TALENT JOURNEY

Providing VET in the manufacturing sector, focusing on Connectivity Devices and Services/CDS (IoT in smart manufacturing).

Erasmus+ Project

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1.0 Introduction

Nowadays, smart manufacturing and the Internet of Things (IoT) are transforming production value chains and business models into digital supply networks. This will have severe implications for labour market policies. Governments and educational institutions must react to this transformation and adapt their programmes in order to provide the adequate skills and to address skills gaps, ensuring EU competitiveness on global markets. For this purpose, Labour Market Intelligence (LMI) is an analytical tool capable to investigate the impact of Industry 4.0 on the labour market. LMI refers to the collection and analysis of quantitative and qualitative data related to employment and workforce in various industrial sectors.

The development and implementation of high quality LMI is critical for: providing lifelong guidance and career development; allowing transferability of skills; building a skilled workforce that foster business competitiveness and inclusive growth; spending educational/training funds effectively. LMI should have the following characteristics: statistically accurate and reliable; comparable over time and across regions; predictive and forward looking; easily accessible and transparent; relevant to end users; not discriminating and impartial (i.e. in accordance with the user's interest only); encouraging mobility.

LMI focuses on the following elements: labour market dynamics (e.g. employment/unemployment, earnings outlooks by sector/occupation, etc.) and regulation at national, regional and local level; trends in skills such as skills needs, mismatches, gaps and expectations; entry and progression routes in educational training and occupations; career planning and assistance; equal opportunities and diversity issues.

Investments in LMI research and institutional capacity must be done in a systematic, focused and coordinated manner. LMI requires an efficient information delivery system and a user support network. LMI benefits a large range of stakeholders. First, LMI empowers students and work-seekers to make the correct education and skills decisions, making them more attractive to employers. Second, governments and companies are able to make better strategic decisions in matching skills demand and supply. This will lead to increased productivity and profits. Third, education and training institutions are able to respond to shifting labour market demand signals more effectively.

The Skills Agenda for Europe, adopted by the EU Commission in June 2016, launched ten actions to make the right training, skills and support available to people in the EU. The goals are to: i) improve the quality and relevance of training and other ways of acquiring skills; ii) make skills more visible and comparable; iii) improve information and understanding of trends and patterns in demands for skills and jobs (Labour Market Intelligence) to enable people to make better career choices, find quality jobs and improve their life chances. The ten actions are the following: Upskilling Pathways: New Opportunities for Adults; European Qualifications Framework; Digital Skills and Jobs Coalition; Blueprint for Sectoral Cooperation on Skills; EU Skills Profile Tool Kit for Third-Country Nationals; Vocational education and training (VET); Key competences; Europass; Graduate Tracking; Analysing and sharing of best practice on brain flows.

In this context, the Talentjourney project will provide VET in the smart manufacturing sector, focusing on Connectivity Devices and Services/CDS (IoT). The main activities of Talentjourney will be the identification of skills trends (for instance, the current and future demand and gaps); the design, implementation and testing of new educational curricula, specialised trainings and upskilling solutions; and the establishment of an EU ecosystem of regional stakeholders focused on knowledge-sharing and networking. The ultimate goal is to establish and design a Platform for CDS VET excellence. In order to achieve this, this document related to Work Package (WP) 2 provides a baseline reference to partners and delineates the future essential steps. The WP2 refers to *Skills need research in the manufacturing sector focused on Connectivity Devices and Services/CDS (IOT in smart manufacturing) that provides user oriented, user friendly and eco-friendly solutions (4.0/5.0).*

2.0 Smart Manufacturing and the Internet of Things (IoT)

Smart manufacturing has been defined differently across technical literature and institutions. It involves the adoption of innovative and disruptive technologies and applications such as, among others, Internet of Things (IoT), artificial intelligence (AI), machine learning, advanced automation/robotics, and additive manufacturing. The Internet of Things (IoT), also referred to as Connectivity Devices and Services (CDS), allows for the digital interconnectivity among equipment, connecting embedded manufacturing techniques with smart production processes and IT platforms. This enables improved communication, control and data analytics in order to derive actions. The continuous flow of information on production equipment, for example about its conditions, position or other attributes, creates an astonishing rise in data volume. This fosters the development of improved computational power, analytics and business intelligence, and human-machine interaction (such as augmented-reality systems).

