well-paid jobs while becoming less carbon intensive. The strategy puts forward a wide range of actions, mixing broad cross-sectoral measures and actions for specific activities. Among the proposed actions are: the creation of framework conditions for sustainable supply and management of domestic primary raw materials; improving resource efficiency by addressing sector-specific innovation performance—for example, in smart manufacturing technologies—and addressing the challenges of energy-intensive activities through actions to improve framework conditions and support innovation. The implementation of this policy uncovers gaps in the skills to fully make it successful, and Talentjourney shall use this report to identify such, allowing future curricular developments. Many member states have taken their own initiatives in the transition towards smart manufacturing, focusing on resource efficiency, etc.— Finland was the first country in Europe to publish a national AI strategy in 2017. Yet it is true that no one country could fulfil the policy requirement of Europe 2020 by itself.

A second report[7] was published in June 2018 and a final version on SMEs will be published this April. Finland, Sweden and Estonia plan to partner to become Europe's top laboratory for AI test trials; this strategy will no doubt uncover new skills that are required within the smart manufacturing sector in Europe.

Employees help companies realise their digital transformation and are the ones most affected by the changes of the digital workplace. Their direct working environment is altered, requiring them to acquire new skills and qualifications. It is critical that companies prepare their employees for these changes through appropriate training and continuing education, so companies require to be informed appropriately. Readiness in the dimension of employees is determined by analysing employees' skills in various areas and the company's efforts to acquire new skill sets that are required to make the companies competitive in the global marketplace.

3.4 Green skills related to sector

Market failures in meeting demand for green skills are linked to the finding that the level of demand for green skills does not correspond with growth towards a green economy and that there is a mismatch between demand and the skills needs that might be expected. This latent demand is not being clearly articulated by many employers, as they may be unaware of these themselves. Consequently, "demand-led" skills development systems face difficulties to respond adequately to business needs[8]. The changing skills content in established jobs and the emergence of new green occupations will require responsive strategies to be adopted by VET providers. Most of the work will need to be done in upgrading the current workforce with basic green skills and environmental awareness[9].

The first step to proceed with the green upskilling of the workforce is to provide basic green skills in order to increase workers' employability and productivity. Basic green skills include transferable green skills, also technical, which can be applied across industries and occupations. This process of upskilling could be implemented by VET providers by the adoption of innovative green skills training programmes[10].

In providing advanced green skills, new learning methodologies should be sought that embrace technological learning environments, facilitated by IOT/IIOT. However, it is recognised that new green or even blue economy occupations might require completely different training programmes and university degrees[10]. Talentjourney shall consider this in regards to smart manufacturing skills and VET programmes. The responsiveness of VET providers in addressing green skills gaps and shortages also depends upon the adoption of quality and effective green skills anticipation mechanisms, with accurate labour market intelligence assisting with this[10].

While most of EU Member States do not have yet a green skills anticipation system, some countries are moving towards this. Estonia, for instance, recently introduced a comprehensive approach to green skills. In the implementation of skills anticipation systems, the Ministries for Labour and Education involve sectoral experts and stakeholders – for instance, representatives of employers – belonging to green industries. This helps in structuring adequate and forward-looking curricula capable to address future skills gaps and shortages[11].

The few green skills anticipation systems currently operating in the EU basis on regional cooperation, directly involving local VET providers in the development of new green qualifications and curricula. Regional cooperation appears more important in the provision of training than in green skills anticipation systems per se. However, regional training provision often involves elements of labour market intelligence. In France, the regional observatories for employment and training (OREFs) regularly release reports on green jobs and skills.

In Spain, the National Observatory of Occupations has a regional network. Green skill gaps are analysed by regional groups of experts[11]. Another feature of green skills anticipation systems is being sector-based, involving professionals and experts from specific green industries, hence being demand-led systems. Examples are Estonia, France, Spain and UK[11].

In the UK, for instance, most skills anticipation exercises are carried out by sectoral bodies, such as the sector skills councils (SSCs). SSCs' assessments of labour market intelligence were also provided for emerging green sectors, which helped the UK Commission for Employment and Skills to deepen its understanding of the green economy. An example is the 2013 RenewableUK report that provided an analysis of the total employment in the renewables sector[12].

As previously mentioned, companies are not always fully aware of the scope of the transition to a green economy and do not always clearly articulate their green skills needs. Therefore, VET providers should be involved in the work of skills development systems in order provide their insights.

The involvement of professionals and experts working in the private sector is essential also in delivering the learning opportunities. VET providers' capacity and the quality of training programmes are not always adequate and the availability of qualified teachers with relevant green knowledge is scarce. In Germany, for example, some inter-company vocational training centres (e.g. Überbetriebliche Bildungszentren) develop and provide new advanced green skills programmes to companies, in particular SMEs[13]. Furthermore, the partnerships between VET providers and private sector could be beneficial in reducing the cost of training for companies in transferable and expansive-to-develop green skills, particularly when considering STEM green skills. Indeed, despite this high cost of training for companies, subsidies and incentives targeting the private sector are not present[11].

This presents an opportunity for collaborative working with VETs and private sector companies to share technological resources, as well as knowledge, to improve the skills output and to reduce cost of delivery.

Therefore, the close involvement of all stakeholders concerned is key for an effective response system to green skills demand. Three types of response models were rated the most effective. First, "demand-led" skills development systems are capable of supplying skills matched to current demand. Second, public-private partnerships in VET have proved to be effective in triggering green change on a larger scale. Third, multilevel skills development responses have been considered the most effective.

Joint initiatives involving companies, VET providers, universities and research institutes, professional associations and NGOs, raise environmental awareness both on the consumption side and the production side[10].

Talentjourney will consider all of the above and will build a cooperative EU ecosystem of educational stakeholders. Also, so far there has been little or no consideration of the gender balance in filling new green occupations[12]. Talentjourney will support the engagement of the female workforce in greening the EU manufacturing sector, especially with regard to STEM green skills.

In a questionnaire to VET teachers of VET institutions across the Talentjourney partnership, VET teachers were asked if their organisations currently deliver green skills; for example, sustainability, resource efficiency, circular economy, etc. Most responded that green skills were currently offered, but at the basic level.

