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Nomenclature

Acronym	Meaning
BSEC	Business-Science-Education Cooperation
CoP	Community of Practice
ECoVEM	European Centre of Vocational Excellence in Microelectronics
EPALE	Electronic Platform for Adult Learning in Europe
HE	Higher Education
PSM	Pact for Skills in Microelectronics
RIS3	Research and Innovation Smart Specialisation Strategies
SMEs	Small and medium-sized enterprises
VET	Vocational Education and Training

1 Executive Summary

The ECoVEM action plan for collaboration for effective governance in the microelectronics sector defines the directions and activities for strengthening vocational education and training (VET) as an enabler of upskilling and reskilling, sustainable development, digitalisation, and resilience. This plan is based on the objectives of the European Commission from the Osnabrück Declaration 2020[1], on the goals of the European Act for Chips, and on the expertise of all partners at ECoVEM.

Microelectronics is the most rapidly developing science and is fundamental in all industry sectors working on the digital technologies of the future. The current VET governance in 6 different European countries has been evaluated together with the policy context on European level. As a result, we propose actions to promote the European Education and Training Area, to reach resilience and excellence in VET in microelectronics, to further establish a persistent lifelong learning culture, and to contribute to ecological sustainability via a green link in VET in microelectronics. To effectively equip the labour force in Europe with the necessary skills, the proposed actions from this plan by the ECoVEM consortium will be accompanied by continual discussions with policy makers.

[1] www.bmbf.de/files/Osnabrueck-Declaration.pdf

2 Introduction

European Centre of Vocational Excellence in Microelectronics (ECoVEM) brings together VET centres, polytechnics, industrial associations, social partners to establish European Cooperation platform of Vocational Excellence in Microelectronics to tackle the challenges of: digitalisation, green technologies and sustainable development, gender equality in technology, and the European initiative on chips.

The main objectives of ECoVEM's Governance Action Plan are to contribute to the sustainable VET governance at national and EU levels through involvement of policy makers in the field of education, social and economic affairs together with social partners, industrial associations and companies for:

- teacher's motivation and training for implementing innovative instructional approaches towards life-long capacity to self-regulate learning, hard skills and soft skills using the ecosystems-based theoretical models and performance support systems;
- implementing the advanced countries' best practices and approaches to excellence in VET into less advanced regions;
- efficient financial models for VET, including work-based and apprenticeship and for investment in VET and applied research;
- raising the role of VET to support the Act for Chips.

3 The Microelectronics Sector

Microelectronics is the most rapidly developing science representing the ground of the e-economy and e-society and the continuous training is crucial. In the era of nanotechnologies an integrated approach is needed: new partnership between the education and industry to foster the development of competencies, technological and soft skills for the new jobs in microelectronics. Since the beginning of the pandemic in early 2020, Europe and other regions of the world have been experiencing significant supply challenges and shortages of chips.

The European Commission reacts by launching "A Chip Act for Europe" as a policy response to economic and social challenges caused by broken chips' supply chain. The European institutions evaluate the role of microelectronics industry as "crucial to key digital technologies of the future, including artificial intelligence (AI), 5G and edge computing, as set out in the EU's 2030 Digital Decade[2]. Put simply, there is no "digital" without chips[3]."

[2] COM(2021) 118
[3] COM(2022) 45 final

4 The Policy Context

The Osnabrueck Declaration addresses the need for response strategies for unprecedented incidents, such as the post-COVID recovery in the field of Vocational education and training (VET), but also to cope with challenges such as demographic change, digital innovation, sustainable or climate neutral approaches, growing demand for STEM skills and the increasing need to constantly upskill and reskill throughout a person's working life. Osnabrueck Declaration VET gains a new importance with the newly updated European Skills Agenda and the Commission's proposal for a Council Recommendation on VET, helping to give weight to the right of individuals to quality and inclusive education, training and lifelong learning as stated in the first principle of the European Pillar of Social Rights. ECoVEM Governance Action Plan calls for implementation European Pillar Action Plan, which fulfils the high expectations for the VET in the microelectronics.

One of the main policy responses in the microelectronics field is the Chips Act Initiative. It will support education, training, skilling and reskilling initiatives. Action will support access to postgraduate programmes in microelectronics, short-term training courses, job placements/traineeships and apprenticeships and training in advanced laboratories. Additionally, the Initiative will support a network of competence centres, located across Europe. The aim is to increase the availability of internships and apprenticeships, raise students' awareness of the opportunities in the field and support dedicated scholarships for masters and PhDs, also aiming at increasing female participation.

We have to make sure VET equips our labour force with knowledge, skills and competences that are relevant for the ever-changing labour market and offers upskilling and re-skilling for inclusion and excellence. ECoVEM is working in this direction.

The partner organisations in ECoVEM contributed to the development of national VET policy overviews for 6 European countries: Bulgaria, Cyprus, France, Germany, Italy, and Spain. These overviews also analyse the needs for change and reforms in each country. They are presented in Annex 1.

5 Objectives and cornerstones

The ECoVEM action plan on collaboration for an effective governance in the microelectronics sector defines the directions and activities for strengthening vocational education and training (VET) as an enabler of reskilling and upskilling and to advocate for implementation of the Osnabrueck Declaration's objectives:

- To reach resilience and excellence through quality, inclusive, and flexible VET;
- To establish a new lifelong learning culture/relevance of CVET and digitalization;
- To contribute to sustainability via a green link in VET;
- To promote the European Education and Training Area and international dimension of VET.

This plan is based on 4 cornerstones that can be supported by the ECoVEM network:

- lifelong teacher's training for implementing innovative instructional approaches towards life-long capacity to self-regulate learning, hard skills and soft skills using the ecosystems-based theoretical models and performance support systems;
- implementing the advanced countries' best practices and approaches to excellence in VET into less advanced regions;
- efficient financial models for VET, including work-based and apprenticeship and for investment in VET and applied research;
- raising the role of VET for implementing the Act for Chips.

The concrete planned actions are presented in the next chapters.

5.1 Resilience and excellence through quality, inclusive, and flexible VET

- To define and anticipate skill needs to inform VET decision-makers and support VET providers to adapt their VET offers to the changes in the labour market:
  - on short-term through analysing the job offers;
  - on mid-term through surveys with industry;
  - on long-term through interviews with researchers.
- To participate actively in the horizontal collaboration networks as the community of practice of CoVEs for mutual support and knowledge generation.
- To promote exchange of best practices and peer-learning activities on innovative policy reforms and VET excellence, also addressing sustainability and digitalisation challenges and the linkage of iVET and CVET qualification offers as attractive career pathways.
- To emphasise the relevance of VET programmes at EQF levels 5 to 8 on a par with applied HE.
- To support creation of VET schools at EQF levels 3 to 5 at the HE institutions for greater permeability in education and training systems and to facilitate the involvement of VET students in research.

- To support the creation of new official VET professional qualification modules for any EQF level, able to include in the curriculum of any technical degree related with microelectronics.
- To attract women to this qualification, because are really underrepresented among STEM VET students in all EU.

5.2 Establishing a new lifelong learning culture – relevance of CVET and digitalization

Microelectronic chips are central to all digital and communication products, from computers, smartphones, IoT, medical electronics, green energy, robotics, AI etc. As the Chips Act for Europe[4] states "there is no "digital" without chips". The main challenge for the sector is to attract and retain highly skilled talents. Moreover, microelectronics is the most rapidly developing science representing the ground of the e-economy and e-society and the continuous training is crucial.

To contribute to the Chips for Europe Initiative the actions will be in the following directions:

- To attract new talents by promoting the application and importance of microelectronics in all areas of the modern digital world and the prospects for interesting innovative work.
- To support the policy-makers in developing/updating the national skills strategies in microelectronics.
- To collaborate with the Pact for Skills in Microelectronics for upskilling and re-skilling of the workforce and for rising the female participation in electronics education and employment.
- To propose CVET strategies to the VET decision makers for the compulsory for microelectronics lifelong learning culture, including new methodical and didactical approaches, micro-credentials, performance-support systems.
- To develop European certification schemes compliant with ISO 17024 for the creation of micro-credentials based certification of competencies.
- To support VET teachers and trainers for their continuous professional development enabling them to progress in their careers by analysing their needs, informing the policy makers and proposing solutions to their problems.

5.3 Sustainability – a green link in VET

- To participate in partnerships for education and training in green technologies.
- To create VET programmes for microelectronics applications in green technologies.
- To promote the exchange of best practices in VET for skills relevant to the green economy.

[4] https://digital-strategy.ec.europa.eu/en/library/european-chips-act-communication-regulation-joint-undertaking-and-recommendation

5.4 European Education and Training Area and international dimension of VET

- To participate actively in the Community of practice of CoVEs for structured transnational exchange between VET stakeholders, VET teachers and trainers and social partner representatives and to inform the national policy makers on the successful innovations in the other European countries.
- To promote the funding programmes for mobility of VET learners, teachers and trainers.
- To promote the opportunities for collaboration in VET with partner countries and to participate in the ETF initiatives.
- To support the preparation and participation of national teams to the VET competitions to raise the attractiveness and image of VET and promote VET excellence.
- To strengthen the use of EU initiatives and practices as Europass, EQF as measures to ensure the quality and recognition of learning outcomes facilitating the mobility in VET.

6 Annexes

6.1 Annex - National VET Policy in Microelectronics – (BULGARIA)

CURRENT SITUATION	**VET in Bulgaria comprises the following main features:** ➢ VET governance is multi-layered (national, regional, local); ➢ There are four VET qualification levels (ranging from EQF [1] level 2 to EQF level 5); ➢ Dual VET (introduced in 2014) remains a major challenge for the country; ➢ State educational standards play a major role in shaping qualifications and curricula. **Distinctive features:** VET is provided at secondary and post-secondary (non-tertiary) levels. There are more learners in VET compared with general education: 51.7% of the total secondary education population in 2017 and 54,5 % in 2018. Secondary general education schools may also open VET classes by a special order of the Education Minister. This option is popular in small towns and rural areas. Since 2016/17, secondary education has been offered in two stages. This improves access to VET, as learners may now choose their education path also after completing grade 10. In the national context, the term initial VET is only used to refer to programmes leading learners to their first qualification, such as textile worker qualification at EQF levels 2 or its part. VET programmes are pursued afterwards; for example, textile production operator and textile technician qualifications at EQF level 3 and 4 are considered continuing VET.