With the introduction of cheap sensors and low-cost connectivity, IoT devices are increasing at an astonishing rate. According to IoT Analytics, in 2018 there were over 7 billion connected IoT devices in the world. According to PwC, businesses, governments and consumers will invest nearly $1.6 trillion to install IoT solutions in 2020, with 6 trillion dollars spent on IoT solutions between 2015 and 2020 (compounded). Software and application development are predicted to make up the majority of these investments.

Therefore, smart manufacturing is transforming production value chains and business models into digital supply networks. Digital supply networks are dynamic and integrated, allowing faster and real time decision making, for example in the area of predictive maintenance, quality management and demand forecasting. A “smart factory” is then a flexible system capable to self-optimise performance, to self-adapt to and learn from new conditions, and to autonomously run entire production processes. This transition is commonly referred to as Industry 4.0. Nowadays, declining technology costs, growing functionalities and a wide range of applications/deployment are opening the road towards Industry 4.0. The Manufacturing sector can have an optimistic future and provide huge opportunities for people to have rewarding and interesting careers in an industry that is an essential part of the EUs economic infrastructure, if it moves to 4.0 and 5.0

3.0 Smart Manufacturing/IoT: current and future trends in skills

This section reports the trends in new skills required by smart manufacturing nowadays and those skills not currently provided (skills gaps).

Over the last decade, following the rise of Industry 4.0, the concept of "T-shaped" skills has emerged, which refers to a combination of both technical specialist skills within one field together with general/complementary skills applicable in multiple fields, which allow employees to collaborate across sectors and disciplines. Following this trend, according to the EU Commission (2018)[1], future professionals are likely to have the following competences: technical skills in an adjacent technology domain or system of thought; skills related to quality, risk and safety; management/leadership skills; creative/innovative/entrepreneurial skills; emotional intelligence and communication skills; critical and analytical thinking; ability to consider ethical implications.

According to the World Economic Forum (2018)[2], in the period 2018-2022, four technological advances - high-speed mobile internet, artificial intelligence, big data analytics and cloud technology - are set to dominate the scene. By 2022, 85 percent of businesses are going to accelerate the adoption of big data analytics, IoT and cloud computing, and to a lesser extent, of machine learning and augmented/virtual reality. In the same period, investments in robotics technologies remain limited, showing potential in the longer run. Accounting for this scenario, Talentjourney will investigate the labour market implications stemming from the adoption of the above technologies and, accordingly, develop new offerings and specialised training as well as upskilling solutions.

Thus, current and future skills gaps reflect a changing nature in business models and labour demand. By 2022, global average skills stability, i.e. the proportion of core skills required to perform a job that will remain the same, is expected to be about 58 percent[2]. Indeed, the European Centre for the Development of Vocational training (CEDEFOP) and the Organisation for Economic Co-operation and Development (OECD) forecast that elementary, manual, routine and low-skilled jobs will decline, while productivity-enhancing and high-skilled jobs will increase.

Today, for instance, demand for jobs that include programming is growing 50 percent faster than the job market overall, and skills related to hybrid jobs are particularly sought after. In the following domains of technical expertise, future skill shortages are expected, also in the manufacturing sector: skills in researching and developing production, digital and cyber technologies; skills in basic and advanced digital technology. By 2022, among the range of established roles that are set to experience increasing demand are Data Analysts and Scientists, Software and Applications Developers, Ecommerce and Social Media Specialists. Within the smart manufacturing sector, roles that leverage distinctively 'human' skills are also expected to grow such as Customer Service Workers, Sales and Marketing Professionals, Training and Development, People and Culture, and Organisational Development Specialists as well as Innovation Managers. Following the diffusion of emerging and disruptive technologies in smart manufacturing, wholly new specialist roles will emerge. Examples are AI and Machine Learning Specialists, Big Data Specialists, Process Automation Experts, Information Security Analysts, User Experience and Human-Machine Interaction Designers, Robotics Engineers, and Blockchain Specialists.

In general, companies indicate three strategies to tackle future skills gaps: hiring new permanent staff already possessing these skills; automating the work tasks completely; retraining existing employees. Beside these, businesses also consider turning to external contractors, temporary staff and freelancer doing task-

[1] European Commission, 2018. Skills for Smart Industrial Specialisation and Digital Transformation. Interim Report.
[2] World Economic Forum, 2018. The Future of Jobs Report 2018.

specialised work. A large portion of employees will then require, to different extent, significant re- and upskilling. However, according to the World Economic Forum (2018), at-risk employees most in need of reskilling and upskilling are least likely to receive such training. Indeed, businesses tend to prioritise employees performing key roles in high value activities. Accounting for this trend, Talentjourney will focus on the latter category of jobs, providing the adequate curricular offering and specialised training as well as upskilling solutions.

