Action Plan for Business-Science-Education Cooperation

Milestone #2

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Document Identity

Number of Pages	13
Recipients	ECoVEM Consortium
Confidentiality Status	Public

Document Versioning

Version	Date	Authors
01	10.03.2021	TUS Slavka Tzanova, Slava Malenkova
02	15.03.2021	TUS + WG4
03	20.03.2021	TUS + WG4
04	25.03.2021	TUS Slavka Tzanova, Slava Malenkova

Document Reviewers

Version	Reviewers
01	Work group 4 (WG4)
02	INES
03	SCS, ROMIT, CCCI, SEMI

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Nomenclature

Acronym	Meaning
BSEC	Business-Science-Education Cooperation
ECoVEM	European Centre of Vocational Excellence in Microelectronics
EPALE	Electronic Platform for Adult Learning in Europe
HE	Higher Education
IoT	Internet of Things
MOOC	Massive Open Online Course
PhD	Doctor of Philosophy academic degree
RIS3	Research and Innovation Smart Specialisation Strategies
SMEs	Small and medium-sized enterprises
STEM	Science Technology Engineering Mathematics
VET	Vocational Education and Training

1. Executive Summary

The ECoVEM action plan for Business-Science-Education Cooperation (BSEC) 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 good practices of BSEC collected from all experienced partners at ECoVEM. The proposed concrete actions towards sustainable competitiveness in VET include the promotion of work-based VET and apprenticeships, the involvement of industrial partners in teaching/training, the support for VET centres to act as entrepreneurial incubators and catalysts for investment, the promotion of collaborative research projects with industry and research institutions. Next to the actions aimed at supporting VET teachers in technological challenges as digitalisation, the BSEC plan recommends European and national funding instruments towards a responsive VET to economic challenges. Finally, the BSEC within and beyond ECoVEM supports and promotes the transition to a circular and greener economy to meet emerging professional needs for green skills and sustainable development in the microelectronic sector. The actions in this plan contribute to an improved quality and performance of VET thanks to a productive collaboration between educational centres and industry and research. The set of policy actions to complement and operationalise the proposed actions should be assured by the Osnabrück Declaration 2020[1].

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

2. Introduction

Today the COVID-19 pandemic as well as digitalisation and climate change have a major impact on our economies, employment, and societies. Vocational education and training (VET) is rightly asked to contribute to response strategies for unprecedented incidents, such as the post-COVID recovery but also to cope with challenges such as 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. Microelectronics is the most rapidly developing science representing the ground of the e-economy and e-society and the continuous training is crucial. For VET to gain a new momentum an integrated approach is needed - new partnership between education and work to address the need of synergy between the education and industry, to foster the development of competencies, technological and soft skills for the new jobs in microelectronics.

This plan for business-science-education collaboration is a milestone for strengthening the European centre of vocational excellence ECoVEM as innovative incubator and skills ecosystem encompassing learning, training and research activities, VET, Higher Education (HE) and research in microelectronics, including support for entrepreneurship and digital and innovative VET resources for all.

3. Objectives and cornerstones

The ECoVEM action plan for Business-Science-Education cooperation (BSEC) defines the directions and activities for strengthening vocational education and training (VET) in microelectronics as an enabler of upskilling and reskilling, sustainable development, digitalisation and resilience. The objectives are:

> - To facilitate innovations in VET (information on VET initiatives and opportunities for qualification, for new jobs, for financing opportunities, for mobility schemes and projects etc.).
> - To provide examples of good practices between VET and industry, and VET and science.
> - To propose solutions to overcome deficiencies in VET provision.
> - To contribute with new courses on new technologies, green energy and with digital provision.
> - To work with VET policy makers for excellence in VET.

The BSEC plan is based on 4 cornerstones that are connected through the ECoVEM network:

> - Responsiveness of VET to the labour market: extend the responsiveness of VET to the needs of the labour market in microelectronics by a stronger collaboration between companies and VET providers
> - Innovation and entrepreneurship in VET: VET centres acting as entrepreneurial incubators and catalysts for investment in addition to promotion of collaborative research projects
> - Digitalisation and life-long learning
> - Green technologies in microelectronics

4. Responsive VET to the labour market

These specific actions for business-science-education collaboration for excellent VET in the microelectronics sector highlight the shared responsibility between education and industry to provide effective qualifications and skills. The goal to cut the skill mismatch in the labour market can be achieved by the alignment of VET strategy with industry recruitment plans, by including companies as learning venues, and by engaging industrial partners in teaching and training. The European added value is to spread the successful models of dual education programmes from some countries to other countries where this type of inclusive VET is less developed.

4.1. Work-based VET and apprenticeships

4.1.1. Analysis of skill gaps between VET and industry

➢ Annual analysis of the skill needs of companies for upskilling and reskilling through surveys.
➢ Extraction of recruitment needs from analysis of job vacancies in microelectronics to update the evaluation of the skill gaps between VET and industry.
➢ Survey for VET teachers to obtain proposals for improving the adaptation of VET contents to the changing labour-market needs.