	According to the pre-school and school education act and the VET act, the acquisition of vocational qualifications is regulated by State educational standards. These standards exist for most VET qualifications. VET qualifications at all levels (EQF 2 to 5) are learning outcomes based. Following the European credit system for VET (ECVET) [3] principles, recent qualifications comprise units of learning outcomes, although a credit system is not yet fully established. The legal basis for validation of non-formal and informal learning in VET has been in place since 2015 and procedures and quality assurance criteria have been developed. Implementation of the Bulgarian qualifications framework will ease putting validation arrangements in place.
PROPOSALS FOR CONCRETE ACTIONS	To make VET more responsive to labour market needs, the pre-school and school education act (2015), which covers VET, increased the responsibility of local and regional authorities. The reform increased their role in planning VET intake and defining occupations, funding staff salaries, organising vocational training for the unemployed, and equipping VET schools. Employer organisations are also becoming more actively involved in implementing VET. Since the 2016 amendments to the VET act, they can propose changes to the list of VET qualifications. Since the introduction in 2015/16, some schools have started offering dual VET programmes. Several pilot projects supporting dual training aim at expanding the training offer in cooperation with business and public authorities from Bulgaria and abroad. Measures, including specialised forums, media campaigns and events, help attract learners and motivate employers to become involved in dual VET that is still mostly project-based. To address quality concerns, the Ministry of Education and Science is adopting the European quality assurance reference framework (EQAVET). The 2015 quality assurance regulation mandates VET providers for adult training to organise self-assessment based on a set of indicators. The government is strengthening initial training and continuing professional development opportunities for VET teachers and trainers to motivate more young people to enter the profession. The new system helps them to keep up with technological innovation and modern teaching methods, and allows for faster career advancement linked to performance. The 2015-17 VET strategy action plan proposes ways to address the challenges: modularisation, more flexible VET provision, and better and more easily accessible career guidance services. Its implementation is also likely to contribute to raising adult participation in learning, which is currently among the lowest in the EU. There is a high level of skills mismatch. According to the NSI business inquiries in March 2019 37.0% of the industrial enterprises pointed out the labour shortages as a factor limiting their activity. In comparison with the same period of previous year (March 2018) the value of the indicator increased by 4 p.p. to 33.3%. Data from VET in Bulgaria Spotlight 2018

PROPOSAL FOR POLICY REFORMS	To learn from the practices of other European countries (Annex 2) and to work towards a low for dual education in Bulgaria. To legalise the microcredentials. To create VET schools at Universities of Applied sciences.

6.2 Annex - National VET Policy in Microelectronics – (CYPRUS)

CURRENT SITUATION	Vocational education and training in Cyprus is mainly public and the Ministry of Education, Culture, Sport and Youth has overall responsibility for developing and implementing education policy. Additionally, the Ministry of Labour, Welfare and Social Insurance has overall responsibility for labour and social policy and the Human Resource Development Authority of Cyprus (HRDA) plays an important role in vocational training. Also, in comparison to other EU countries, Cyprus's economy is heavily depended on the service sector (84.5% of Gross Value Added) and not limited secondary production sector (manufacturing and heavy industry sector), partly due its small size and partly due its geographical location. This might be one of the reasons that VET is less attractive than general education at national level. However, the rapid technological advances in all economic sectors, including the services sector, and the government's ambition for digital transformation of the local industry will increase the need of specialized personnel in occupations related to VET. Currently VET is available at secondary and tertiary education levels. Secondary level VET programmes are considered the evening technical schools and the apprenticeship system. On the one hand, technical schools offer two types of three-year programmes, theoretical and practical, leading to EQF 4 school-leaving certificates, equivalent to those of secondary general education schools. Specialisations are selected in the first year. Graduates are eligible for admission to universities and other tertiary education institutions in Cyprus and abroad. Both streams are mainly school-based: they combine general education subjects with VET subjects and integrate practical training in enterprises at the end of the first and second years. The theoretical stream is for those who want to continue to higher education and the practical one is for those oriented more towards entering the labour market. On the other hand, the apprenticeship system is addressed to young people between the ages of 14 and 18 and it is divided in ***"Preparatory apprenticeship"*** and ***"Core apprenticeship".*** ➢ ***"Preparatory apprenticeship"*** (EQF 2) can last up to two school years, depending on the level and age of the apprentice. Young people aged between 14 and 16, who have not completed lower secondary programmes, may participate. After completing 'preparatory apprenticeship', graduates can either continue to 'core apprenticeship' or upper secondary programmes, provided they succeed in entrance examinations.

	➢ ***"Core apprenticeship"*** lasts for three years. Eligible candidates must be less than 18 years old to apply and must have either completed a lower secondary programme (EQF 2) or 'preparatory apprenticeship' or be dropped out of upper secondary programmes. On successful completion, participants may continue with evening technical school programmes, which lead to an EQF 4 certificate, and receive an upper secondary education qualification (school leaving certificate) in two years instead of three. The apprenticeship certificate (EQF 3) allows access to several regulated occupations, provided all other requirements of relevant legislation are met. At tertiary, non-university, level VET is provided at public and private institutes/colleges, offering an opportunity to acquire, improve, or upgrade qualifications and skills. Successful completion of these accredited programmes, which may last from two to three years, lead to a diploma or higher diploma awarded by the institution (EQF 5). The public post-secondary institutes of VET were accredited in 2017 by the Cyprus Agency for Quality Assurance and Accreditation in Higher Education as public schools of higher vocational education and training; they offer accredited two-year programmes leading to a diploma. Vocational training for adults is extensively available in Cyprus for the employed, the unemployed, vulnerable groups and adults in general, through a mixture of public and private provision: colleges, training institutions, consultancy firms and enterprises. Also, the Human Resource Development Authority (HRDA), provides financial incentives to encourage enterprises and employees to participate in vocational training activities. In general, Cyprus has a high level of educational attainment with a strong cultural trend among Cypriots in favour of general secondary education (83.3% of enrolments in 2017/18) followed by higher education instead of technical and vocational education (16.7% of enrolments in 2017/18). However, the economic crisis of 2012-15 combined with efforts to increase VET attractiveness, have resulted to an increase of upper secondary VET enrolments (by four percentage points from 2011 to 2017). Furthermore, due to the economic crisis VET now is targeting also employed, unemployed and economically inactive population offering individualized guidance, training and work placement in order to promote their employability and reduce the danger of long-term unemployment.
PROPOSALS FOR CONCRETE ACTIONS	The economic crisis of 2012-15, and its adverse effects on the labour market challenged the VET System and in response training has been redirected aiming to tackle the gap between the skills mismatch and skills shortage with the need of a fast-changing labour market. According to the CEDEFOP Skills Forecast 2020[5] for Cyprus, the two sectors that are expected to see the greatest growth in Cyprus, over the period 2018 -2030, are business and distribution and transport. Considerable growth is also anticipated in the sub-sector of computer programming and information services, due to the high level of digitalization/digital transformation in various sectors, public and private alike. However, based on the digital economy and society index (DESI) 2019 [6], Cyprus' performance in the human capital

[5] CEDEFOP, Employment Forecasts 2020: Cyprus. 2020

[6] Theocharous, A (2020). *Vocational education and training for the future of work: Cyprus*. Cedefop ReferNet thematic perspectives series.

	dimension, which measures the skills needed to take advantage of the possibilities offered by digital developments, is below the EU average. More specifically Cyprus has a lower share of information and communication technologies (ICT) specialists in the workforce (2.3%) than the EU average (3.7%), a low share of science, technology, engineering and mathematics (STEM) graduates (9.8%), ranking lowest among EU countries [7]. The government acknowledging that digitalisation is very important as a means to enhance competitiveness and modernise the local economy, which currently is mainly based on services, launched several initiatives and policies aiming to enable and support the digital transformation. The first initiative was the ***Digital Strategy for Cyprus 2012 – 2020***[8], promoting the digital transformation of both the public (e-Government) and private domains. Particular importance to the VET sector are objectives 4 & 5, with 4 focusing on promoting Digital Education (by using ICT as a dynamic tool aiming at the upgrade, enrichment and reform of the educational process) and 5 placing emphasis on the promotion of Digital Entrepreneurship. Another important initiative was the adoption of the Cyprus ***Research and Innovation Strategy (R&I) 2019 – 2023*** [9]***,*** which aims at the technological, social and economic development of Cyprus, based on research and innovative entrepreneurship as well as the appointment of the ***National Chief Scientist for R & I*** with the political mission to lead and coordinate all efforts for Cyprus to become a dynamic and competitive economy, driven by research, scientific excellence, innovation, technological development and entrepreneurship, and a regional hub in these fundamental areas. Responsible for the promotion and implementation of national R&I Strategy is the *National Board for Research and Innovation (NBRI)*. In addition, on May 2019, the Government announced the ***Cyprus New Industrial Strategy 2019- 2030***[10] ***which*** will introduce a new framework and an action plan with the aim to upgrade Vocational Education and Training (VET) systems to respond to the skill gaps in the labour market as well as the new skills emerging from the fourth industrial revolution. This policy will help the enterprises to respond to customer demand, their ability to maintain or increase their production levels and their ability to apply new technologies. Also, in January 2020 has been approved the ***Cyprus Artificial Intelligence (AI) Policy***[11] which focus on the following priority areas: • Cultivating talent, skills and lifelong learning; • Increasing the competitiveness of businesses through support initiatives towards research and innovation and maximising opportunities for networking and partnerships; • Improving the quality of public services through the use of digital and AI-related applications;

[7] Theocharous, A (2020). *Vocational education and training for the future of work: Cyprus*. Cedefop ReferNet thematic perspectives series.
[8] Department of Electronic Communications, *Digital Strategy for Cyprus*. Nicosia: MCW,2012
[9] National Board for Research and Innovation, *Cyprus Research and Innovation Strategy Framework 2019/2023*.Nicosia: NBRI, 2019
[10] Industry for Development, *The New Industrial Policy of Cyprus 2019 – 2030.* Nicosia: 2019
[11] Department of Electronic Communications,*Εθνική Στρατηγική ΤΝ: Δράσης για την Αξιοποίηση και Ανάπτυξη της ΤΝ στην Κύπρο*, Nicosia :MCW, 2012

	• Creating national data areas; • Developing ethical and reliable AI Through this strategy, Cyprus is planning to utilise more the potential of AI in *Human health activities, Transport, Tourism, Energy* and *Cybersecurity*. Considering all the above, it is evident that in order to achieve the ambitious goals and when those goals are achieved there will be an increase need in the labour market of competent personnel, researchers, engineers and technicians specialized in ICT, robotics and in microelectronics. Therefore, in the future vocational education in Cyprus will need to respond to the higher demand for digital skills development. Another important area in which VET needs and challenges are anticipated to arise is that of the Cypriot market transitioning to a green economy model. In a 2018 report, the Human Resource Development Authority of Cyprus (HRDA) conducted the study ***"Identification of Green Skills Needs in the Cyprus Economy 2017-2027"***[12] aiming to examine and analyse the green economy and green occupations, to map out the green economy of Cyprus and to identify green skill needs in the local economy during this period. This study forecasts that green economy will employee by 2027 close to 98.988 persons and will impact on 30 economic sectors and 60 occupations from the whole spectrum of the Cyprus labour market including professionals, technicians and craft workers. Several of the identified green skills are new skills arise in relation to new green technologies, environmental legislation and environmental issues that require a high degree of specialisation; on the other, the majority of professional skills that need to be developed are already existing skills, which have to be adapted to the requirements of moving to a greener economy. Specifically, in regards to VET, 30 different occupations were identified for technicians and craft workers which among others will need to have some knowledge or specialisation in semi-conductors/microelectronics (like building electrician, electrical engineer and applicator of electrical machines and devices, Electrical line installer and maintainer and cable connector, Engineer and installer of electronic equipment, machines and devices, Electricity generator operator and etc.). Essential role/part to the government's effort to increase the attractiveness of VET plays the "a ***Strategic Plan of technical and vocational education and training 2015 - 2020*** [13]and the proposal for the upgrading of secondary technical and vocational education (STEV) include measures aiming at further improvement of the quality of STVE and the acquisition by students of the (digital) skills and competences needed by the labour market. For example, new specialisations related to digital skills have been introduced in secondary technical and vocational education (STVE), such as computers, networks and communications, digital technology and programming, industrial design and 3D printing in the theoretical direction, and computer networks and communications technician in the practical direction. The post-secondary institutes of VET, which have been accredited as a public school of higher VET, offer two-year accredited programmes, leading to the acquisition of a Diploma.