Currently, policies, initiatives and strategies relevant to the future "high-tech T-shaped skills" focus on co-developing educational initiatives and materials. They tend to introduce high-tech topics to children or to adapt university programmes to the needs of industry. While focusing primary on technical aspects, combinations of technical skills with managerial/entrepreneurial skills or quality/risk/safety skills are common. On the other hand, emotional intelligence skills and application of system thinking are not present today, which undoubtedly need to be considered.

4.0 Partners' Current Position

4.1 What current skills or strategies are currently required by the manufacturing/smart manufacturing industry? Focus should be on local/national/EU and global levels.

Smart manufacturers increasingly need employees capable to work with new technologies and to thrive in a digitised workplace. The ultimate goal of VET providers is then to have insights into smart manufacturing processes in order to successfully delivery the right skills for its supply chain.

For this purpose, the ability to use and to interact with smart applications (like robots, tablets etc.) is required as well as the capacity to install, handle, monitor and maintain smart complex equipment. The following technological skills are nowadays in high demand: IT knowledge and mathematics; advanced automation/robotics; industrial connectivity devices and services (CDS)/Internet of Things (IoT); artificial Intelligence (AI); cloud computing and big data processing; additive manufacturing; IT and network security; data protection (cybersecurity). Currently, in a perspective of environmental sustainability, being aware of sustainable practices and being capable to apply lean manufacturing to Industry 4.0 is a prerequisite, also referred to as circular thinking. Engineers working in R&D are expected to be conscious of new materials and components, to be capable to adopt new tools and software, and to implement innovative solution-oriented approaches, essentially be resource efficient

Further technical and digital skills are needed in the following fields: production optimisation, (distributed) production management and control, quality assurance, regulation and data processing; intra-logistics, optimisation and automation of production processes: smart machines and equipment, mechatronic systems, actuators and smart sensors, virtual technological production systems, remote monitoring and management, modular products/solutions and new intelligent materials; software and device design; human-machine interface; user interface/experience design; coding (back-end & front-end).

Beside technical skills, it is important to have knowledge of a systematic approach (holistic mindset) and understanding of the process. The so-called soft skills and attitudes are still considered relevant in the transition to a smart manufacturing industry. Creativity, flexibility and emotional intelligence, i.e. the capacity to adopt an effective communication and to coordinate with others (teamwork), are required. Cognitive skills such as critical and analytical thinking, reading comprehension, problem solving and decision making will still play a big role. A positive attitude towards active lifelong learning, self-initiatives and collaboration (also through collaboration platforms) are widely appreciated by employers and will be much sought after in the smart manufacturing sector.

4.2 What is the current strategy on digitalisation on local/national/EU and global levels? Please relate answer to the manufacturing sector.

4.2.1 Global and EU level

Currently, digitalisation strategies at local, national, EU and global level share common objectives. These, among others, are developing appropriate digital infrastructures, construction of broadband infrastructures, ensuring high levels of cyber security, improving digital literacy among employees and citizens, fostering innovative e-business, enabling remote work, optimizing business management through digitisation.

At global level, the leading strategy is the United Nations Development Programme's (UNDP) Digital Strategy, which is characterised by two inter-related concepts: Digitisation and Digitalisation. Digitisation is the process of converting physical information into digital formats. It is commonly driven by technologies which focus on enhancing efficiency by automation of existing processes. Digitalisation is the use of digital technologies to change an organisation's business model, including creating new or improved ways of delivering services, and improving the quality of what is delivered.

At EU level, the Digital Single Market (DSM), launched in 2015, designates the strategy of the European Commission for the best possible access to the online world for individuals and businesses. The DSM ensures that individuals and businesses can access and engage in online activities under conditions of fair competition and high level of data protection, irrespective of their nationality or place of residence. The DSM Strategy is built on three pillars: i) better access for consumers and businesses to digital goods and services across Europe; ii) creating the right environmental conditions for the development of digital networks and innovative services; iii) maximising the growth potential of the digital economy. The European Commission has identified the DSM as one of its six political priorities in the period 2019-2024.

Within the DSM, the pan-European network of Digital Innovation Hubs (DIHs) helps in smoothing the differences in the level of digitalisation across sectors and regions in the EU. With technical universities or research organisations at the core, DIHs act as one-stop-shops where companies —especially SMEs, start-ups and mid-caps— can get access to technology testing, financing advice, market intelligence and networking opportunities. For this, the European Commission is investing EUR 100 million per year from 2016 to 2020. To help DIHs to effectively collaborate and network, the European Commission set up the European catalogue of DIHs. It now includes over 200 fully operational hubs across the EU.