Some teachers were aware of modules related specifically to environmental protection, renewable energy solutions, and ergonomics, and that in some other less specific modules, teachers are giving some emphasis on the topic. One respondent from replied that currently they exchange know-how and special skills by increasing teacher mobility, use supplies and rarely needed measuring devices in collaboration with each other and that anything that can be recycled is recycled as much as possible. About half of the respondents were unaware of any specific modules or activities related to green skills, despite the current need for green skills in the future of IIOT/smart manufacturing.

3.5   Data about the influence of new era society on working people

By 2025, two billion of the global population will consist of the youngest generation: Generation Alpha - the iGeneration.

Generation Alpha is defined by those born between 2010 and 2025[14]. Generation Alpha use IOT technology, such as smartphones, tablets and other AI/AR devices naturally. Their reality has always included the concept of the Internet or AI/AR in the form of smartphones and video games. Some of them live in smart homes and speak with smart voice assistants, such as Amazon's ''Alexa'' or Apple's ''Siri'' as a part of their daily routines. Consequently, the workplace organisation will move towards a more agile ways of working, with corporate structure having less hierarchy and an increasing use of independent contractors and freelancers[15]. The workplace will also have to become a purpose-driven and authentic environment, reflecting renewed values. It will have to meet three basic human needs, augmented by younger generations: autonomy, sense of belonging and mastery[16].

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Autonomy can be defined as the need for control and ownership over decisions and outcomes. This can be achieved by allowing a decentralised working environment and more opportunities for decision making. Sense of belonging represents the need for a deeper connection and shared experience with colleagues, sharing common values. Mastery mainly refers to the need for self-improvement. The workplace needs to become a place for lifelong learning and skills development to allow employees to feel empowered. Indeed, new generations value current employability over long-term employment. Companies are increasingly accounting for this and taking responsibility for talent and skills development[17].

A purpose-driven workplace needs to reflect the intrinsic values of the younger generations – corporate social responsibility towards climate change and circular economy being an example. Indeed, Generation Z has placed a great importance on societal impact of businesses and on their ethical behaviours with respect to all stakeholders[18]. According to Deloitte (2020)[14], 70 percent of businesses that have moved towards Industry 4.0 are increasing profits while contributing to society.

Generation Alpha is accustomed to gaining knowledge and insight through learning-by-doing, screen-touching and using digital tools. Therefore, education institutions should prepare for the influx of Generation Alpha by providing adequate learning environments, complete with digital tools and creating programmes of study that enhance this type of ''deep learning''[14].

When surveyed through the Talentjourney project, various stakeholders (companies) involved in smart manufacturing offered the following suggestions to the change in workplace culture due to Generation Z as well as future generations, such as Generation Alpha:

- Introduce a flexible and agile way of working (co-working, remote working, etc.)
- Increase the number of external contractors and freelancers to get specific tasks done
- Create a purpose-driven and authentic environment based on shared values (e.g. corporate social responsibility, ethics, etc.)
- Establish a lifelong learning culture
- Develop a cooperative approach to work (e.g. project based, teamwork, etc.)
- Introduce less hierarchy; enable the decentralisation of decision-making

Talentjourney will take into account the beforementioned future implications for the smart manufacturing sector and skills development systems stemming from the new era society. Specifically, Talentjourney will take into consideration the needs and expectations of the future workforce when structuring innovative curriculum offerings.

4.0 Process of collecting data

The goal of this report is to explore how Talentjourney is ensuring sustainable data collection – but also how they are using this data to create change rather than using data for data sake. This report is to follow up on a previous report on skills gaps in Industry 4.0/IIOT in smart manufacturing, but especially from this report it is clear that technology advancement calls for continuous updates of such reports in order to make valuable insights on labour market and skills data. Therefore, the process of collecting skills data (i.e. the mechanisms and methodologies that could offer us every year an update of skills needs in Industry 4.0/IIOT) must be established to assure that the latest knowledge is delivered through VET (i.e. excellence in VET).

Furthermore, key to the development of the joint curricula and platform and thus ensuring excellence in VET training is user-centricity. Interactions that occur within regional and EU-wide ecosystems in the area of Industry 4.0/IIOT in smart manufacturing have a significant impact on the learner and on their education. Therefore, interviews conducted by partners with regional VET providers (management and teachers), as well as with companies, as well as desk research conducted on national and EU levels provide the basis of this report. The use of this design thinking methodology has played a vital role in exposing insights in the development of the joint curricula; in turn, this allows for the sustainability (i.e. relevance) of the Talentjourney joint curriculum and platform and concept as the very design, or foundations, of the joint curriculum and platform is centred around the users themselves.

Interviews and questionnaires, collected digitally so data could be easily extracted into Excel worksheets and analysed for trends, provided an empathetic and more personal approach to questionnaires developed within the scope of this report.

Talentjourney's quest for excellence in VET is supported by the development of a platform that is focused on users, follows the trends of technology, provides relevant content to acquire the knowledge and skills that companies need, and takes into account the pre-existing pedagogy and professional development of the teachers and lecturers.

Therefore, the structure of the questionnaires – aimed at VET management, VET providers/teachers and companies – were based on the seven indicators of vocational excellence established by the ETF's Network for Excellence (ENE), which, according to previous research, are particularly relevant to schools and centres in the ENE:

- Education-business collaboration and cooperation
- Pedagogy and professional development
- Autonomy, institutional improvement and resources
- Lifelong learning in VET
- Smart specialisation – mobilising innovation, ecosystems and SMEs
- Industry 4.0 and digitalisation
- Going green – supporting sustainable goals

For the purpose of this report and the subsequent development of the Talentjourney joint curricula, a particular emphasis is placed on digitisation and green skills.

Desk research also forms the backbone of this report, through which credible sources on vocational excellence are referenced. Before delving into local and regional level VET, background research is conducted on the national, EU and global level, referencing reports of Cedefop, PwC, Deloitte and so on. For example, country specific skills forecast reports by Cedefop offer quantitative projections of future trends (factoring in various demographical data) in employment by sector of economic activity and occupational group. According to Cedefop, these reports combine international data and a common methodological approach to allow for cross-country comparisons about employment trends in various sectors, occupations and qualifications, and the forecasts and methodologies are validated by a selected group of national experts.

Interviews and questionnaires used in the Talentjourney research found that VET providers need to keep pace with labour market needs. Furthermore, the distinct differences between some but not all Talentjourney partners make it difficult for employers in each region to identify the skills and qualifications an individual has obtained in another EU region.