[12] HRDA, *Identification of Green Skills Needs in the Cyprus Economy 2017-2027.* Nicosia: ANAD, 2018
[13] Theocharous, A (2020). *Vocational education and training for the future of work: Cyprus*. Cedefop ReferNet thematic perspectives series.

	The programmes of study, among others, include the following, which aim at preparing students for respective labour market needs: • CNC technology – woodworking industry; • computer and communication networks; • industrial and residential automation. Other measures, suggested in the Strategic Plan of technical and vocational education and training 2015 – 2020 regarding the reform in the existing VET system are: a. utilising labour market and employment forecasting studies to implement targeted measures in order to increase STEM and science, technology, engineering, production (STEP) skills. Also, to redesign and improve vocational education and training programmes, both initial and continuing (including improved internship and apprenticeship programmes); b. adjusting and customising existing public sector training programmes to respond to the actual needs of industry and industry 4.0 technologies; c. enriching secondary education programmes, both technical and general, higher education and Continuing Vocational Education and Training (CVET) curricula with certified programmes; d. establishing a framework for industry, academia and research collaboration for the extensive use of university laboratories by industry; e. refining the programmes of VET at secondary level (esp. for technical schools) according to industry needs; f. creating a register of technical school graduates by specialisation. Furthermore, in In June 2019, HRDA launched the Project for the Development of Vocational Qualifications System –VQS aiming at the development of 80 new standards and the updating of 72 existing ones. The main objective of the VQS is to upgrade human resources by assessing and certifying one's ability to perform effectively at a specified level of professional competence. So far Qualifications Standards have been developed in the areas of tourism industry, manufacturing, construction industry, wholesale and retail trade, vehicle repair, professional training, communication systems and networks / computers.
PROPOSAL FOR POLICY REFORMS	Considering all the above, it is fair to say that at the local level many policies were drafted and initiatives took place especially, after 2018, towards the reform and the increase of the attractiveness of VET as well as the creation of a common consensus of the importance of VET in covering the futures needs of the labour market. To begin with, it is important to ensure that the measures, mentioned above (like the improvement of the VET curricula, certification and validation of skills, etc.) will be implemented occurring on the actual needs of the labour market. Also, it is important to establish sustainable framework for industry, VET, universities and research collaboration. As mentioned in the Cyprus Competitiveness Report 2019[14], Cyprus has low rates of technology adoption by business as well as little cooperation between the academia and industry. Some

[14] Republic of Cyprus, *2019 Cyprus Competitiveness report.* CECC: 2012

	proposed actions by HRDA, which can support the systematic effort to support this collaboration are[15]: I. Enhancing the employability skills of students and graduates. Employability has been recognized as the biggest international challenge today tackling the problem of graduates unemployment, it is supported in many ways by the European Commission through a series of actions (Erasmus +, Mobility programmes, Alliances, Strategic Partnerships, Networks, etc.). II. Strengthening the entrepreneurial skills of graduates and young researchers for stimulating entrepreneurship with: a. Practice, project-based training of undergraduate and postgraduate students in entrepreneurship, such as business plans, innovation, modern ways of financing (incubators, venture capital, crowdfunding, start-ups, etc.) b. Training for using the results of scientific research and conversion in commercial products / services (IPR, patents, Research Management, Strategic Planning, Commercialization) III. Consolidation in the framework of Corporate Social Responsibility of the institution offering mentoring by renowned professionals and entrepreneurs with the aim of stimulating labor market and youth entrepreneurship. IV. Ability of companies to cooperate and communicate with students / graduates with flexible internships through the open communication channels provided by Communities of Practice of professionals, companies and institutions. Moreover, the Covid-19 outbreak showed the importance and need of VET providers to offer efficient distance and blended learning utilising e-learning methods. One proposal is the creation of a MOOC aggregator (Collector Massive Open Online Courses) with the cooperation of all university/technical university institutions, VET providers, public bodies and companies, hosting through the philosophy of OER (Open Educational Recourses): 1) Short-term vocational training programmes for students interested in studies and career in informatics, using the educational technique of micro-Learning, where with short videos the trainees will be able to be informed about the labor market and the issues of the sector, on-demand. The educational material will come from the Virtual Community of Practice with the assistance of stakeholders 2) Massive Open Online Courses (MOOC) that will train students / graduates (general education and VET) on issues such as problem solving, teamwork, creativity and innovation such elements can be by Universities in their curriculum as such or in the form of blended learning programmes 3) Professional development programmes, where in collaboration with companies in the industry and within the framework of their policies,

[15] HRDA, *Αξιολόγηση Χάσματος Επαγγελματιών Τεχνολογιών Πληροφορικής και Επικοινωνιών (ΤΠΕ).* Nicosia: ANAD, 2015

	either for academic programmes or on the framework of Corporate Social Responsibility, to be provided with a special regime Finally, a major issue and challenge to be addressed in the field of Vocational education in Cyprus is that of diversity in the workplace and the creation of an inclusive and non-discriminatory labour market. Sensitization on diversity issues is particularly crucial in Cyprus, a country in which those issues are especially evident in the case of gender equality and the employment of third country national (TCN), especially asylum seekers. While the national legislation is harmonized with the EU Racial Equality Directive (2004/43/EC) and the Employment Equality Directive (2000/78/EC), there are still significant barriers to the achievement of workplace diversity. These barriers include changing employers and employees' attitudes about gender roles, or issues of physical disabilities and attitudes t towards other religious groups. Evidence of that is the low rate of female enrollments and graduates on STEM and other technical occupations, in Cyprus.

6.3 Annex - National VET Policy in Microelectronics – (FRANCE)

CURRENT SITUATION	The major reform of the VET initiated in France in 2017 with 'four-party system' in charge of jointly managing the development and implementation of the VET policy in the country: The State, the regions and social partners (employee representatives and employer representatives), with the regions taking on more responsibility in guidance and less in steering of apprenticeships[16]. Firstly, the State is responsible for the development of standards and strategies for vocational training. It guides the policy of continuing vocational training and apprenticeship in a logic of securing professional careers and access to employment. Three ministries are particularly concerned by continuing vocational training and apprenticeship: The Ministry of Labour, the Ministry of National Education and the Ministry of higher education, research and innovation. The Ministry of Labour prepares and implements the Government's policy in the fields of labour, employment and vocational training. Secondly, the regions have been in charge of training specific audiences previously under the responsibility of the state. They are in charge of organizing and financing the regional public service for vocational training. Thirdly, social partners have an essential role in regulatory, policy and financial aspects of lifelong learning programmes (IVET and CVET). The inter-professional agreements they sign form the basis for the introduction of reforms and are generally reflected in legislative and

[16] European Commission (2018). *Education and training monitor 2018: France*. https:/ec.europa.eu/education/sites/education/files/document-library-docs/et-monitor-report-2018-france_en.pdf

	regulatory documents. Social partners also contribute to the development of diplomas and take part to boards of examiners. For the period 2018-2022, the Big Investment Plan (GPI) is being implemented in France. It is being based on four priorities: accelerating ecological transition, building a skilled society, securing competitiveness through innovation and creating the Digital State. The second priority -increasing skills and employment- consists in training and assisting two million low-skilled people in finding employment in order to provide a concrete response to unemployment among the least skilled workers, for whom the unemployment rate is 18%. Moreover, support is provided to improve the initial training of young people both at college and at university, as well as their professional integration. In 2022, the national programme France2030[17], as a national investment plan, has been elaborated by the French government, focusing on sectors of France's industrial future by the year 2030. Faced with the challenge of the ecological transition, the plan, drawn up with Europe, aims to support the transformation of sectors of excellence in the French economy in the automotive, aerospace, digital, green industry, biotechnology, culture and healthcare. It will be worth €30 billion over five years. In order to develop the strategic objectives for the French industry, the France 2030 investment plan foresees strong actions in the domain of skills and education: the goal is to elaborate a 10-year strategy in order to transform and modernise the training offers towards new jobs and new skills that will be required by 2030 (2 000 millions €). The professional bodies generally rely on work done by the campus of trades and qualifications (CMQ - Campus des Métiers et des Qualifications). The different CMP are organized according to multiple skills sets (*blocs de compétences*) of vocational qualifications contributing to the autonomous exercise of a professional activity and which can be evaluated and validated. The skill blocks constitution pretends to building bridges between qualifications.
PROPOSALS FOR CONCRETE ACTIONS	There is a major need to emphasize the need to better equipping candidates with competences better aligned with the needs of the labour market. In that sense, the various players in the training and professional ecosystem must be aggregated to properly define not only the skills of the professions of the future but also the content of training. Pôle Emploi finances training programmes that support skills development at local level, in targeted sectors of the economy where there is either insufficient or abundant demand for certain jobs. INES PFE, together with Pôle Emploi and the French region Auvergne-Rhône-Alpes, propose promoting an experimental methodology which

[17] https://www.diplomatie.gouv.fr/en/french-foreign-policy/economic-diplomacy-foreign-trade/promoting-france-s-attractiveness/france-relance-recovery-plan-building-the-france-of-2030/

	seeks to bringing together the trainers of the companies, the trainers of the training centres, and the trainees (job seekers), with the ultimate goal that they all find a job afterwards. This methodology meets the objective of ensuring collective work between sectors (companies and education). Stakeholders from both the training and industrial sectors[18] were gathered together in September 2021 to learn about the ECoVEM project and work on building bridges with the national governance plan. A new label - "green training"- will be explored in the region Auvergne-Rhône-Alpes so as to articulate the training needs and bring together training stakeholders who will gather all training offers on the green technologies sector. Campus des Métiers et des Qualifications (CMQ) would coordinate the formalization of this labelling and ensure, together with the rest of the stakeholders, a real political echo. A dedicated training program of one of the French Campus des Métiers et des Qualifications (CMQ) exists in microelectronics sector: Program I-NOVMICRO[19] in French Region Provence-Alpes-Côte d'Azur. This program addresses students (initial training), employees for vocational training and job seekers. The program focuses both on semiconductor production and on microelectronics design, research & development. The training methods is based on concrete facilities (clean room and advanced educational and technological platforms for microelectronics and electronics), digital pedagogy. Such a platform and a program are unique in France. A potential extension of the program has part of the France2030 investment plan is currently under discussion.
PROPOSAL FOR POLICY REFORMS	The main proposals for policy reforms are the following: **Foster regional cooperation with CMQ.** While CMQ are essential bodies for adapting to needs and changing contexts of the socio-economic sphere, regional training and research centres need to work closer with their regional Campus des Métiers et des Qualifications. Nowadays, the ambition is to create Campuses of excellence in all the regions of France in synergy with regional economic development policies. The CMQ -Smart Energy Systems at the Auvergne-Rhône-Alpes region is at the heart of professional training for a global vision of the zero-carbon transition in France and the convergence of smart energy systems characterizing the need for an efficient energy mix to meet the multiple uses of smart city (produce, manage, store, use). It aims to increasing the number of regional stakeholders brought together: secondary and higher education establishments (public / private) other