Several EU initiatives and projects are shaping the pan-European network of DIHs. These are: ICT Innovation for Manufacturing SMEs (I4MS), Smart Anything Everywhere (SAE), Open Data such as Data Pitch Innovation Programme and Open Data Incubator Europe (ODINE), Robotics such as European Coordination Hub for Open Robotics Development (ECHORD++) and Robotics Digital Innovation Network (RODINE), Photonics such as Access Centre for Photonics Innovation Solutions and Technology Support (ACTPHAST 4.0) and Empowering Photonics through Regional Innovation Strategies in Europe (EPRISE), HPC such as Supercomputing Exercise for SMEs - SESAME NET. EIT Digital (from the European Institute of Innovation and Technology) will also contribute to the network of DIHs through its project MIDIH. In addition, the DIHNET.EU Coordination and Support Action will coordinate the whole network of Digital Innovation Hubs.

In the period 2014-2020, the EU Cohesion Policy and the Regional Operational Programme of the European Regional Development Fund (ERDF) 2014-2020 included national and regional Innovation Strategies for Smart Specialisation (RIS3). These are integrated and place-based agendas aiming at: i) support investments for knowledge-based development; ii) promote regional/national competitive advantages and excellence; iii) foster innovation and technological advances; iv) gather and encourage stakeholders to work together; v) implement monitoring and evaluation systems.

4.2.2 Italy

At national level, in Italy, the Ministry for Economic Development has launched the strategy “Industry 4.0” aimed at integrating innovation technology and digitalisation in order to improve the competitiveness of its national manufacturing sector. The strategy includes measures based on the following principles: operating in a perspective of technological neutrality; intervening through the adoption of a horizontal approach, not top-down or sector specific; promoting the enabling factors. This strategy includes various actions such as the implementation of financial instruments (for instance, favourable lending conditions and tax credits), with particular focus on SMEs and start-ups, research projects and strategic industrial investment plans, and the creation of technological competence centres (CCs) providing training and consulting to enterprises (for example, in the area of IoT, big data and cloud, additive manufacturing, augmented reality and cybersecurity). This strategy also developed an Industry 4.0 Network composed by 88 Digital Enterprise Points (PIDs) to provide basic services to MSMEs at local level, before they turn to more specialized entities such as DIHs and CCs.

Moreover, the national platforms Digital Ecosystem for Innovation (EDI) (launched by Confcommercio) and Industry 4.0 GetReadyForFuture (launched by Confindustria) actively support the national policy through the provision of training and consulting to enterprises. Also, the digital atlas Atlantei4.0 is a platform that helps enterprises to learn about innovative products and services and to get in touch with experts.

At regional level, in the Italian Region Friuli Venezia Giulia, the Industrial Platform IP4FVG combines and enhances existing resources and initiatives in order to generate local development and employment through process innovation and digital transformation of enterprises. In the Italian Region Veneto, the economic system is characterized by SMEs which show a significant gap in the level of digitalization (Digital intensity indicator) if compared to large businesses. Because of this, smart manufacturing has been chosen as one of the four areas of intervention within the EU Innovation Strategies for Smart Specialisation (RIS3) in the region, having the strongest incidence (39%) in terms of projects submitted at ERDF 2014-2020. The major fields are IoT, data analytics, modelling and simulation.

4.2.3 Slovenia

In Slovenia, the Slovenian Digital Coalition (digitalna.si) comprises stakeholders from industry, science, education, public administration and civil society in order to support the development and the implementation of the Digital Slovenia 2020 Strategy. This policy supports data driven economy by fostering digital entrepreneurship (integration of Slovenian companies in the European digital market), digital infrastructure, construction of broadband infrastructure, improvement of cyber security and development of an inclusive information society.

According to the corporate strategy on digitalisation provided by the MAHLE Compass for Industry 4.0., its objective is to connect workers with smart equipment and data in order to shape the future business model using digital technologies to optimise productivity and quality. Further goals are to encourage positive attitude towards Industry 4.0; to utilize appropriate data to steer business; to support robust and flexible manufacturing processes; to align to market/customer needs.

4.3 What current programmes (educational/training programmes), joint research programmes or frameworks already exist related to digitalisation or smart skills in manufacturing?