A poor understanding of qualifications and skills competencies across the EU obstructs labour mobility. It is imperative that new shared data driven digital tools are devised to bridge this communication difference between the VET providers and employers in the supply chains of smart manufacturing.

4.1 Observations on existing databases

The European Skills, Competences and Occupations (ESCO)[19] works as a dictionary, describing, identifying and classifying professional occupations and skills relevant for the EU labour market and education and training. Those concepts and the relationships between them can be understood by electronic systems, which allows different online platforms to use ESCO for services like matching jobseekers to jobs on the basis of their skills, suggesting trainings to people who want to reskill or upskill etc, hence it is future focused and allows VET providers to understand the relevance of their education and training programmes. The objective of ESCO is to support job mobility throughout Europe and therefore a more integrated and efficient labour market, by offering a shared understanding on occupations and skills that can be used by various stakeholders on employment and education and training topics.

Europass is a European Union initiative to increase transparency of qualification and mobility of citizens in Europe. As a free online tool offered in all European languages, Europass aims to make a person's skills and qualifications clearly understood throughout Europe. Since 2012, individuals have been able to assemble all Europass documents in the European Skills Passport to create a personal record of their skills, qualifications and experience, receive personalised course suggestions, prepare and keep track of applications, design custom CVs and cover letters for different courses and studies, and store all files in one secure location. The five Europass documents include the Curriculum Vitae (CV), Language Passport, Europass Mobility, Certificate Supplement, and Diploma Supplement.

Also, at the EU-level is the Skills Panorama platform, which aims to help policymakers, policy-experts (making decisions mainly on education, training and employment issues), researchers and guidance practitioners remain informed of the latest developments and trends related to skills and labour markets in the EU. Skills Panorama ''aims to foster the development or improvement of skill needs assessment and anticipation'', allowing VET systems to become more responsive to labour market needs, matching skill supply and demand across the EU.

RefterNet a network of institutions created by Cedefop in 2002 to provide information on national VET systems and policies across Europe, has established a VET in Europe database on national VET systems, which helps policy makers, social partners, researchers and other stakeholders better understand similarities and differences of national VET systems through easy-to-navigate up-to-date descriptions that are structured by theme. The database also contains detailed information about each VET programme type, including qualification levels, share of work-based learning, providers, target groups, etc.

The European Centre for the Development of Vocational Training (Cedefop) publishes skills forecasts reports per EU member state every few years, which are available for public consumption on their online depository – along with various other highly relevant and insightful reports and country-specific data on demographics of skills, skills gaps, skills matching, impact of trends such as industrialisation and AI on skills, and so on. Cedefop has published skills forecasts reports per EU Member State for 2019, which summarise the key future trends in jobs and skills for each EU Member State up to 2030. The skills forecast country reports provide an in-depth look into employment trends by sectors, occupational groups and educational levels in addition to offering key demographical insights of job markets. According the Cedefop, implications for future labour market imbalances (i.e. skills gaps) can be drawn when demand and supply are looked upon in unison.

"Where do you go to find valuable data?"

The 2018 Cedefop skills forecast report for Slovenia has demonstrated that there will be a significant sectoral shift toward the business sector and the increase in manufacturing, which will in turn hike up demand for high-skills occupations such as information and communications technology (i.e. IIOT) professionals and for more low/medium-skills occupations such as stationary plant and machine operator and handicraft and printing workers[20]. In other words, there is expected to be an increase in the demand for skills related to IIOT/smart manufacturing. In a Cedefop skills forecast report for Slovenia conducted for 2020, however, all sectors apart from manufacturing and primary sector and utilities are expected to see employment growth in the short term (2018-22) and longer term (2022-30)[21]. Skills forecast reports should be regularly monitored by VET to assure sustainable data collection and thus positive change in VET.
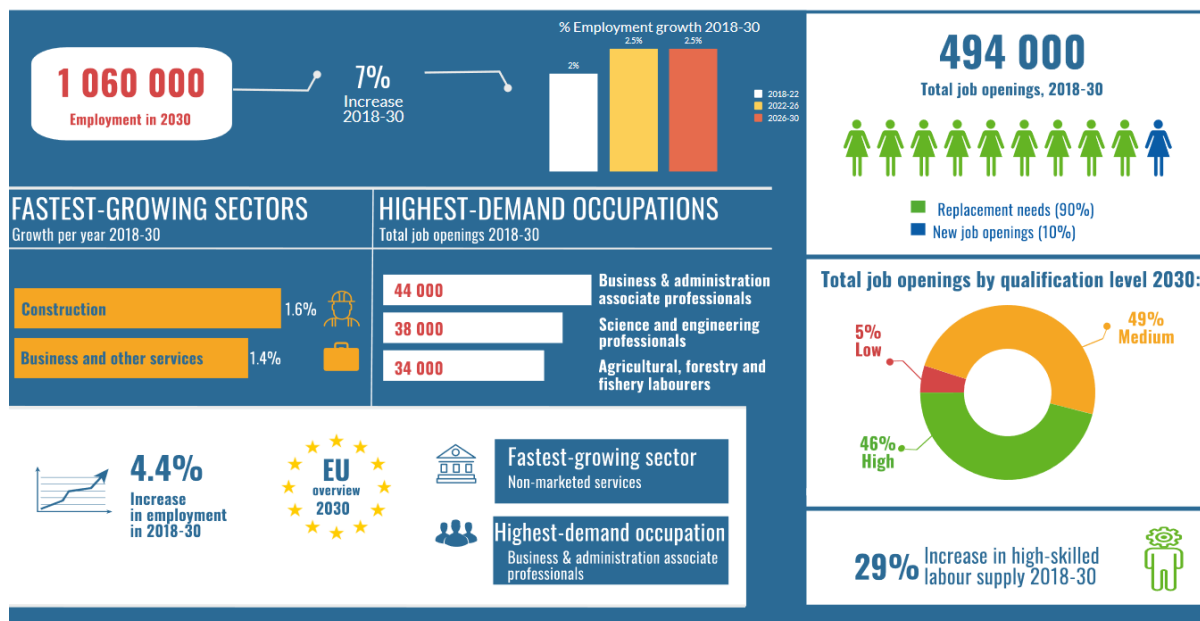
Figure 3. Cedefop Skills Forecast 2020 for Slovenia[21]

Furthermore, the European credit system for vocational education and training (ECVET) serves as an important EU-wide tool for increasing cross-border cooperation in education and training. The aim of the European Credit system for Vocational Education and Training (ECVET) is to:

- make it easier for people to get validation and recognition of work-related skills and knowledge acquired in different systems and countries – so that they can count towards vocational qualifications;
- make it more attractive to move between different countries and learning environments;
- increase the compatibility between the different vocational education and training (VET) systems in place across Europe, and the qualifications they offer;
- increase the employability of VET graduates and the confidence of employers that each VET qualification requires specific skills and knowledge.