[18] Région Auvergne-Rhône-Alpes, SYMBIO, Tenerrdis, CARA, AXELERA, France Hydrogène, Michelin, Le Campus des Métiers et des Qualifications (CMQ) Auto'Mobilités, Le Campus des Métiers et des Qualifications (CMQ) Smart Energy Systems, Pôle Emploi, Institut National de l'Energie Solaire – Plateforme Formation & Evaluation (INES PFE).
[19] https://campus-industriefutur-sud.com/i-novmicro/

	training centres, research structures, companies, communities, competitiveness clusters, employment organizations. The training offer of the I-NOVMICRO program that is part of the CMQ-Industry of the future in the Region Provence-Alpes-Côte d'Azur promotes high-level professionalization in microelectronics and electronics and meets the needs of recruitment and development of the skills necessary for changes in the professions and technologies of companies in the sector. **Nurture key competences.** The common set of knowledge, competences and culture in compulsory education is necessary but not sufficient to respond to the latest skills demanded in the labor market. That's why VET courses play a key role in the recycling and renewal of skills and abilities. **Upskill low-qualified youth and unemployed.** The Investment in skills plan (PIC) aims at training and supporting the access to employment of one million young people and one million job seekers. It is funded up to EUR 15 billion for the period 2017-22. The plan links skills need analysis and innovation with the provision of new training paths. **Training aid for job creation.** In some cases, an employer who hires a jobseeker who needs training to carry out the requested tasks may benefit from training aid financed by Pôle Emploi. Operational employment preparation is financial assistance allowing jobseekers to be trained in order to be able to respond to a job offers and market's needs. **Promote the retraining and reskilling of company workers.** The job market is constantly changing, so it requires knowing how to adapt and seize the opportunity to retrain. To carry out a professional retraining, it is very important to gather as much information as possible on the socio-economic environment of the sector in which it is planned to find a job. Making use of the various new tools and projects developed around is indispensable to learn about new professions. **Develop cognitive and softs skills.** In order for active workers to show the agile adaptability needed with respect to rapidly changing job content, courses soft skills – such as critical thinking, creativity, communication- need to be provided. Seeking compliance of the above-mentioned proposals, and their subsequent translation into policy reforms, requires breaking silos and bridging bridges between the business, science and education sectors.

6.4 Annex - National VET Policy in Microelectronics – (GERMANY)

CURRENT SITUATION	Germany is widely known for its high-quality vocational education and training (VET) system. The two key features of that system are (a) firm-based training programmes accompanied by a school- based component (of one to two days per week), in which apprentices acquire upper secondary general education in core subjects (like math and German) and theoretical knowledge in their training occupation. This duality of

	practical and theoretical knowledge acquired at the workplace and at vocational schools is (b) accompanied by the private-public duality in the governance structure (i.e., public governance of the vocational schools, provide governance of the firm-based training). The dual apprenticeship system has always been the core of the German initial vocational education and training system. Until recently, even after massive educational expansion of general upper secondary schooling as well as tertiary education, the majority of a birth cohort received training within the dual system.  Source: BIBB The Figure above shows the different ways a school leaver can take to the professional carrier. More than one-third of all school leavers graduating from secondary school in Germany enter a vocational training programme, of which one-third go on to pursue a single-track, school-based VET and two-thirds the dual-track counterpart. Approximately 68 percent of the latter system's graduates enter the workforce in the company where they were trained immediately after training. Every year there are more than 500,000 apprenticeship positions available across all sectors of the economy and public administration. **Adult VET** The percentage of apprentices older than 23 years is average. "Older" adults do not participate in the dual system or vocational schools, instead they might participate in short-term further training programmes, which are often also firm-based and build on the occupations for which they were initially trained. In addition, the employment agency provides or subsidizes special training programmes for the (long-term) "older" unemployed. These programmes are not part of the VET system. Due to the emphasis of initial VET, occupational mobility is rather risky in Germany. There are only few possibilities to get training in new occupations after the age of 25-30. Thus, occupational mobility often leads to employment below the actual qualification level in Germany.
PROPOSALS FOR CONCRETE ACTIONS	Despite obvious and supported by statistical data strengths of the German dual VET system, which appeared to be more robust and resilient in the crisis times than in other countries, several problems still can be observed.

	Insufficient number of students entering the VET system. Every year several thousands placements for VET programmes are not filled and the trend is worsening. The areas, which are affected most, traditionally – health and care, services, but in the recent years even technology- and manufacturing-oriented programmes (including e.g. Microsystems) face the lack of students. Among major reasons for this tendency are demographic shift and the fact that more and more school leavers prefer to enter tertiary education programmes. **Proposal**: To extend the efforts aimed at improving the visibility and attractiveness of VET in the field of Microelectronics to potential candidates. To revise the framework requirements for the Microsystems programme in order to (potentially) widen the scope. **Disadvantages for low-achieving school leavers.** Statistics demonstrates that low-achieving school leavers who did manage to start an apprenticeship are overrepresented in the lower-skilled and least attractive occupations, characterized by low wages and high unemployment risks. Usually they are trained in lower-tier skilled trades or lower-tier skilled occupations in agriculture and domestic services. In Germany today, these occupations constitute the most unstable economic sectors, and are the ones most heavily threatened by shrinking labor demand, low(er) job security, and a high risk of dismissal/unemployment. Proposal: To strengthen the pre-vocational programmes offer in order to improve the harmonization of competence levels for VET system candidates. Work with schools to identify those pupils who are at risk to leave the school as low-achieving and divert them to pre-vocational programmes. **Insufficient opportunities for adults' VET**. As indicated above the programmes focused on re-training and changing professional profiles are not part of the VET system. Most of them are provided through the Unemployment services (Arbeitsamt) and target those already unemployed. Additional VET opportunities provided by other providers (e.g. Volkshochschulen, etc.) are not firm-based, which reduces their attractiveness. **Proposal**: to study the opportunities to extend the offers for short-term further- or re-training programmes within the current VET system
PROPOSAL FOR POLICY REFORMS	The policy making process in the field of VET in Germany includes several stakeholders, namely: • Federal Government and Bundestag (The Parliament) setting up the general frameworks allowing the unified standards of vocational education across the country. Moreover, the policy implementation mechanisms include funding schemes allowing to generate and disseminate best practice in VET • German Federal Institute of Vocational Education (BIBB), which is responsible for development of VET programmes' standards, certification/accreditation of VET providers. Moreover, BIBB is a consulting and supporting body to the Government and the Parliament.

	• German Chamber of Commerce (IHK) involved in the functioning of the dual VET system on the side of the industry (see above) • Governments and legislative bodies of the Federal States (Länder) of Germany. The VET system, as well as all other parts of education system in the country, is funded on the regional level. Therefore, the local stakeholders define the financial aspects of the VET system functioning, priorities of VET programmes (in line with the regional Smart Specialization Strategies) and other key aspects. The Germany's VET system has been maintained and defended by many different actors – firms, trade unions, employer associations, and politicians on the federal and state level, as well as parents and the broader German public. Without any doubt, it continues to present many young people with a very attractive and viable alternative to higher education. About 60 percent of apprentices are eventually hired by their training firms after completing their training and, thus, the VET system helps young German adults to transition rather smoothly into the labor market – a major advantage of the dual system compared to university education. Therefore, the major aims of the German VET policy is to preserve and maintain the strengths of the system (e.g. close links to the labor market, high quality of training, etc.), and to enable graduate evolution in order to adapt it to the changing market/societal conditions. Thus, the policy-related recommendations might include: • To extend the opportunities for VET teachers re-training in such emerging areas as e.g. IoT, Industry 4.0, Industrial AI. Special projects addressing this goal could be designed and implemented to equip potential training providers with such opportunities. Involvement of major relevant innovation partners (e.g. leading Universities, Research & Technology Organizations, industrial stakeholders, etc.) can be envisaged. • To incentivize the emerging German regional European Digital innovation Hubs to include VET services in their portfolio (via national funding instruments). Include related KPIs for the EDIHs.

6.5 Annex - National VET Policy in Microelectronics – (ITALY)

CURRENT SITUATION	The spreading of digital technologies, both at transversal level as well as at a specific level such as microeletronics, is a precondition for digital transition. Microeletronics can be defined as a leading sector of Italian economy. Nonetheless, related educational and training programmes suffer the same problems as the Italian VET system in general.

	The development of the digital culture goes hand in hand with the necessity to invest in young people's education, on active labor policies and on lifelong learning system. Within all these areas, the Italian VET supply requires intervention for improvements. Considering just initial education and training, two systems coexist: the technical vocational secondary school programmes (5 years) and the VET programmes managed by Regions (3 + 1 years), representing 10% of the supply for the 14 – 18 age group. VET initial training is characterized by an experiential learning, even on-the-job mode (apprenticeship), and by its inclusive function, especially towards the so-called early school leavers. Unfortunately, this supply is not homogeneously distributed on the whole national territory. It is widespread to a greater extent in the centre-north of the country, mostly managed by training agencies accredited by the regions; it is less common in the south of Italy, where it depends on state educational institutions. One of the main limitations to the diffusion of VET in initial training is the low horizontal and vertical permeability between the two systems. The European Commission affirms that "education and training systems should allow vertical and horizontal pathways between VET, general school education, higher education and adult education" (Proposal for a COUNCIL RECOMMENDATION on vocational education and training (VET) for sustainable competitiveness, social equity and resilience - 01.07.2020). Within the Italian framework, the transition from the VET regional system to the national one is still arduous, but the transition from initial VET to tertiary technical-professional education and training is even harder. Italy is still not provided with a strong and comprehensive channel of post-secondary vocational training. The Higher Technical Institutes (HTI) are two-year courses of education and technical-vocational 5th EQF level, introduced in 2011 in close collaboration with the business world. So far, this experience produced great results, with regard to employment outcomes: 80% of 2019 graduates found employment within 12 months after graduation, 92% in positions consistent with the field of study (source: INDIRE, 2021). Nonetheless, the number of annual graduates stands at approx. 3,500, considerably less than the needs of the productive system and the 120,000 annual university graduates in Italy. All data are to be seen in a context in which only 28% of young people under 34 obtain a tertiary qualification, a much lower result than the European average of 44% (source: OECD). In addition, there are the difficulties in passing from the secondary level (EQF level 4) to the post-secondary level (EQF level 5), in particular for students of regional initial training who want to access HTI higher education.