Šolski Centre Nova Gorica offers the following education/training programmes: Digital supportive environment; Digital competences - data acquisition system, data processing, data modification, data analytics; Machine learning by means of Java on PSG calibration; Smart technology - future solutions; Smart Manufacturing: Moving from Static to Dynamic Manufacturing Operations, Navigate the Industry 4.0 revolution; Implementing Industry 4.0: leading change in manufacturing and operations; Digital Business Strategy: Harnessing Our Digital Future; Professional certificate programme in machine learning & artificial intelligence.

Šolski Centre Kranj is integrating digitalisation into mainstream vocational education. The process of integrating digitalisation is largely left to the schools themselves and is not systematically regulated. Schools have a 20% open curriculum in their programmes that can be adapted to the needs of companies. In addition to regular formal training, Šolski Centre Kranj provides customized training for companies. In this area, topics are related to digitization, automation, robotic, etc.

Additionally, in Slovenia, there are further research programmes provided by universities and other actors in the following fields: AR smart glasses; Real-time data for machine adjustments; Additive manufacturing; Augmented virtual factory (digital twin); Edge computing. Also, two educational programmes are being updated and implemented: technician of electro engineering and electrician.

In Italy, the Higher Technical Institutes are Italy's initial experiment of vocational tertiary education provision. They are specialised in innovation technology, in connection with the production industry. They were set up in 2010 to train skilled technicians in strategic areas for Italy's economic development and competitiveness. The educational provision of the higher technical institutes answers industry's need for new high-level technical and technological skills to promote innovation processes. They are placed at Level 5 of the EQF (European Qualifications Framework). Also, in Italy, I.S.I.S. "A. Malignani" offers training in cooperation with industry (Pearson Italia and Comau) for skill certification in robotics. It also provides CISCO courses on infrastructure implementation.

4.4 What are the current skills gaps? Focus should be on green skills (resource efficiency/circular economy)

Identified as a major skills gap and to be integrated into educational trainings, green skills refer to technical knowledge, values and attitudes needed by the workforce to achieve sustainable social, economic and environmental outcomes, in business and communities. Green skills can be differentiated in skills supporting resource efficiency, skills supporting low-carbon industry, skills supporting climate resilience and skills to protect natural assets. The principles of circular economy must be then included in the design and management of value chains. Examples are competence in energy and resource management, energy efficient construction, energy audit/certifications, eco-design, green manufacturing and materials, and core STEM (Science, technology, engineering and mathematics) skills.

STEM skills have the advantage of being transferable. The concept of STEM skills recalls the notion of "T-shaped" skills, which refer to a combination of both technical specialist skills within one field together with general/complementary skills, such as STEM skills, applicable in multiple fields, allowing employees to collaborate across sectors and disciplines.

Skills gaps are also identified in transversal digital competences and soft skills. Digital skills gaps are mainly reported in advanced IT skills/programming, in performing complex technical tasks, in advanced data analytics, in applying AI and robotics and in running virtual and augmented reality applications. Required soft skills are creativity, entrepreneurship and self-initiative, communication and customer service skills, emotional intelligence, problem-solving, analytical and critical thinking, active lifelong learning.

In the field of automotive, engineers are expected to learn how to use resources efficiently, to reduce or to replace current materials with innovative and sustainable o[illegible] Also, in a perspective of circular economy, competence in product lifecycle management (PLM) and waste disposal are going to be increasingly demanded. A further skills gap faced by automotive engineers relates to the ability to provide new production technologies because of increasing demand for compact and efficient products (for example, in the area of smart mobility/electric motors).

4.5 What is the "current situation" on LMI regarding smart manufacturing? What skills types and numbers are employed today and in 5-10 years' time.

As of August 2018, there were 508 000 open jobs in the US manufacturing sector. Projections assume that by 2028, US manufacturing employment will grow at an average rate of 1.5 % per year. This implies that as a baseline, the industry would need to employ approximately 1.96 million additional workers between 2017 and 2028. On the other hand, the skills gap faced by US manufacturing is expected to leave an estimated 2.4 million positions unfilled between 2018 and 2028, with severe implications for economic growth[3]. Across the EU, there is limited information regarding LMI related to smart manufacturing. It is suffice to say, that Talentjourney can use the aforementioned as an indicator for the need of additional skills. Worldwide, almost 60% of business executives from different fields seemed worried about current or future shortages in the technical and engineering fields. Within the EU, 40% of EU manufacturing employers reported a critical shortage of skilled labour force[4].