In the United States there exists the database, O*NET OnLine, which provides detailed descriptions of the workforce climate for use by job seekers, workforce development and HR professionals, students and researchers. The online platform allows the user to browse groups of similar occupations to explore careers, such careers in STEM, as well as search for occupations that use a specific tool or skill.

In Italy, VET have access to the is the Atlas of Qualifications, which contains the National Directory of education and training qualifications and professional qualifications on a national level. This national directory represents the reference framework in Italy for the certification of skills. The National Repertoire is made up of all the repertories of education and training qualifications, and professional qualifications

issued in Italy (issued by the Ministry of Education, university and research; the regions and autonomous provinces; the Ministry of Labor and Social Policies; the Ministry of Economic Development and the other competent authorities for the certification of competences referring to qualifications of regulated professions; or issued as a result of an Apprenticeship contract). The Qualification Atlas is organised into three sections: second cycle of education; high school education; regional vocational training.

It is important also to note that since 2018, Italy has implemented a National Qualifications Framework (QNQ), a tool for describing and classifying the qualifications issued under the National Skills Certification System, on the basis of EQF. The QNQ represents the national tool for referencing Italian qualifications to the European Qualifications Framework, with the function of linking the Italian qualifications system with the systems of other European countries. Referencing to the QNQ is mandatory for all qualifications for the purpose of validation and certification within the National Competence Certification System. QNQ referencing procedures are managed by the EQF National Coordination Point at ANPAL. It is therefore quite easy to identify how a degree issued by a given school corresponds to each EQF level (there is a correspondence table); however, the situation is a little more complicated when it comes to other qualifications/degrees.

5.0   Analysing data

The labour market refers to the supply of and demand for labour, in which employees provide the supply and employers provide the demand. The labour market should be viewed at both the macroeconomic and microeconomic levels.

Labour market data comprise a key set of indicators for the assessment of the cyclical situation and for macroeconomic and social policymaking; labour market information explains the workplace or labour market. Labour market information describes the condition of the labour market, past and present, as well as future projections. Given the technological revolution, many traditional methods of data collection will be essentially be redundant, thus requiring a new Industry 4.0 labour market intelligence system that is in line with in-demand skill groups. The Industry 4.0 labour market analysis process will require identifying the appropriate labour market(s) for various types of positions, as presented in Talentjourney report.

5.1 Pre-existing data

With the increased digitisation of the labour market and vocational education and training processes, there is a greater amount of big data sources that contain information on occupations, knowledge, skills and competences. Real-time job market data can offer quick and fast insights into the 21st century world of work. Labour Market Intelligence (LMI) helps policymakers, education providers, employers and career guidance make more effective decisions concerning employment policies, curriculum planning, business development, and careers advice.

5.2 Analysing and determination of new skills

To support and offer further insights to intensive desk research on skills gaps in Industry 4.0/IIOT in smart manufacturing, and to ensure user-centricity throughout the Talentjourney project and development of the joint curricula, interviews were conducted with learners, tutors, companies, stakeholders and Talentjourney partners, with the specific regional focus on Estonia, Finland, Italy and Slovenia. When analysed, these interviews were able to provide valuable qualitative and even quantitative data for the purpose of identifying further skills gaps; for example, certain meta skills or subcategories of green skills that were not previously exposed through desk research.

5.3 Preparing data for publishing

Within the scope of this report, multiple designed questionnaires were developed for three main target groups of the Talentjourney joint curricula: senior management of VET institutions, VET teachers/instructors and companies involved in smart manufacturing. Answers were obtained from these groups the implementation of the joint curricula in various situations; for example, how (specifically) they would ensure inclusion in the involved partners' strategy and internationalisation policy for the joint curriculum developed within Talentjourney. These questionnaires were distributed across the Talentjourney partner countries (SL, FI, EE, DE, IT) and provided data that supports the intensive desk research conducted.

The links to the questionnaires can be found below:

- [Talentjourney Questionnaire: Questions for Senior Management](#)
- [Talentjourney Questionnaire: Questions for companies](#)
- [Talentjourney Questionnaire: Questions for VET providers/teachers](#)
- [Revised Questionnaire for Talentjourney VET provider partners](#)

5.4 Defining consequences with new skills identified

In order to stay competitive in a globalising economy smart manufacturing companies have to increase their knowledge and skills to apply and implement Industry 4.0 technologies. The Talentjourney literature review, interviews and questionnaires showed that organisations found it difficult to provide information about the knowledge and skills needed in the future and therefore they are not able to anticipate on future changes; this was not a surprise from an SME context.

A combination of desk research and survey findings of the Talentjourney consortium has demonstrated that strategic developments should provide for the increasing demand for hybrid jobs in smart manufacturing; e.g. employer/industry engagement strategies.

Additionally, further approaches to addressing the increasing demand for hybrid jobs in smart manufacturing across Europe include the co-creation of transnational curricula and resources, allowing individual learning experiences, the use of alternative learning environments and the use of alternative learning tools.

The six modules of the Talentjourney VET joint curricula identified are:

- AI/AR
- Cybersecurity
- Robotics engineering
- Production process development
- Data science
- Industrial IOT (IIOT)

According to the Talentjourney consortium, each learner engaging in the Industry 4.0/IIOT module of the joint curricula will need to enter first the "holistic IIOT module". In the frame of the module, the learner will be able to understand what correlations exist, for example, between AI and robots, or AI to data science, or robots to production process development, and so on. After completing a "holistic IIOT module", the learner will be able to choose other specific modules, such as AI/AR or/and Cybersecurity or/and Robotics engineering or/and Production process development or/and Data science, etc. – all of which are fields in which significant skills gaps are expected in the coming years and can be found in the conclusive report findings of report 2.1.