	Once they terminate the four-year period of training (EQF level 4), regional VET graduates can access HTI (EQF level 5) only if they complete the fifth year from the state education system or from attending another year in the VET system (which is not regularly available). This uncertainty about continuing their studies discourages young people and their families from enrolling in regional VET courses.
PROPOSALS FOR CONCRETE ACTIONS	The National Recovery and Resilience Plan (NRRP), Italian version of NEXT GENERATION EU, dedicates MISSION 4 to EDUCATION and RESEARCH. Specifically, within the scope of intervention "Qualitative improvement and quantitative expansion of education and training services", the NRRP introduces the following Measures: Reform 1.1 "Reform of technical and vocational institutions", Reform 1.2 "Reform of the HTI system", Reform 1.3 "Reform of the organization of the school system" and Reform 1.4 "Reform of the guidance system". The reform of technical and vocational schools integrates the principles of Industry 4.0 and those of the digital innovation into the training model. The reform will involve 4,324 Technical and Vocational Institutes and the VET education system (regional direction VET). The VET system reform is aimed at boosting the HTI model through the development of qualifying technological competences (*IMPRESA 4.0* – Enterprise 4.0), the consolidation of the HTI offer in the system of professionalizing post-secondary education and the integration of HTI pathways within the university system of professional degrees. Thanks to the reform of the guidance system, modules on training guidance will be introduced in the curricula of lower and upper secondary school, in order to help students making a conscious choice pursuing their educational path or higher vocational education and training (HTI), which is qualifying for the job market. Furthermore, experimentations on upper secondary education and four-years technical institute will be deepened. A series of legislative and regulatory interventions are already planned, and they will be defined by the competent Ministries during the next months, and implemented in the next years to come.
PROPOSAL FOR POLICY REFORMS	The context is changing and it is likely to welcome some concrete directions in the ongoing processes that, during the development of the ECoVEM project, appeared relevant to promote the diffusion of technological and digital competences in the VET framework. 1. Permeability of education and VET systems It is necessary support permeability between general education system and initial VET:

a) Horizontal permeability: allowing the passage from a system to the other one, without wasting years, providing personalized guidance and training actions that allow the student who has obtained eligibility for the following year in one system and wants to access the other without starting over

b) Allowing access to HTI higher technical training (EQF level 5) also for graduates of VET initial training after a four-year course (EQF level 4). Currently they can access the selections for admission in an HTI path:

- graduates of the state education system after a 5-year course (EQF level 4)
- specialized from Higher technical education and training
  - after 5 years of state education (EQF level 4) + 1 year of VET (EQF level 4)
  - after 4 years of VET (EQF level 4) + 1 year of VET (EQF level 4)

In the meantime, an experiment is underway to obtain the high school diploma in four years (instead of five) and the above mentioned NRRP plans to extend this experimentation from 100 to 1,000 classes, also involving technical education.

This situation shows the poor integration between the state education system and regionally directed VET.

The outlined proposal to allow the access to HTI to VET graduates after a four-year course of EQF level 4 is supported by the business sector, represented by *Confindustria* and *Associazione FORMA*, which gathers all main training Agencies on the national territory.

Furthermore, this proposal is consistent with the strengthening of the experimentation on four-year upper secondary schools/technical institutions that the national government is preparing to launch.

2. Guidance

Italy is suffering from a serious skills mismatch between education and job market, and the effects of a constant exodus of qualified human capital. About 33% of Italian enterprises complain about recruitment difficulties, while 31% of young people up to 24 years old do not have an occupation, but they are looking for it. At the same time, only 1,7% of tertiary students enrol in HTI courses, while University drop-out rates remain worrying.

This situation is due to a weakness of the Italian educational system, which lacks proper professionalizing post-secondary training supply (HTI/professional degrees). Even in the secondary education segment, the supply by upper secondary schools prevails over that of technical and vocational institutes.

	The growth of a vocational post-secondary training supply, stable and well linked to the productive local systems, is recent and little known. The selection of a technical-vocational education path in the age class 14-18 is very often linked to an unsatisfying result from the first cycle of education. The factors contributing to this phenomenon have deep roots within the socio-economic and cultural evolution of the country, starting from the past century to this day. The NRRP addresses the problem and introduces guidance modules into the curricula of the lower and upper secondary school with the aim of training students' self-direction skills, informing about the new skills required by the labor market and on new training opportunities. The experience gained by the partners of the ECoVEM Project suggests that, during the implementation phase, they find adequate space in the training guidance activities: a) VET in the initial training segment: for this offer to meet the interest of the population, it is necessary that it can be integrated and permeable with general secondary education and with post-secondary vocational education and training; b) professionalizing post-secondary training (HTI/professionalizing degrees): alongside the need to increase the number of graduates, there is in fact an equally pressing need to train the technicians who will accompany the digital transition and the green transition. The development of a professional training chain is essential to bridge the skill mismatch between job supply and demand, to promote talents and new entrepreneurship and to reduce the number of high school and university dropouts.

6.6 Annex - National VET Policy in Microelectronics – (SPAIN)

CURRENT SITUATION	At the beginning of 2015 the proportion of upper secondary students enrolled in VET programmes in Spain was below the EU average: 34.4% in 2014 compared to 48% in the EU; 35% in 2015 compared to 47% in the EU. 100% of upper secondary iVET students were following work-based programmes in 2014 (whether on dual track or not), against 34% in the EU. The employment rate of recent upper secondary graduates was also low: 54.7% in 2014 and 54.9% in 2015 compared to 70.8% and 74.1% in the EU respectively. Adult participation in lifelong learning was below the EU average: 9.8% in 2014 and 9.9% in 2015 compared to 10.7% on average in the EU in both years.

	The education and training system in Spain was faced with the challenge of bringing young people's skills closer to labour-market needs; consequently, VET qualifications in the education system have been updated with the aid of business. VET had to gain in attractiveness. There was a need to increase the in-company training period so as to bring students closer to employers and provide the former with greater employment opportunities, especially in times of economic crisis and high unemployment. Dual VET had been introduced in 2012 and was in place in all autonomous communities by 2014. New incentives for involving enterprises in dual training were being set up. A reform of the training system within the public employment service was underway, and the introduction of a personal training account has being prepared by Cedefop (2020). *Developments in vocational education and training policy in 2015-19: Spain*. Cedefop monitoring and analysis of VET policies. https://www.cedefop.europa.eu/en/publications-and-resources/country-reports/developments-vocational-education-and-training-policy-2015-19-spain Employment aimed at vocational training graduates has exceeded the demand for university graduates. In total, a 41.3% of the offers published by companies are looking for candidates with this training. Taking as a reference the global job offers, the VET Middle Degree qualifications have been demanded in the 18.5% of the offers are the protagonists of this rise. Higher-level VET degrees, for their part, have seen their demand slightly reduced: from 23.4% in 2019 they passed to the current 22.7% (-0.1 p.p.). 47.6% of the job offers that include among their requirements being in possession of a Vocational Training qualification do not specify a professional family. Of the remaining 52.4%, the Electricity and Electronics area opts for 8.76% of the job opportunities in which candidates with Vocational Training are sought. (Report Infoempleo Adecco, 2020) https://cdn.infoempleo.com/infoempleo/documentacion/Informe-infoempleo-adecco-2020.pdf
PROPOSALS FOR CONCRETE ACTIONS	A productive model with great sectoral diversity, an atomized business structure and digital skills deficits, which affect workers, managers and owners of microenterprises, are some of the great challenges facing digital transformation in Spanish industry. Supporting this transformation requires not only a wide variety of measures to promote and support research and innovation, entrepreneurship, the development of network infrastructures, but also a rise in the qualification level of the population in general, and of certain groups in particular, and the creation of quality employment with high added value. An efficient and good coordination of the strategies implemented for the digital transformation in the Spanish education and training sectors and the economy is necessary to guarantee the success of this transformation, especially when different departments and governance levels are involved, allowing to undertake joint actions and profit from synergies. Measures deployed care for both the development of infrastructures and facilitating the integration of these technologies in companies, public services and educational centers, as well as for the training of workers and employers, and citizenship in general. This training is not only the result of specific training

	actions, but also in non-formal and informal ways, thanks to other types of actions and personal experiences, both individual and professional. In the education sector, digital skills are included at basic education (compulsory) before the VET or high school stages, so that students reach those with a minimum of digital competence. These skills are being reinforced in some cases with others more specific to i.4.0 such as programming or computational thinking. However, the challenge of reducing the mismatch between demand and supply of ICT specialists still persists. Updating and designing new qualifications to meet the demand for skills of the I4.0 era, setting up mechanisms for the rapid design of new qualifications to meet new demands, and flexible structures that offer such qualifications are required. New teaching methodologies are required, extending beyond initial levels, which favor collaborative learning, problem solving and innovation, and the development of soft skills demanded by I4.0, while stimulating the choice of STEM professions as aging and low birth rates add demographic challenges to those already deriving from technological changes. The incorporation of female students, still a minority in these subjects, is an objective to be reinforced. From the training in employment side, several measures have also been put in place to train workers - employees, unemployed and young people – in technologies linked to the I4.0. However, we cannot forget that professional competences are acquired and developed not only in the educational-training system, but also through non-formal and informal learning and through experience. Beyond favoring the acquisition of knowledge via e-learning, learning needs to be promoted through other methodologies (such as project-based learning, gamification, virtual reality, etc.). It is necessary that there are adequate mechanisms, new criteria and methodologies, in line with the new production models, which facilitate education training and employment transitions, to favor adequate, positive and permanent attitudes to this endless transformation. Finally, the process of digital transformation is affecting the whole of the society and the economy and modifying the traditional balance of economic and social organization. This requires governance systems that allow the final balance of the process to be positive, thus contributing to sustainable and inclusive development. Social dialogue plays an important role in preventing and limiting possible social imbalances, especially in working conditions Sancha Gonzalo, I. (2020). *Vocational education and training for the future of work: Spain*. Cedefop ReferNet thematic perspectives series. http://libserver.cedefop.europa.eu/vetelib/2020/vocational_education_training_future_work_Spain_Cedefop_ReferNet.pdf
PROPOSAL FOR POLICY REFORMS	The law defines a single vocational training system as a set, which identifies the professional competencies of the labour market, ensures suitable training offers, enables the acquisition of the corresponding training or, where appropriate, its recognition, and makes it available to the population a professional guidance and support service that allows the design of individual and **collective** training itineraries.

	A model of professional training, recognition and accreditation is established of skills and professional guidance based on training itineraries facilitators of progression in training. It is structured in five degrees ascending A, B, C, D and E, descriptive of the Training Offers organized in Units designed according to the National Catalog of Competency Standards Professional. It defines the instruments created, by modification of the current National Catalog of Professional Qualifications, a new National Catalog of Standards for Professional Competence and a Modular Catalog of Professional Training, plus a Catalog of Professional Training Offers. With a State Register of Training Professional will allow any citizen to access it and obtain a LifeTraining-Professional updated. It regulates the offer of professional training. the double offer disappears current to create a single creditable, certifiable and accessible offer, allowing with this to the citizenship to design and configure their own itineraries adapted to their needs, capabilities and expectations. Flexibility is expanded in the design of the curriculum, so that each educational administration can incorporate elements that improve the adjustment of training to the specific needs of the productive sector in its environment. The basis of the relationship between professional training and university is established, both constitutive of higher education in the country. The regulation of vocational training actions is incorporated in Business. It regulates Dual Vocational Training, declaring all vocational training in grades C, D and E. Dual, regulating the appropriate distribution of the development of the curriculum between educational and vocational training centers and work centers. Likewise, the figures of Company Tutor, Dual Tutor of the Center are regulated, as well as such as the role of the social partners and intermediate bodies. Adaptation to the needs of people or groups with specific support needs or difficulties in finding work is foreseen. With regard to the centers, the two networks of vocational training centers, independent until now (of the educational system and centers and entities authorized for FP for employment), became complementary. The creation of specialized centers by sectors is incorporated, which will promote permanent innovation and will be tractors of the rest of the network. It addresses the aspects related to teachers and trainers of vocational training for employment, establishing different profiles according to the type of training and the type of training action in question. It addresses, in addition, the permanent training aspects of the teachers and trainers, as a fundamental element for the maintenance of the quality of the system. The precepts relating to the accreditation of professional competences acquired through work experience and non-formal training routes are collected and updated, establishing a permanent open procedure. It is established that it is compulsory to have a mechanism for the Evaluation and Quality of the System, in accordance with the principles agreed upon at the European level.