The 2017 European Data Market study showed that approximately 6.1 million EU citizens could be considered 'data workers'. This number grows with around 2 to 3% per year, rising up to 10.4 million by 2020. In this regard, 12% of all 'data workers' are employed within the manufacturing sector[5]. The European skills and jobs (ESJ) survey shows that about 85% of all jobs in the EU need at least basic digital skills. With the diffusion of smart manufacturing, this scenario might even become worse. In the near future 9 out of 10 jobs will require digital skills, and currently only 57% of Europeans has a basic level of digital skills, so industries will find it difficult getting these skills as they will be recruiting from the same pool. Looking only at those people currently in employment, there are 145 million workers (67%) who have at least basic level of digital skills. The CEDEFOP's European skills forecasting model also projects that by 2025 about 48% of all job opportunities in the EU will need to be filled by individuals with tertiary level qualifications[6].

In the EU, the impact of Industry 4.0 on the number of persons employed as ICT specialists has been massive. This employment role grew by 39.5% during the period from 2006 to 2016, which was more than 10 times as high as the corresponding increase (3.6%) of total employment. In 2016, there were 8.2 million ICT specialists, up from 7.3 million 3 years earlier. However, the supply of ICT specialists cannot keep pace with demand: it is estimated that there will be over 500 000 unfilled vacancies for ICT professionals by 2020. Similarly, for e-leaders, it is estimated that there will be a gap of up to 250 000 jobs by 2020[7].

The situation is even worse in the fields such as big data, IoT and cybersecurity, which are considered the most critical for the successful transition to smart manufacturing. According to a survey conducted by the EU Commission, 68% of organisations reported a high demand for cybersecurity skills and 61% for big data skills. According to Frost & Sullivan's forecast, the EU will face a projected skills gap of 350 000 cybersecurity professionals by 2022. Similarly, data specialists account for (far) less than 1% of total employment in the EU, but demand for data specialists is increasing fast. In the UK, the demand for 'big data' specialists is forecasted to increase by 160% between 2013 and 2020 and estimated to represent an additional 346 000 jobs. Similarly, Sweden will be short of 70 000 ICT specialists by 2022[7].

[3] 2018 Deloitte and The Manufacturing Institute skills gap and future of work study.
[4] Skevy et al. (2014). Current Skills Gap in Manufacturing: Towards a New Skills Framework for Factories of the Future.
[5] EU Commission (2012). Employment and Social Development in Europe 2012 – The skill mismatch challenge in Europe.
[6] CEDEFOP (2018). Insights into skill shortages and skill mismatch: learning from Cedefop's European skills and jobs survey.
[7] EU Commission (2019). Supporting specialised skills development: Big Data, Internet of Things and Cybersecurity for SMEs. Interim Report.

In the Engineering Construction Industry (ECI) sector, the increasing use of big data and analytics is predicted to create over 40 000 jobs in roles such as data analysts, infrastructure engineers and solution architects between 2017 and 2020[8]. OPITO (Offshore Petroleum Industry Training Organisation) expects the recruitment of 10 000 workers in new, and in some cases presently non-existent roles, such as robotics, remote operations, or data management, between 2018 and 2035[8].

[8] ECITB 2019. Industry 4.0: The impact of technological change on the Engineering Construction Industry.

4.6 What are future expectations for the (smart) manufacturing industry? Focus also on green skills (resource efficiency/circular economy) at local/national/EU and global levels

Many industries will face the need to digitise and to adopt innovative dashboards/devices. Pressure from lower wages in developing countries will require workers to achieve high productivity and efficiency. Also, old workforce is retiring without the same volume of new talents replacing it, this is not a problem in certain industrial sectors, but most definitely is with regards to smart manufacturing. Artificial Intelligence will drive the collaboration between people and technology, helping new talents to learn faster from this immense volume of "institutional knowledge" in order to make fact-driven decision-making.

The workforce will be characterized by a shift in mindset towards a culture of lifelong learning. The workplace organisation will move towards a more agile ways of working, with corporate structure having less hierarchy and increasing use of independent contractors and freelancers. New business units will be created having a cross functional approach to work, hence collaborative teams' networks. C-suite and HR activities will then have to undergo deep changes in the ways they operate and think.

This digital industrial transition will require employees to adopt a systemic thinking and to develop effective communication, allowing for a transdisciplinary cooperation/collaboration with other teams within the business. The diffusion of Internet of Things (IoT) will result in higher standardisation of production processes. Smart manufacturing products will shift from large and standardized production to more selected and personalised offerings to consumers. The digital chain of manufacturing will be extended to distribution and consumer demand. Hence, an increased focus on local markets while having a true global overview and understanding.