Finally, it must be noted that the field of Industry 4.0/IIOT in smart manufacturing field is developing at an accelerated rate, year to year. As providers of IIOT knowledge, skills and competences, the Talentjourney consortium must be aware that they will need to be agile and responsive to incoming new trends. For example, when the Talentjourney joint curriculum offers modules on cybersecurity or robotics, the content of these modules will need to be continuously updated as new technologies and processes emerge. Thus, the methodology for designing a joint curriculum should have a necessary level of flexibility that is needed in the joint curriculum development.

6.0 Data collection - Timing for use in Talentjourney

Big data analytics has the potential to transform the approach Talentjourney measures the impact and outcomes of the transnational joint curricula in each of its international learning environments. Enabling the Talentjourney regional ecosystem providers to develop new ways of achieving excellence in learning and teaching and providing learners with new information to make the best choices about their vocational education and training is imperative.

Throughout education, industry, government and third sector organisations, enormous amounts of data are being collected and processed to develop understanding of activities, in an effort to optimise organisational processes and outputs.

The Talentjourney structure requires to be connected digitally and possess a mechanism that allow dual flows of information; this information is to be agreed upon by all Talentjourney stakeholders. It would be advisable to create a governance structure of the entire

Talentjourney ecosystem as well. Various Talentjourney stakeholders will have the understanding or preferences on the most effective and appropriate methodologies for collecting data from specific target group respondents. The perspectives and values that individual stakeholders bring to Talentjourney will be explicitly acknowledged in making decisions about the data to be collected, which is valuable to all involved in the Talentjourney ecosystem.

While some partners of Talentjourney have come to the project with different purposes, there requires to be a mutual understanding amongst all within the Talentjourney ecosystem that the risks involved in data sharing cannot be overcome in isolation. It is very much encouraged that a data sharing agreement (DSA) is produced to de-risk any future misunderstanding. In signing such an agreement, mutual trust across the entire ecosystem should be established. It is recommended that commonalities are identified within the ecosystem, thus facilitating the forging of such a necessary document. It should be noted that Talentjourney's data sharing is regional, national and international, so laws such as the EU's General Data Protection Regulation (GDPR) shall specify additional compliance requirements to the developed DSA.

The significant time and effort spent in engaging and building consensus within Talentjourney shall ensure the sustainability of the transnational joint curricula. It is suggested that the process of

KPI data and methodology of collection is structured by "virtual partner meetings" (VPMs) each month for an initial period of six months. Thereafter, monthly VPM shall suffice, the online meeting lasting not more than sixty minutes in duration.

After the agreement of KIPs and data collection method from all Talentjourney stakeholders, the following should be appraised through big data analysis.

- Has a data sharing agreement been created?
- Have the anticipated outputs, outcomes and impacts KPIs of the Talentjourney ecosystem been identified, validated and understood by all Talentjourney stakeholders?
- Has baseline data been generated before engagement of the pilots; this of course will be used to compare with post-pilot data?
- Do adequate measurement and reporting systems exist to permit all partners to track business changes attributable to stakeholder dialogue?
- Are all stakeholders going to be involved in the monitoring and evaluation of the engagement process? If so, then it is encouraged that the same data access is open to all?
- Can the Talentjourney platform handle the requirement of data collection for the purpose?

7.0 Conclusions

According to various thematic reports the European Centre for the Development of Vocational Training (Cedefop) in 2020, the trend towards further digitalisation – including advancing artificial intelligence (AI) and automation technologies – in European labour markets highlights a ''need for adaptiveness on behalf of vocational education and training (VET) systems, so they can adequately prepare citizens for the challenges of the future of work and equip students with 'robot-proof' skills''[22]. The reports were prepared by ReferNet, a network of institutions created by Cedefop in 2002 to provide information on national VET systems and policies across Europe, and also present examples of VET systems using digital technologies for enabling distance and online student learning, a key requirement following the Covid-19 crisis. As outlined in the country-specific reports, national policy strategies and VET policy programmes/initiatives should be catered toward digitalisation; the use of AI/big data methods for identifying skill needs and recent national initiatives and training programmes for adapting to automation and AI[21] should be taken into consideration.

Further, the increasing trend of digitalisation in labour markets is offering increased opportunities for transformation in current jobs and business models, even in the manufacturing sector. An increased reliance on remote working in light of the global Covid-19 pandemic must also be factored into the development of the Talentjourney joint curricula[23].

Employees in the manufacturing sector change jobs and employers more frequently than in the past, and new skills are regularly needed and geographical and occupational mobility is increasing. Online talent platforms, such as job boards and social media, are transforming the way recruitment takes place; as an illustration, LinkedIn would be a prime location to search for the millennial and Generation Z generations. Employers and job seekers increasingly use digital tools to publish and apply for job offers or to look for and offer training opportunities. Companies and education and training providers need clear and updated information on skills and qualifications to better manage talent and to address skills gaps on education and training programmes. It is recommended that the Talentjourney platform uses contained data and information to promote those learners wishing to entre the world of work; obviously, the promotion of this new regional digital platform will require intensive dissemination, and this should start immediately to prepare employers of this talent service.

As with traditional labour market intelligence (LMI) systems, ESCO needs to be continuously improved to remain an added value for the labour market and VET providers, as new emerging

occupations and skills such as smart manufacturing are requested by employers and changes in curricula are introduced in VET programmes. To address these changes, it is important to share feedback frequently; suggestions and proposals on how to improve the content and management of the classification with organisations using ESCO and other ESCO stakeholders are encouraged. For this the European Commission has organised several "ESCO community fora" to be regularly in touch with different ESCO stakeholders and gather information from them. It is recommended that the Talentjourney is one such hub and feeds into the evolution of the ESCO tool during the implementation phase of the joint curricula.

It is recommended that Talentjouney become part of the community fora of ESCO. It is the conclusion from the Talentjourney report on

''Skills Data Collection for Connectivity Devices and Services (IOT 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, 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. Suffice to say, the pilot implementation of the transnational curricula shall be based on a skeletal model of the above, with sufficient monitoring and evaluation, using data analytics.

7.1 Why use data in the design process?

The advent and evolution of the internet and big data collection and storage mean that now, VET providers can understand their ''customers'' (learners) better than they ever thought was possible.