	Last year the Royal Decree 272/2022, of April 12 was published, which establishes the Spanish Qualifications Framework for Lifelong Learning.

6.7 Annex - Digital and Entrepreneurial Training for Teachers

Introduction

Digital and Entrepreneurial skills are set of fundamental competences to be acquired not just at the highest level of education, such as Universities, but also at VET level, especially if one considers its tight connection to the labour market. The close link between VET providers and the job market must be seen as a great opportunity to understand needs and demands arising from both sides, and as a possibility to build efficient responses.

In order to deliver high standard digital and entrepreneurial training to their students, teachers are the first subjects needing upskilling and reskilling, since these sectors rapidly evolve and education has to keep up with changes. During the past years, the European Union has delivered some interesting tools which allow education systems to maintain coherence on the pursuing of objectives, even among different countries.

With respect to Digital skills, **DigCompEdu** is the European reference framework for educators to evaluate and develop their digital competences. Regarding Entrepreneurial Skills, **EntreComp** provides for a competence framework at European level. In the next paragraphs, DigCompEdu and EntreComp frameworks will be introduced as valid means for teachers' training.

Digital skills and the DigCompEdu: useful training areas for VET teachers

If there are no doubts digital technologies have been playing a decisive role in our everyday life for the past decades, the COVID-19 outbreak has significantly increased the use of them in every sector, including VET. The global health emergency gave a boost to the use of technologies within the educational systems, both as a supporting means, but also as a real competence in its own right to be explored and exploited. While the utility of digital technologies is not questioned, their effectiveness goes hand in hand with the level of preparation of teachers. The Policy Brief "Education during COVID & Beyond", issued by the United Nation in August 2020 has clearly reported that teachers were mostly unprepared to adopt technological teaching methodology, even when provided with adequate infrastructure and connectivity context. At European level, the COVID-19 pandemic has highlighted the gaps even more: according to the Cedefop report "Digital Gap during COVID for VET Learners at Risk in EU" (June 2020), VET teachers have insufficient experience in creating digital learning contents.

Especially with regards to the VET system, which usually involves a great deal of time spent on face-to-face laboratories, teachers had to find solutions to deliver knowledge and to allow students to practically experiment with the acquired notions. Teachers' upskilling on digital technologies revealed to be fundamental in order to find an efficient interaction channel with students: remote skills transfer is not limited to publishing online handouts, virtual classrooms and making sure users access them every day. It requires a change of mentality in particular from the teachers and tutors/coordinators side, that can be expressed making use of the digital skills reference framework for educators **DigCompEdu** (based on the DigComp framework), and which allow them to be capable of:

- interact with colleagues, learners, parents and other interested parties through the means of digital technologies (Area 1 DigCompEdu)
- select digital assets; organize, share and publish digital resources; create and modify digital resources (Area 2 DigCompEdu)

- designing, planning and implementing the use of digital technologies in the different stages of the learning process (Area 3 DigCompEdu)
- use digital tools and services to improve interaction with students (Area 3 DigCompEdu)
- use assessment models and digital strategies to improve assessment, analyse evidence, use digital tools to provide timely and personalized feedback (Area 4 DigCompEdu)
- ensure access to educational resources and activities for all students including those with special needs (Area 5 DigCompEdu)
- facilitate learners' digital competence (Area 6 DigCompEdu)

The strong feature of DigCompEdu is certainly its capability of aligning teachers' digital competence in every European country. On the other hand, it must be pointed out how the adoption of DigCompEdu is far from being settled: as observed in some Cedefop reports, DigCompEdu is still far from being absorbed and operative from the VET side, often remaining on a level of abstraction. There is the need to favour the adoption of the European tools at local level. The Erasmus+ programme proved to be a valid means to experiment with and spread the DigCompEdu, even for VET providers.

Entrepreneurial skills, EntreComp framework and its application on VET teachers' training

Especially in the context of Vocational education, students need to acquire tools and skills that allow them to eventually undertake a path of self-entrepreneurship. Compared to Universities, that often have a "Firm Creation" support mechanism for their students to establish a business or launch a start-up (business incubator, accelerator, career office, mentorship programmes, etc), no VET providers in Europe have anything similar. This generates a serious lack for VET system and the students who, provided with the right knowledge, skills and tools could otherwise develop brilliant ideas for businesses. VET students are only provided with some theoretical concept on entrepreneurship, at best there are business plan competitions and simulations, but no real firm creation. No skills applicable to the job market are provided.

Very similarly to the digital skills, students can only acquire entrepreneurial skills when their teachers are properly ready and upskilled and have developed an entrepreneurial mindset. This means they do not just possess mere knowledge, but they are also creative and able to envision less travelled paths to guide and encourage their students.

The EntreComp Framework, delivered by the Joint Research Centre of the European Commission in 2016 is aimed at offering a clear scheme that defines entrepreneurial skills, and it is addressed to teachers and trainers, policy makers, people working with young people outside formal education, start-ups and entrepreneurs, people working in human resources. The framework defines 3 competence areas and a list of 15 competences, learning outcomes and proficiency levels.

Areas of Competence	**Competence**
Ideas and opportunities	Spotting opportunities
	Creativity
	Vision
	Valuing ideas
	Ethical & Sustainable thinking
	Self-awareness & Self-efficacy

Resources	Motivation & perseverance
	Mobilising resources
	Financial & economic literacy
	Mobilising others
Into action	Taking the initiative
	Planning & management
	Coping with uncertainty, ambiguity & risk
	Working with others
	Learning through experience

The adoption of EntreComp as basis for teachers' training would respond to the immediate need to promote Firm Creation and Start-Up promotion in VET systems, turning generic and theoretical "entrepreneurship education" into real business promotion. This tool aims at enable public authorities and private actors to improve their guidance, training and mentoring services for young people and job seekers, and at the same time further an entrepreneurial mindset among citizens. Its adoption for VET providers' teachers training allows the application of entrepreneurial skills on a practical level, building actual bridges between the education system and the labour market. Entrepreneurship is understood as a transversal key competence applicable by individuals and groups, across all spheres of life.

The acquisition of Entrepreneurial skills on the teachers' side would also have positive effects on the long run. Beside being able to deliver accurate knowledge to students, upskilled teachers would be promoters of a new trend, which would see Europe as a strong protagonist of entrepreneurial culture, nowadays still weak compared to elsewhere in the world.

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6.8 Annex - Understanding teachers' motivation and satisfaction

Introduction – A general overview on teachers' motivation and satisfaction

Motivation and satisfaction deriving from a teaching career are changing factors, variable processes which are influenced by the interaction among many dimensions (biological, emotional, cognitive, behavioural) and causes (internal and external, contextual). Whatever the level of motivation of a teacher is, it is factual the tight interrelation between a teacher's motivation/satisfaction and the learning outcomes of his/her students. From a pedagogical point of view, a high level of motivation on the teacher's side translates to a greater opportunity to build a good relationship with the student, who is likely to gain greater educational accomplishments (which is in turn a source of satisfaction for the teacher). The educational relationship is dynamic, deriving from the different teacher's and the students' personalities. The parties also have an imaginary or unconscious representation of the other, which often condition both parties' reactions: curiosity, fascination and interest, or fear, repulsion and disinterest. The higher the level of motivation and satisfaction, the more the teacher is inclined to be completely aware of the relationship dynamic, therefore being able to address it to a more fruitful direction. Furthermore, a satisfied teacher is unlikely to leave the job, assuring a continuity with the students, a factor that positively affects their academic career. About this point, it must highlight the OECD finding, that says that teachers who are satisfied with their terms of employment are significantly less likely to intend to leave their profession within the next few years, while teachers experiencing work-related stress are more likely to leave the job (even permanently).

An interesting observatory of these dynamics is in fact carried out by OECD, which regularly conducts international investigations on teaching and learning (*TALIS - Teaching and Learning International Survey*). Since 2008 the survey provides for a global, yet detailed, overview on the educational systems in the OECD countries, and it is the first major international survey of teachers and school leaders on different aspects affecting student learning.

Motivation, satisfaction and fulfilment of teachers is not just important to retain well-experienced long-time professionals within the field, but it is also crucial to attract new entrants to the profession in the future: the social image of teachers, the possibility to exchange positive experience with long-time professionals during the training years are influential factors which might determine the professional choice of many promising new entrants. Attracting the right individuals to the teaching profession is necessary to ensure teaching quality. To these individuals, the school system must offer the possibility to cultivate their initial motivation, transforming it to a permanent and stable source of professional purpose during their entire career.

Overall and according to OECD reports, it can be affirmed that the majority of teachers hold a good level of motivation and satisfaction, although it is difficult to maintain the same level throughout their entire career cycle, since many hindering factors may rise up. Of course, situations may vary from one country to another, but certain patterns can be recognized more or less everywhere, especially during COVID-19 crisis, which brought up almost identical sets of problems and uncertainties not just in Europe, but everywhere around the world.

Beside the already known factors which influence teachers' motivation, the COVID-19 crisis has certainly imposed much more psychological pressure on this already delicate profession, and the consequences are foreseen to influence teachers in the long run.

Teachers motivation: affecting factors and proposals

In order to find solutions on how to boost teachers' motivation pursuing their career, it is important to understand the critical points which determine discontent and frustration:

- Social image
- Salary
- Continuous professional development
- Mutual support-collaborative environment
- COVID-19
- Professional career path
- Mission

SOCIAL IMAGE

As already mentioned above, the social image of the teaching profession plays an important role in defining the motivation of teachers. In general terms, society does not consider the teaching profession with due regards, and this trend is much stronger when related to the lowest cycles of education (kindergarten, primary school, lower secondary school), while teachers from higher education (upper secondary school, university, etc.) enjoy greater consideration. Nonetheless and regardless of the educational cycle, teachers carry on a very delicate profession, having on their hands the learning and training phase of young people, whose future active role in society depends also on the beneficial and long-term interaction with their teachers. Unfortunately, this profession is too often underrated by society, leading teachers themselves to underestimate their role in young people's lives.

→ To overcome this lacking of social consideration, there should be a collective effort to:

- Improve teachers' self-image of their work and their importance as role models for students. This means allowing teachers to acquire more confidence regarding their profession. This process must start during their training years and continue throughout their entire career;
- Build stronger connections between schools and the community, with parents and employers, to enhance the status of teaching. The active involvement of other subjects in the school system is necessary to spread consciousness regarding the teaching profession;
- Enhance the image of teaching through general campaigns in the media;
- Take into due consideration teachers' own views about what needs to be emphasised, for example, teaching's social relevance, working with young people, creativity, autonomy, working with colleagues;
- Promote the benefits of teaching to under-represented groups, e.g. males and those from minority cultural backgrounds, by:
  - promoting positive teacher role models from these backgrounds;
  - correcting misconceptions responsible for negative views of teaching;
  - disseminating information about teaching to these groups.

SALARY

Pragmatically speaking, a very important variable that determines motivation and satisfaction of teachers is salary. Here a variety of factors intervene, but most importantly the level of experience and the geographical position determine the level of satisfaction. Too often a high level of experience does not correspond to a just and fair salary (but on the other side new entrants are usually satisfied). Furthermore, while a salary might be considered as passing by teachers living in rural areas, this cannot be affirmed regarding teachers living in cities, where housing prices and the cost of living are typically higher than in rural areas. Salary is often considered inadequate with respect to work overload and with regards to student-teacher ratio; teachers would benefit from a smaller

number of administrative tasks, which would enable them to spend more quality time with their students.