The following competences will be particularly important: autonomy (self-determination), self-initiative (initiative and performance competence), self-management (decision competence), agility (systems competence), creativity (innovation competence), digital literacy. It is these competencies that should be considered in the development of the needed new curricular and training offerings.

In the field of automotive, for example, manufacturing lines are expected to become more complex. Also, there will be the replacement of people with automatized lines (robots) for those operations carrying risks for health and safety. The adoption of innovative materials and of eco-friendly production technologies is also to be expected.

4.7 Do you know of any existing ''blueprint'' for Big Data collection? For example, data ingestion, data storage, and data analysis.

The Skills Agenda for Europe, adopted by the EU Commission in 2016, launched 10 actions to make the right training, skills and support available to people in the EU. Among these actions, the Blueprint for Sectoral Cooperation on Skills was included to improve skills intelligence and to address skills shortages in specific economic sectors. Under the blueprint, stakeholders work together in sector specific partnerships, also called sectoral skills alliances, to develop and implement strategies in order to address skills gaps in these sectors. Talentjourney falls into the aforementioned, thus it is important to recognise the significance of the project objectives for the very outset.

The first five EU blueprint alliances began their work in January 2018: automotive; maritime technology; space - geo information; textile, clothing, leather and footwear; tourism. Four additional blueprint alliances started their activities in January 2019: additive manufacturing; construction; maritime shipping; steel industry. Six blueprint alliances will become active around the beginning of 2020: bioeconomy, new technologies and innovation in agriculture; batteries for electro-mobility; defence technologies; energy value chain - digitalisation; energy intensive industries/industrial symbiosis; microelectronic manufacturing and design. The next six sectors eligible for funding under Erasmus+ are: blockchain; cultural heritage; cybersecurity; rail supply and transport industries; work integration and social enterprises; software services.

Additional tools are the European Skills Forecast and Skills OVATE (Online Vacancy Analysis Tool for Europe) provided by CEDEFOP.

4.8 What do you consider the best methodology for collecting skills data for smart manufacturing techniques, methodologies, etc. within the partnership?

The ideal methodology would be digital. It would require establishing for each partner what to collect, when, how. A methodology should be “dual” or “combined”: a first one that is easy to implement and allows to receive enough feedback (for example, e-survey); the second that allows to get deeper insights on certain topics (for instance, interviews or group discussions). A suitable method would be to collect data from official sources by adopting algorithms, without the need to prepare questionnaires too often. Then, evaluate the results and process them in order to produce a report. The best approach would be to start by collecting few skills, test the efficiency of this approach and define future improvements.

Involving institutions, such as chambers, associations of employers, blueprints associations, existing EU platforms etc., would provide Talentjourney with the necessary data and would stimulate these institutions to take care of data collection. Indeed, it would be a difficult if not impossible task for VET providers or companies to complete data collection on our behalf from scratch. However, carrying out interviews with leading smart manufacturers and research centres would be helpful, as well as collecting anticipation data from McKinsey, Deloitte, Forbes, etc.

Adopting a closed questionnaire would allow to compare the feedback but could inadvertently ignore important aspects of skills data for smart manufacturing. On the contrary, adopting an open questionnaire carries a risk of over-dispersion.

To conclude, the methodology for collecting skills data for the smart manufacturing sector within the partners consortium would be digital and implemented in two-steps, using questionnaires or algorithms according to the types of data. In collecting the skills data the reliance on institutions, sectoral associations and consultancies is necessary. For the purpose of processing such data, responsibilities and tasks will be allocated to partners.

4.9 What are some key requirements for establishing a successful, user-friendly platform for vocational excellence?

To establish a successful and user-friendly platform for vocational excellence, it would be desirable to invest in sound partner relationships within the Talentjourney project, to foster mutual trust, understanding and support. The focus of the platform should be the end users, accounting for their needs and interests. The long-term functioning of the platform depends indeed from their level of service satisfaction. The end use should be considered the employee and indeed the beneficiary organisation, hence it is important to have close collaboration with significant industrial partners or their representatives.

To do so, the platform would ideally have an efficient and handy design, offering easy and intuitive access to relevant contents, also from mobile devices. The contents should be easily interpretable and in line with the core needs of end users. Allowing individuals to customize the platform (for instance, adoption of their native languages) would offer a personalized experience.

Overall, the platform should foster networking. The ultimate goal should be to enable users to identify the skills already acquired and based on that, to offer employment opportunities. It must enable individuals to overcome skills gaps. For this purpose, the platform should guarantee free access to all trainings and a continuous dialog/feedback among stakeholders and should foster mobility of students and teachers across countries.