Data in the design process opens up new frontiers of opportunity. The use of big data can improve quality of delivery (e.g. through digital reflective pedagogical approaches), in turn producing greater expectation in a continuous feedback loop of the Talentjourney process. It is suggested that Talentjourney is expected to deploy big data in the pilot phase of the transnational joint curricula to know and anticipate user needs at

both an individual learner level and also the wider regional stakeholders' level.

Caution has been previously mentioned in having access to big data on literally everything is that separating the valuable from the inferior is incredibly difficult; this will require a transnational consensus. It is known that the

data evaluation will be idiosyncratic to each of the Talentjourney organisations. Fortunately, there are a few essentials that will likely apply to all within the Talentjourney ecosystem – these can be referred to as the agreed outputs or KPIs. It is recommended for Talentjourny to provide a data sharing agreement between all involved in the ecosystem.

Design thinking does not have to be something that only designers or creative organisations use. Anyone can use the framework to drive forward business and educational objectives in tandem. It is recommended that the ecosystem provides a transnational ideation workshop based on the implementation phase of the transnational joint curricula.

Understanding the Talentjourney ecosystem and its challenges, and iterating to solve them would be a sound educational and business strategy. Talentjourney should take an additional step by superimposing the Design Thinking method with big data to drive more meaningful insights, providing a quality product in the transnational joint curricula in smart manufacturing. In doing so, monitoring and evaluation of the transnational joint curricula can be conducted faster and more effectively by all regional stakeholders in the Talentjourney ecosystem. It is recommended that the Talentjourney platform integrates an API for data collection, based on the findings of the transnational Design Thinking workshop. The frequency of educational data and its collection should be by semester (or module) completion; data from other stakeholders in the ecosystem shall be determined by the transnational governance structure which is recommended.

7.2 Findings within the scope of Talentjourney

It is clear from our analysis that there a large number of globally significant opportunities in smart manufacturing markets and will drive a demand for skilled resources for many years to come.

The challenge for Talentjourney therefore is not whether there is a need for skills in smart manufacturing that is to be pursued, but rather how does it do this. Success will require Talentjourney to add something to the mix that makes the offer more attractive than companies or government agencies can present on their own. In addition, to push beyond the immediate opportunities, Talentjourney needs to be cognisant of their global, not local, competitors.

The VET system is positioned both physically and educationally within the local and regional communities. But those communities themselves are ever-changing, reflecting new ideas, cultures and needs; this is true of the four pilot areas of the joint curricula. The concept of change is critical to ensuring that services, curricula and delivery take into account what is needed, given the aforementioned. At the same time, VET providers also bridge a gap between communities and the

local economy, hence the need for their participation in regional stakeholder groups.

VETs provide a local/regional context in which the demographic and economic needs of the region should be analysed.

This will include information about the population, deprivation rates, economic profile including characteristics of the local economy and employment/ unemployment rates, skills and qualifications, all of which requires data collection. Data should indicate how the VETs will help to contribute to economic development and growth in locally, regionally and the EU as a whole, hence it requires to be in tune with policy drivers. This will involve identifying smart manufacturing companies and its associated value chains to determine the methods in which the VET can provide support. Included in this offer should be training and lifelong learning to meet the needs of existing workers for retraining and upskilling. Given the emphasis in each of the respective four pilot areas, national policy and connection of Government/agencies is integral to the Talentjourney ecosystem that address issues associated with social and economic deprivation hence widening access to vocational education and training provision.

During research conducted by Talentjourney. it was found that teachers and support staff often provide successful anecdotal examples of post-program progression into employment or onto further learning at university by previous learners. This practice informs learners and helps them to focus on potential career pathways. However, learners do not benefit from comprehensive data sets relating to previous learner experiences, such as withdrawal or successful completion rates at group level. Talentjourney found that during pre-programme discussions held with applicants across a range of subject areas, focus on positive examples to influence learner programme selection was generally the option chosen. In using such approaches, applicants often make vocational choices without possession of the full facts. These facts or data sets are important, as they relate to their learners selected learning programme and their likelihood of succeeding. Agreed by Talentjourney, large data sets should provide the learner with holistic insights and should be the preferred approach adopted by all four pilot participating partners. Talentjourney should develop common digital enrolment procedures to ensure that learners have a positive experience of their initial experience of this transnational programme. It is recommended that data extends to induction arrangements—also in the development of a common Talentjourney persona, helping all learners settle quickly into Talentjourney. The Talentjourney platform should also incorporate developing creative approaches to capture the views of learners through the use of social networking platforms as these approaches will provide learners with opportunities to express their views in a transnational context; this allows learners to "buddy up" in their respective learning journeys. In doing so, this social data can be used as part of the quality assurance process as it shall allow for evaluation from learners on their learning and broader Talentjourney transnational experiences. The chosen social networking platforms will also provide opportunities for promotion by wider centre life; indeed, it will also disseminate the Talentjourney into other vocational areas.

8.0 Summary of main findings

"Report 2.2 explored how well Talentjourney is prepared for managing and using data to enhance the quality of the learner experience through monitoring, target-setting and planning for improvement in the regional and transnational contexts."

1) Developed methodology

   - Report 2.2 explored how well Talentjourney is prepared for managing and using data to enhance the quality of the learner experience through monitoring, target-setting and planning for improvement in the regional and transnational contexts.

   - The methodology shall evaluate the ways in which participating partners are preparing to use data sets to enhance quality and the learner experience and deliver on commonly agreed Talentjourney outcome agreements.

2) How, when, where and by whom will data be implemented (collecting and data analysing)

   - The complete Talentjourney ecosystem shall provide data to inform of any environmental changes that impact on the programme.

   - A Talentjourney data-sharing group shall be established to address data returns along with other regional data concerns.

   - Some other data sharing agreements and partnership support arrangements shall be put in place.

3) What data will be provided; who will be provided with data?

   - The entire Talentjourney ecosystem shall provide data, it is intended to have an ideation session to determine the exact data do be used.

   - Most Talentjourney partners are not yet clear about the data requirements of their centre in a regional context, although they fully understand their own organisation reporting requirements and arrangements – the data sharing group will prioritise the data set requirement.

4) How, where and when and how often will the data be published

   - The data-sharing group shall determine this – Talentjourney Regional Stakeholder Groups will require, particularly in the early stages of the newly-formed transnational partnership, accurate data sets to evaluate how the model is performing and to identify areas for improvement, essentially a quality assurance process.