→ In order to deal with this matter, it would be of utmost importance to activate a dialogue at policy level, not only to ensure an increase of salary, but also to discuss other related matters, such as: providing flexible working conditions by increasing the opportunities for part-time teaching as well as sabbatical leaving, extended leave without pay and job exchanges with industry. This process must be activated or further developed at single Country level, since school system policies may greatly vary in each context.

CONTINUOUS PROFESSIONAL DEVELOPMENT

A delicate point when it comes to teachers' motivation regards the possibility to professionally develop from a learning and training perspective. In a rapidly changing society and with the continuing spreading of new technologies, many teachers suffer the difficulty to keep up to the complex needs of their students. The impossibility to adequately respond to their students' needs, the inability to understand dynamics without the tools offered by pedagogical updating, coincide with a lower level of motivation and satisfaction. This is a time in history when teachers would highly profit from support for continuous professional development, since they need constantly updated information.

→ Continuous professional development activities include participation in online seminars, education conferences and network of teachers (which could also be important for spreading information about the new practices and routines required during the COVID-19 crisis). The level of satisfaction might also be influenced by the material support teachers receive for continuous professional development, such as reimbursements, provision of materials and salary increases, and reduction of teaching hours. It is also important to keep up to date with the most discussed topics at international level, such as green sustainability, digital transformation, social inclusion and active citizenship, allowing teachers to become a direct connection between the school system and the most active dynamics of the outside world.

MUTUAL SUPPORT – COLLABORATIVE ENVIRONMENT

School is a collaborative environment in which different subjects contribute to delivering a composite educational programme to young people. Nonetheless, teachers need more opportunities for discussion among colleagues, in order to collaborate from a pedagogical-didactic point of view, to compare and share their different professional experiences and to create cohesion. Being able to feel as an active part of a whole, to share one's own opinion and to contribute to the smooth running of the school/institution, results in an increased level of motivation and satisfaction. Professional collaboration is therefore associated with higher job satisfaction and teacher self-efficacy. Feedback from peers is a unique form of collaboration that puts teachers at the centre as experts of their own practice.

→ In order to foster a collaborative environment, each school should:

- Create moments of exchange among colleagues and school leaders. These gatherings should be the moments to exchange professional experiences, to work on common/interdisciplinary projects, to share opinions on students, pedagogical strategies, etc.;
- Staff participation in school governance. Participating in school governance means having the opportunity to shape the work environment. Effectively including teachers in the decision-making process could both improve the process itself and make teachers feel more empowered and satisfied with the conditions of their work environment. This was particularly meaningful, during the COVI-19 crisis, where teachers were required to adapt and contribute

to an overhaul of school practices and routines to reduce the risk of contagion for students, parents and themselves;

- Staff participation to seminars/events led by external experts, such as team building activities, emotional and communication training, etc.

COVID-19: effects on teaching profession

As well as in many other sectors, COVID-19 crisis imposed heavy consequences on the school system: the uncertainty of being able to deliver face-to-face teaching, the forced adoption of technologies to ensure online education and training are just some of the difficulties school had to face during the past year and a half. If on the one hand, students are the subjects who suffered the most from the inability to attend school and cultivate relationships outside the family, on the other hand teachers suffered a great deal of stress due to innovative teaching methods which they have been forced to adopt. When the COVID-19 crisis struck, teachers in many educational systems had to teach in a new context (online) and were uncertain regarding the reopening of schools. Once schools reopened, they did so amidst varying safety measures and the constant threat of school closure. All those conditions are likely to have substantially affected teachers' job satisfaction and stress.

Teachers' conditions during the pandemic varied in each country. While in some countries teachers were already technologically prepared, advanced, trained to deliver online teaching, and equipped with the right tools and devices, in many other Countries teachers found themselves forced to self-update. Digital literacy played an important role during the past year and a half: while highly digitally skilled teachers could more easily cope with this situation, many other teachers with basic or none digital skills faced greater difficulties. It is difficult to quantify the effects on the different subjects involved in the school system, but any doubt is out of the question with regards to an increased level of stress suffered by teachers. In general terms, the pandemic has highlighted the need to boost digital literacy among teachers, in order to bring their level of digital competence to a common point, without leaving anyone behind.

PROFESSIONAL CAREER PATHS

The possibility to move up to the teaching career path is strictly connected to the peculiar system of each Country. But generally speaking, it must be highlighted the extreme difficulty to accomplish significant results. Beside discontent with regards to the salary, which often is not adequate to the years of experience, in the school system it is quite difficult to occupy higher positions in terms of governance, leadership and responsibilities.

→ A sense of gratification would come from the possibility to professionally evolve, combining the increase of experience with the chance to take on new responsibilities, for instance at school governance level.

MISSION

Beside more practical sources of motivation, the teaching profession must also be based on a strong, inner, and personal calling. Many aspiring teachers recognize the importance of the earliest stage of life for learning and becoming valued citizens, and very often undertake their profession as a sort of a "mission" to accompany young people through the path that is supposed to prepare them for life after the education cycle. Motivation and satisfaction come from the possibility to pass on knowledge and skills to young people, being aware of one's own chance to positively shape others' people's lives.

→ Of course, this personal source of motivation can be influenced by the other factors, especially when aspiring teachers conclude their training period and have to confront their ideals with the actual (often tough) reality of the school system. The capacity to keep constantly alive these kinds of purposes is related to a great number of variables: personal/emotional situations, internal and external causes (also linked to the school system). It can be affirmed that mission related motivation can be kept high when also the other factors meet satisfactory standards.

Conclusion

The possibility to maintain high level of motivation and satisfaction for teachers to pursuing their career is a joint effort of different factors and subjects:

- Of the **teachers** themselves, who should be able to believe in their mission, to be willing to pass on knowledge and skills to the youngsters for their future and for their role in society;
- Of the **school/educational institution**, that should detect and respond to the teachers' needs (i.e. organizing more spaces for dialogue among colleagues, organizing continuous professional development occasions, etc.);
- Of the **policy makers**, who have the responsibility to design and realize structural reform interventions that requires favourable conditions, long processing times and economic resources to invest (i.e. request for a salary increase).

It is important to start a collaborative dialogue in order to find suitable solutions to maintain and enhance teacher's motivation and satisfaction.

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6.9 Annex - Efficient financial models for VET

a) Developing sustainable financial models that combine public and private funding;

Across the EU, a variety of national and regional models exist that support VET, combining public and private funding. These good practices initiated either by national and regional authorities, or by industrial ecosystems and academia, should constitute the basis to build a pan-European all-encompassing approach on VET. This European approach will give the opportunity to students, teachers and workers to support their career and study development, consequently creating a highly-skilled workforce and advancing the position of Europe in a highly competitive global environment. Examples of such good practices include industry participation in teaching/learning as well as work-based apprenticeships with emphasis on regional development, digitalisation, green technologies, networking and life-long learning.

At the European level, the 4-year METIS project (Microelectronics Training, Industry and Skills) was launched in November 2019. The project implements a new strategic approach to sectoral cooperation on skills for microelectronics by involving the key players across industry, education & training and regulatory/certification bodies. The purpose of METIS is to contribute to the competitiveness of EU microelectronics industry by addressing the shortcomings in education & training, skills and employability with a focus on paving the way for EU leadership in data-driven technologies such as AI, which generates unprecedented opportunities that go beyond market dynamics and job creation, and encompass issues related to security and technological sovereignty. To institutionalise METIS into sustainable and durable mechanisms to promote the competitiveness of the EU microelectronics sector at systemic level through robust VET-industry collaboration.

Further to this European project, the Europractice initiative launched by the European Commission aims to enhance the European industrial competitiveness in the global market. Over the past 25 years, EUROPRACTICE has provided the industry and academia with a platform to develop smart integrated systems, ranging from advanced prototype design to volume production.

A French initiative, the GIP-CNFM (National Network providing Education and Training in microelectronics) in the field of electronics, microelectronics and nanotechnologies. This project is devoted to upskilling and reskilling in microelectronics. The main activities of the GIP-CNFM network are:

-Initial education for future engineers and PhD students;

-LifeLong Learning focused on employees of companies (upskilling and reskilling);

-Innovation in the development of training content and an approach in accordance with the needs of the companies.

In other regions in Europe, specifically in the Balkan region, different examples of models have been established. Among one of them, there is the investment in foreign companies which consists in organising several meetings where VETs are active partner and exchange ideas. The meetings boost creativity and bring collaboration to find solutions for local development. The other example concerns the industry's sharing of equipment with universities and educational institutes, the students can develop their skills qualification in the microelectronic sector with new curricula, programmes of

teaching process, retraining teachers, career guidance by creating a network model for vocational in different education levels.

"COMET plus", an Italian initiative, involves companies and universities. The project is building a bridge between the industry and the CVET. Around 40 VET courses addressed to employees and managers are developed. The contents are identified yearly upon research on the specific industrial needs, carried out by the project. Another type of good practice is a foundation initiative named "ICT Kennedy foundation", gathering about 200 organisations. These partners ensure ample opportunities for internships, teaching, planning, updating on specific ICT topics, sharing of projects and networking. Thus, the students are connected with the industry at the start of their careers. In addition, we can find in Italy the "ADDITIVE FVG". The initiative supports companies in the adoption of advanced production technologies, stimulates change in business models, improves skills and promotes investments for new "additive" startups. ADDITIVE FVG revolves around ADDITIVE FVG SQUARE, a shared space open to collaboration, which is dedicated to develop the skills of companies in the field of additive technologies. Moreover, a YouTube communication channel has been created, with materials and activities targeting students, related to higher education, training, research and technology transfer in the Electronics sector.

In France, several initiatives have been put in place to strength the local market in the industry of VET. The project partially funded by a European programme, the H2020 project FRIENDSHIP (on solar thermal energy) (2020-2024) involves the creation of partnerships between industries and teachers/learning through European projects where both share content and pedagogical knowledge in the microelectronics. Further initiative is a training responding to the technological challenges in solar energy. The production of renewable energy, the management of energy networks and the storage of energy are at the heart of the Research Center located at INES, where the circular economy approach is integrated in all our technological developments with regard to the requirements of sustainable growth. The training programme is built around the needs of the market and the content of the training is continually updated to ensure the link between supply and demand.

In addition to these initiatives, the project NEREID (NanoElectronics Roadmap for Europe: Identification and Dissemination) focuses on the It is about the publication of laboratories cartography with an expertise in microelectronics research based in the South of Francepublication of laboratories,

In Germany, local manufacturing SMEs but also other business entities interested in adopting Industry 4.0 technologies, are supported in their digital transition, with an initiative supporting infrastructure across the country. It allows companies to identify their needs for training in all staff category. Then, the training measures tailored to the company's needs can be designed and implemented with the support of best local specialists using various options, including face-to-face training in small groups, individual coaching, webinars,

A project of Business-science-education cooperation in Agritech which is co-funded by the Cypriot government is ongoing. The project's goal was to prepare a portable diagnostic device from a prototype to an optimal system able to throughput more than 80 samples per day for screening pesticide residues samples.