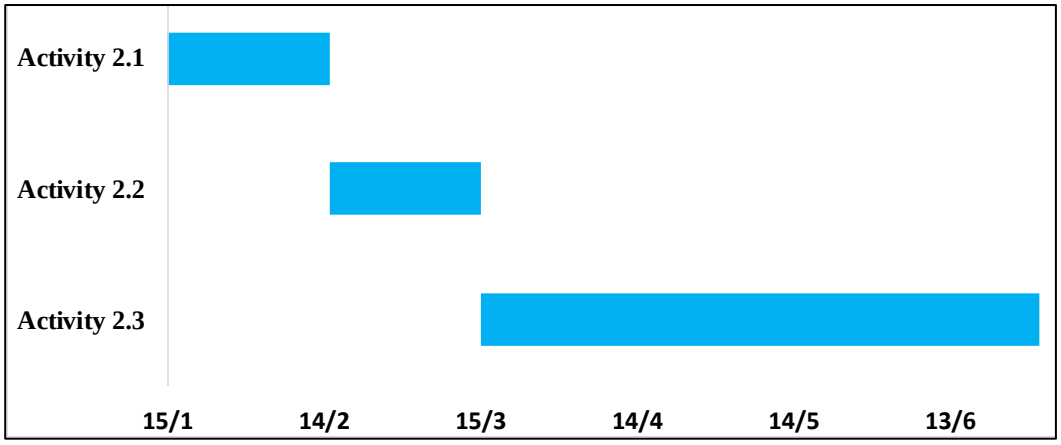
To conclude, from the management side, the platform should be easy to manage and responsible, allowing up-dating, provide effective communication, allow to search and archive documents, customers support.

5.0 Conclusive Recommendations

The next steps of the WP2 of the Talentjourney project will require further involvement and contribution from each partner. Over the period to June 2020, with the support of EIfI-Tech, partners are expected to provide further and detailed information in relation to activities 2.1, 2.2 and 2.3 of the WP2. A separate paper shall be sent to partner in due course.

Some partners are involved in smart manufacturing, some are not at all aware. The Talentjourney project will strive to close these regional gaps with respect to skills development in smart manufacturing through the establishment of a cooperative EU ecosystem of regional stakeholders focused on knowledge-sharing and networking. The Talentjourney project will prepare the whole educational stakeholder ecosystem to be ready to answer to the challenge posed by new era labour market by providing adequate training and curricula. The ultimate objective of this EU ecosystem of regional stakeholders is also to develop a sustainable Platform for CDS VET excellence in the smart manufacturing sector.

WP2 Project Timeline



Report Methodology

This report aims at providing a baseline reference for the project partners' knowledge and expertise related to (smart) manufacturing, as well as what current skills or strategies are currently required by the (smart) manufacturing industry, with a focus on local, national, EU and global levels. The analysis that forms the basis for this report is the result of the work conducted by EIfI-Tech in cooperation with the Talentjourney partners is an extensive survey of current and emerging skills in the manufacturing sector, focusing on Connectivity Devices and Services/CDS (IoT in smart manufacturing), with the ultimate goal of identifying future skills and vocational and educational training (VET) programmes required for the emerging smart manufacturing industry. Outlined here is the methodology through which EIfI-Tech will develop the WP2 report with the support of the Talentjourney partners.

The key concept for the construction of this report is Labour Market Intelligence (LMI). LMI is an analytical tool capable to collect and analyse quantitative and qualitative data related to employment. LMI is essential in understanding the impact of Industry 4.0 on the labour market dynamics.

This report begins with an overall review on the notions of Smart Manufacturing and the Internet of Things (IoT), using information provided by major international institutions and consultancies and identified by EIfI-Tech in a comprehensive literature review and background/general research. This review serves as reference for later describing the major labour markets implications stemming from the adoption of innovative and disruptive technologies, such as current and future skills trends, requirements, gaps and expectations.

Following, this report provides the summary of the Talentjourney partners' current positions and expertise within the realm of smart manufacturing. This has been possible thanks to the completion of a questionnaire developed by EIfi-Tech, which asked partners to provide essential information for creating the context for the successful completion of the activities 2.1, 2.2 and 2.3 of the WP2. Partners were expected to answer according to their knowledge and experience, making also reference to external documents.

To conclude, this report highlights the following steps to be to be conducted in the context of WP2 of the Talentjourney project by EIfI-Tech with the support of the Talentjourney partner consortium to successfully achieve the objectives of WP2.

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