   - The Talentjourney outcome agreements shall identify targets, agreed with the lead partner, to meet the needs of learners and smart manufacturing industry in the regions they serve.

5) What/who will be data source(s) and at which level (regional, national, EU, global)

   - The European Centre for the Development of Vocational Training (Cedefop)

   - Cedefop skills forecast reports

   - ECVET – European credit system for vocational education and training

   - European Skills, Competences and Occupations (ESCO)

   - Europass

   - ReferNet

   - Skills Panorama

   - Digital Skills and Jobs Platform of the European

6) Responsibilities of the project's partnership in the process of methodology implementation

   - While most companies surveyed clearly value the development and implementation of a Talentjourney joint curriculum, through which open discussion and collaboration with VET to ensure relevance to industry needs, there still appears to be a disconnect between VET providers and companies involved in Talentjourney.

   - To combat lack of engagement, sustainable support can be provided by the participation of mentors from companies in the process of teaching modules, which is a key finding of this report.
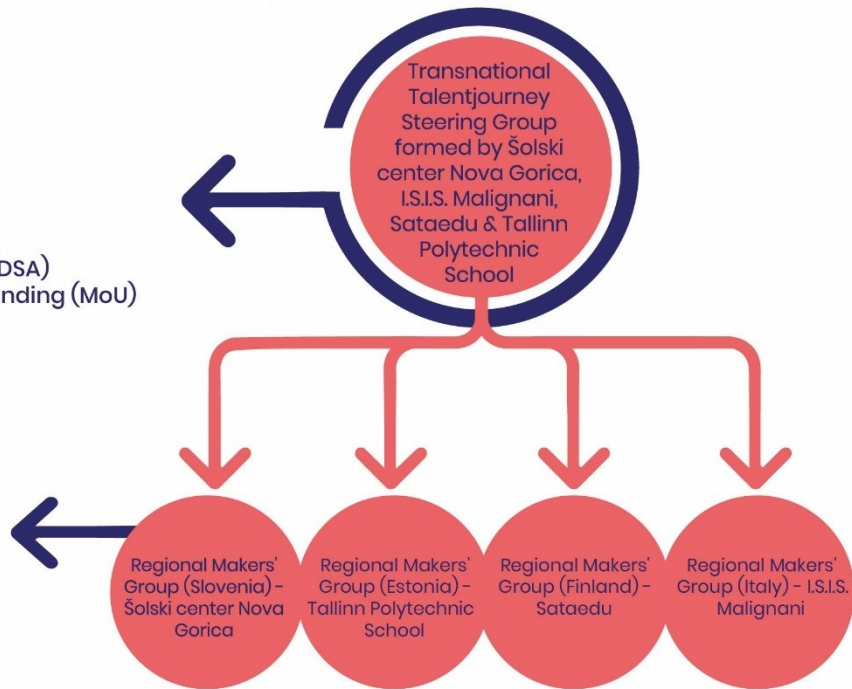
TALENT JOURNEY

Erasmus+
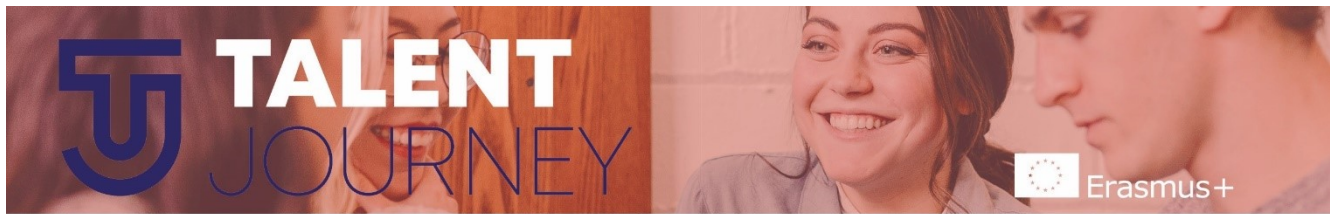
WHAT

Strategic guidance providing:
- Quality Assurance/Governance
- KPI selection
- Signed Data Sharing Agreement (DSA)
- Signed Memorandum of Understanding (MoU) Database selection

Operational guidance providing:
- Internal data on performance
- Local policy - economic, environmental, societal
- Learner feedback - "Learner voice"

Transnational Talentjourney Steering Group formed by Šolski center Nova Gorica, I.S.I.S. Malignani, Sataedu & Tallinn Polytechnic School

Regional Makers' Group (Slovenia) - Šolski center Nova Gorica

Regional Makers' Group (Estonia) - Tallinn Polytechnic School

Regional Makers' Group (Finland) - Sataedu

Regional Makers' Group (Italy) - I.S.I.S. Malignani

HOW

Regular "virtual partner meetings" of the transnational stakeholder group to establish a structure of sustainable data collection.

The Talentjourney platform shall connect high-quality, reliable and robust labour market intelligence through API connections. This is vital to offering effective career paths and allowing learners to navigate complex labour markets in smart manufacturing, informing career decisions based on jobs and trends in changing IOT/IIOT labour markets.

WHY

1 MILLION

new jobs in smart manufacturing

2.4 MILLION

replacements for the retiring workforce expected between 2013 and 2025 in smart manufacturing

WHO

An initial transnational steering group consisting of 4 Talentjourney pilot partners from

Estonia

Finland

Slovenia

Italy

Šolski center Nova Gorica,
I.S.I.S. Malignani,
Sataedu
Tallinn Polytechnic School.

VET/ Universities

Industry

Government /Agencies
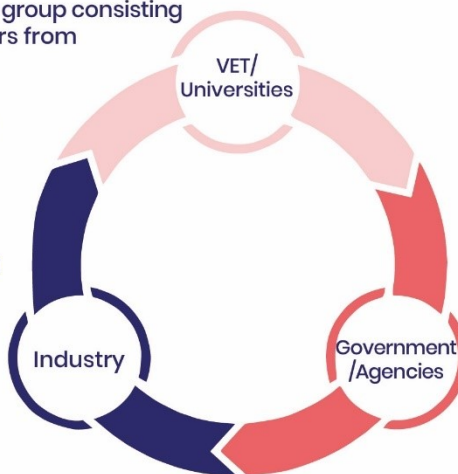
WHEN

Talentjourney Transnational Steering Group meetings shall be held each month for an initial period of six months.