The project Platform Integration of Laboratories based on the Architecture of visiR (PILAR) in Spain is defined by the integration of the 5 main existing VISIR system in Europe (VISIR is a remote laboratory for wiring and measuring electronics circuits on a breadboard remotely). It allows open

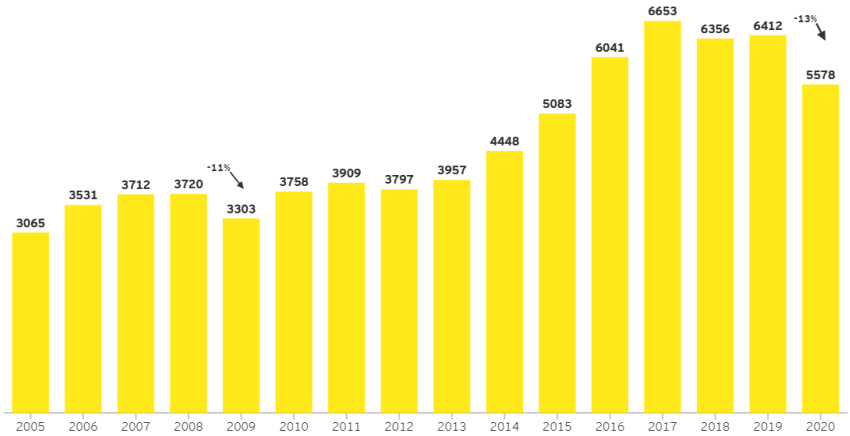
access to the (new developed and old ones) hardware, software, courses, educational activities and document repository. Furthermore to the PILAR project, there are series of open-access webinars presenting IoT and new frontiers in education to a high numbers of teachers.

b) Supporting the attraction of foreign investment projects by ensuring timely provision of skills for companies investing locally;

Since the past pandemic event, the digital skills have been a priority for the governments seeking to attract international investment and improve the local market with the new technology. COVID-19 generated new lifestyles, new working environments "homeworking", digital customers and workforce with technology skills are leading to the invest.

The significant level of digital upskilling and reskilling have been in the action recovery plan from the European Commission. The impact of job lost, or income loss has been hitting European citizens during the pandemic crisis. Member states are working on upskilling some workers to keep them in their working environment or moving them to a new one. Concerning graduates, this is more challenging to guide them in their first steps of professional experience.

Foreign businesses sees Europe as one of the most attractive regions around world to invest for long-term: a relatively stable political and regulatory regime, a highly skilled workforce and comparatively robust transport, energy and telecoms infrastructure. Therefore policymakers must focus on skills, sustainability, stimulus to ensure Europe remains an attractive regions for future.

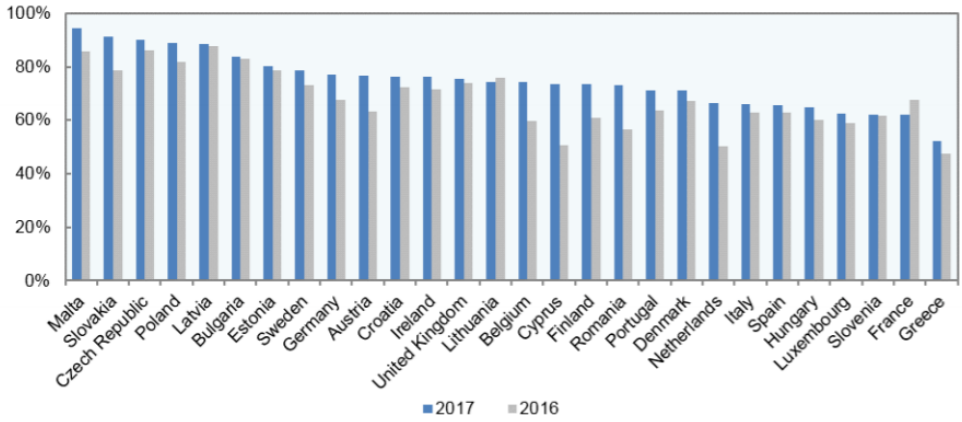


[20]Figure 1 - Number of foreign investment projects announced in Europe

European Countries can cooperate better on the design and funding of education and training programmes and improve recognition of skills acquired informally or abroad. A whole-of-government approach is needed.

Strengthening labour markets in countries add to skills becoming more crucial. Companies face difficulties find and hire staff with the right qualifications.

[20] Source: EY European Investment Monitor 2021



Base: *All firms. Q. Thinking about your investment activity in […], to what extent is lack of staff with the right skills a major or minor obstacle or not an obstacle? Bars combine shares for 'major' and 'minor' response options.*

[21]Figure 2-Lack of skilled staff as impediment to investment by member state

Prioritising higher education and professional training in some companies are more concerned about skills being an obstacle to invest. It can be observed at country level where more firms observed a lack of skills to be an obstacle and guide themselves towards public investment in training and higher education.

POLICY RECOMMENDATIONS:

1. To create a Task force for electronics education and skills:
   - To address specific skills in the industry
   - To bring together experts from industry (electronics manufacturing) and VET
   - To anticipate the required competences and skills
   - To develop new offers for internships with educational projects
2. Developing a campaign for skills:
   - to educate students, learners about microelectronics
   - to increase awareness in the sector of jobs, apprenticeships
   - creating the next generation from secondary school to postdoctoral
3. Other suggestions:
   - Promoting networking and partnerships connecting the communities and industries to create innovation for microelectronics
   - Improving access to lifelong learning
   - Expanding courses to include transversal skills (entrepreneurship, critical thinking)
   - Providing training in new technology for teachers

[21] EIB - Investing in Europe's future: the role of education and skills, April 2018

c) Making full use of EU financial instruments and Funds.

EU FINANCIAL INSTRUMENTS AND FUNDS TOOLS CAN BE USED UNDER DIFFERENT EU PROGRAMME SUCH AS:

ERASMUS+ Key action 2

ERASMUS+, open to education, training and organisations across all sectors for lifelong learning in Europe. Under this EU programme, there is the key action 2 which is a cooperation among organisations and institutions which supports partnerships for Excellence Centres for Vocational Excellence. To bring lasting effects on the participating organisations and expecting to result in the development, implementation of innovative practices at local, regional, national and European levels.

This action funding has 3 targets:

Teaching and learning

- Methodology of lifelong learning
- Developing innovative centres for VET

Cooperation and partnerships

- Establishing business education partnerships for apprenticeships
- Exchange of staff and teachers between organisations and VET centres

Governance and funding

- Effective governance with the relevant stakeholders
- Making full use of EU financial instruments and funds

ERASMUS+ Jean Monnet

Jean Monnet is an action run under Erasmus+ that supports teaching, learning and research. From March 202, the programme offers funding opportunity in vocational education and training institutes.

Under Jean Monnet programme the action of "Teacher training activities":

This action promotes knowledge on the European Union in schools and vocational education and training institutes in the Programme Countries. It aims to offer opportunities to:

- education providers to develop and deliver content to learners
- teacher training providers to support teachers with methodologies and updated knowledge on European Union issues
- promote debate and exchanges between school and VET representatives and stakeholders on learning about European Union subjects

Modules are short teaching programmes or courses on EU studies at Higher Education Institutions. They are organised by one researcher/professor and may also call for the participation of colleagues and experts, they can be introductory modules on the EU, courses that concentrate on a specific aspect or discipline within EU studies, or be more multi-disciplinary in approach.

European Green deal

"Education for climate coalition", to promote the green and digital transitions of education and training throughout the European Union. The European Education will work in synergy with the EU skills, the renewed VET policy.

To allow the European Education Area to become a reality by 2025 and to keep track of the progress achieved, the Commission proposes to establish an enabling framework for cooperation and engagement with Member States and other stakeholders. The Commission will work closely with the Member States towards developing a fully-fledged governance framework for the European Education Area. It will also establish a permanent European Education Area platform as a public gateway to its actions and services, which will ensure transparency and access to information on the European Education Area and the outputs of policy cooperation.

ESF

The ESF supports investments under 4 key priorities: employment; social inclusion; education, training and life-long learning; institutional capacity building. A critical mass of human capital investment will be ensured through a minimum guaranteed share of the ESF within the cohesion policy funding in each Member State. ESF funding is available through the Member States and regions. Organisations interested in ESF funding for a project should contact the ESF Managing Authority in their country or region.

Horizon Europe

1. **The Marie Skłodowska-Curie Actions** fund excellent research and innovation and equip researchers at all stages of their career with new knowledge and skills, through mobility across borders and exposure to different sectors and disciplines. The MSCA help build Europe's capacity for research and innovation by investing in the long-term careers of excellent researchers.

MSCA is supporting 5 types of funding:

- Doctoral network: to train doctoral candidates
- Postdoctoral fellowship: career perspective in postdoctoral research
- Staff exchange: collaboration between organisations
- Cofund: co-funding at national or regional level
- MSCA and citizens: bringing together researchers close to public

2. **The European Institute of Innovation and Technology (EIT)** is a EU programme in the framework of Research and Innovation, which is part of Horizon Europe.

   The Institute is a unique EU initiative that drives innovation across Europe by integrating business, education and research to find solutions to pressing global challenges. They support the development of dynamic, long-term European partnerships among leading companies, research labs and higher education. These partnerships are called Innovation Communities and each is dedicated to finding solutions to a specific global challenge, from climate change and sustainable energy to healthy living and food.

3. **The EIF (European Investment Fund)**

   The Skills & Education Guarantee Pilot (S&E Pilot) is a new debt financing initiative dedicated to stimulating investments in education, training and skills – as part of the solution to get more people into jobs and to better respond to the European economy's changing needs.

   Investments in skills contribute to growth, competitiveness and social convergence, while addressing the challenges linked to digital transformations and the transition to a carbon-free economy.

The EIF provides a free-of-charge first-loss capped guarantee (or counter-guarantee) to selected financial intermediaries building up new portfolios of debt financing dedicated to eligible groups of final beneficiaries as outlined below. This effectively means that the eligible final beneficiaries will be able to access debt financing in various forms (e.g. loans, deferred payments, income linked loans, etc.) through dedicated financial intermediaries (e.g. financing institutions, universities, vocational training centres, etc.) and such debt financing will be guaranteed by the EU. Thanks to the guarantee, final beneficiaries will be able to access finance easier and at better terms.

The programme supports different actors:

Students or learners: to continue studying and updgrading their skills through academia, vocational training, lifelong learning and other forms of education. The S&E Pilot will also support the mobility of students and learners pursuing educational programmes in a different Member State other than the one of the residency of the individual.

European enterprises: that contribute and facilitate such skills transformation efforts by investing in improving the skills set and skills utilisation of their workforce; thus helping to increase the company's competiveness and productivity, whilst preserving jobs.

European organisations: that are active in the field of skills, training and education or developing projects in the education field with the objective of significantly improving the ecosystem of the supply of education, training and skills-related services. Kindergartens, nursery schools, early childhood services, and similar organisations are also included in this category.

4. **Digital Europe**

The Digital Europe Programme is a new financial support tool for the 2021-2027 period, aimed at bolstering the digital transformation of society, the economy and public administrations in the EU. With a financial envelope of €7.6 billion (in current prices), a figure 17.5 % lower than the initial Commission proposal, it will build up digital capacity and infrastructure and support a digital single market. The programme will operate mainly through coordinated and strategic co-investments with the Member States in the areas of high-performance computing and data processing, artificial intelligence in the public and private sectors, cybersecurity and trust, advanced digital skills and deployment, best use of digital capacities and interoperability.

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