06 MONTHS

WHERE

- World Indicators of Skills for Employment (WISE)
- The Global Public-Private Knowledge Sharing Platform on Skills for Employment (Global KSP)
- The Global Jobs Indicators Database (JoIn)
- VOCEDplus
- Digital Skills and Jobs Platform of the European Commission

talentjourney.si

TALENT JOURNEY

9.0 Summary of recommendations

- Work with Talentjourney and other agencies to support the establishment of effective learner application data-sharing arrangements.

- Government/agencies are integral to the Talentjourney ecosystem addressing issues associated with social and economic deprivation and hence data collection on these.

- Consider the introduction of wider-reaching categorisation of learner destinations, especially for those leaving programmes early for employment into smart manufacturing or related IOT industries.

- Promptly establish and maintain effective communication and data reporting arrangements on the Talentjourney platform.

- Ensure that Talentjourney staff have a clear understanding of managing, using and reporting data in a transnational context.

- Align constituent centre quality calendars and reporting timeframes to a transnational context.

- Establish transnational approaches to managing and reporting of data, including learners' wider achievements.

- Track and report learner destinations effectively.

- Transnational comparison of Talentjourney key performance indicator (KPI) outcomes with appropriate benchmarks to be agreed and developed by RSGs and participating pilot centres.

- Talentjourney large data sets should provide the learner with holistic insights and should be the preferred approach adopted by all four pilot participating partners.

- Talentjourney should developed common digital enrolment procedures.

- The Talentjourney platform should also incorporate developing creative approaches to capture the views of learners through the use of social networking platforms.

- Talentjourney ecosystem members should be held accountable for delivery of their contribution, through a formal agreement.

List of abbreviations

AI – Artificial Intelligence

AR – Augmented Reality

CDS – Connectivity Devices and Services

Cedefop – European Centre for the Development of Vocational Training

CoVE – Centres of Vocational Excellence

ESCO – European Skills, Competences and Occupations

ECVET – European Quality Assurance in Vocational Education and Training

EQAVET – European Credit System for Vocational and Education Training

EQF – European Qualifications Framework

ESF – European Structural Fund

EU – European Union

ICT – Information and Communication Technology

IOT – Internet of Things

IIOT - Industrial Internet of Things

NGO – Non-Governmental Organisation

OECD – Organization for Economic Co-operation and Development

OREF – Observatoire Régional Emploi Formation

SDG – Sustainable Development Goal

SMEs – Small Medium Enterprises

SSCs – Sector Skills Councils

STEM – Science, Technology, Engineering, Mathematics

VET – Vocational Education Training

VR – Virtual Reality

List of visual aids

Figure 1. Strategic and Collaborative Partnership Structure of Talentjourney

Figure 2. Inclusion of the Talentjourney joint curricula in VET institutions' (Talentjourney partners') strategies

Figure 3. Cedefop Skills Forecast 2020 for Slovenia

Talentjourney Transnational Steering Group Infographic

List of databases

The European Centre for the Development of Vocational Training (Cedefop)

Cedefop skills forecast reports

ECVET – European credit system for vocational education and training

European Skills, Competences and Occupations (ESCO)

Europass

The Global Jobs Indicators Database (JoIn)

The Global Public-Private Knowledge Sharing Platform on Skills for Employment (Global KSP)

O*NET OnLine

ReferNet

Skills Panorama

World Indicators of Skills for Employment (WISE)

VOCEDplus

References

1 CEDEFOP (2018). The changing nature and role of vocational education and training in Europe. Volume 3: the responsiveness of European VET systems to external change (1995-2015). Luxembourg: Publications Office. Cedefop research paper; No 67, <http://data.europa.eu/doi/10.2801/621137>.

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

3 Australian Industry and Skills Committee (2019), *Cross-sector projects,* <aisc.net.au/content/cross-sector-projects>.

4 World Economic Forum (2018) *The Global Competitiveness Report 2018.*

5 Eurofund (2011) *European Foundation for the Improvement of Living and Working Conditions: Employment trends and policies for older workers in the recession.*

6 Europe 2020 Strategy (2010). European Commission. EU Strategic Policy. <https://ec.europa.eu/environment/gpp/eu_policy_en.htm>.

7 Frost & Sullivan (2019) *Industry 4.0, the Fourth Revolution. Challenges, Benefits, Adoption and How to Begin.*

8 HM Government (2011) *Skills for a green economy. A report on the evidence.*

9 Deloitte (2017) *The smart factory. Responsive, adaptive, connected manufacturing.*

10 ILO and CEDEFOP (2011) *Skills for green jobs. A global view.*

11 Cedefop (2012). *Green skills and environmental awareness in vocational education and training:* Synthesis Report. Luxembourg: Publications Office of the European Union.

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

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

14 Fourtané, Susan (2019) *Augmented Reality: The Future of Education.* <https://interestingengineering.com/augmented-reality-the-future-of-education>.

15 PwC (2018) *The Industrial Internet of Things.*

16 World Economic Forum (2019), *Internet of Things,* <intelligence.weforum.org/topics/a1Gb0000005LWrfEAG?tab=publications>.

17 Deloitte (2020*) Industry 4.0: At the intersection of readiness and responsibility.*

18 World Economic Forum (2020) *Three rules for engaging millennial and Gen Z talent in the workplace.*

19 European Skills, Competences and Occupations – ESCO (2020). Database. <https://ec.europa.eu/esco/portal/home>.

20 Cedefop (2018). Skills forecast 2018: Slovenia. Cedefop skills forecast. <https://www.cedefop.europa.eu/files/cedefop_skills_forecast_2018_-_slovenia.pdf>.

21 Cedefop (2020). Skills forecast 2020: Slovenia. Cedefop skills forecast. <https://www.cedefop.europa.eu/en/publications-and-resources/country-reports/slovenia-2020-skills-forecast>.

22 Cedefop (2020). Country specific reports, *VET for the future of work*. <https://www.cedefop.europa.eu/en/publications-and-resources/country-reports/vet-future-work>.

23 Cedefop (2020). *Impact of digitalisation and AI on* skills. <https://www.cedefop.europa.eu/en/events-and-projects/projects/digitalisation-and-future-work/impact-digitalisation-and-ai-skills>.

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