4.1.2. Reinforcement of existing programmes

➢ Open days at VET centres for companies to present their activities and possibilities for work-based training to the students.
➢ Surveys in VET centres to detect the most common problems in the collaboration with companies in apprenticeship programmes.
➢ Student visits at the companies to experience a real work environment in a particular job or career in the field of microelectronics ("job shadowing").

4.1.3. Promotion of apprenticeships

➢ Promotion of the good practices of existing nationally funded dual education programmes (combined work-study contract over 1 or 2 years), traineeships, and apprenticeships from Germany (Ausbildung[2]), France (Alternance[3]) and Italy (Formazione[4]).
➢ Presentation of testimonials, examples of success stories of companies that have implemented work-based VET.
➢ Contact newly founded companies in Europe which may be interested in training their recruitments in the domain of microelectronics.

[2]www.bibb.de/en/77203.php
[3]www.alternance.emploi.gouv.fr/portail_alternance/jcms/recleader_6113/decouvrir-l-alternance
[4]www.lavoro.gov.it/temi-e-priorita/orientamento-e-formazione/focus-on/Formazione/Pagine/default.aspx

4.2. Involvement of industrial partners in teaching and training

4.2.1. Involve industry professionals in VET schools

➢ Involvement of industrial experts and VET schools' Alumni as trainers at VET centres.
➢ Regular evaluation of curricular contents by external industry associations and external research institutions from the microelectronics sector to identify the skills needs and close the gap between academia and industry.
➢ Support and development of mentoring programmes between industrial experts/Alumni and students.
➢ Establishing regular joint meetings at VET schools of teachers and managers of the regional microelectronics sector to strengthen the collaboration on curricular content, knowledge transfer, and skill management.

4.2.2. Joint courses and master/PhD programmes

➢ Development of joint training courses, master's and PhD programmes between universities and industry in the field of electronics and microelectronics, which cover the specific knowledge and skills needed by industrial partners.
➢ Involvement of companies (especially SMEs) into VET courses by providing concrete industrial practices/business cases that students must solve together (with the support of trainers) including designs and prototypes development.
➢ Integration into VET curricula of proposals for master's thesis/final degree work topics according to the needs of companies in microelectronics.

5. Innovation, common research, and smart specialisation strategies

These specific actions in VET of microelectronics for business-science-education collaboration aim at strengthening VET centres as innovative incubators and skills ecosystems that are responsive to socio-economic challenges. The ECoVEM platform will promote innovation and skill needs through ecovem.eu and the further proposed actions for collaboration between HE, research centres, and VET providers will improve the permeability between vocational and academic pathways.

5.1. Catalyst for innovation

5.1.1. Courses on entrepreneurship

➢ Inclusion of courses in the ECoVEM curriculum on entrepreneurship (business development) in the microelectronics sector covering how to start an own business, how to prepare a business plan, what is considered as innovation, how to get funds for new ideas on a national or European level.
➢ Organisation of training seminars on entrepreneurship and open days at Science Parks and incubators for the pedagogic consultants and managers in VET schools.
➢ Establishing network of VET schools' alumni to promote entrepreneurship with testimonials, success stories, evaluation, or e-mentoring, as well as involvement in training activities.

5.1.2. Competitions and discussion forums in microelectronics

➢ Organisation of competitions as type of "open schooling" where partnerships between teachers, students, researchers, and professionals from industry are made in order to work on real-life challenges.
➢ Promotion of problem-solving contests responding to the needs of industry (products, processes, organisation) with attention to the circular economy and green economics.
➢ Launch of a discussion forum for microelectronics problems responding to needs (products, processes, organization) to be solved in a shared way by industry, VET centres, and research centres.

5.2.   Common research strategies

5.2.1. Sharing best practices

➢ Showcasing of existing successful collaborative projects between companies, research and education in microelectronics.
➢ Organisation of conferences and seminars on microelectronics research to promote partnerships that foster networking, sharing of research findings, and joint publications amongst teachers, researchers, and professionals.

5.2.2. Sharing equipment

➢ Promote sharing of equipment and human resources for innovative activities and research projects in microelectronics between industrial companies, research centres, and educational organisations.
➢ Encourage building new laboratories in collaboration with industrial stakeholders, research organisations, and educational centres in the microelectronics sector.

5.2.3. Networking and mobility

➢ Networking with existing cooperative platforms such as 'Les campus des métiers et des qualifications'[5] for microelectronics in France and with platforms for excellence in VET such as the Community of Practice in VET[6] and the EPALE network[7].
➢ Publishing information on the ECoVEM platform from different stakeholders (business, training institution, research centre) about international placements for interns, researchers, and Master/PhD programmes.

5.3.   Smart specialisation

5.3.1. Matchmaking for smart specialisation

➢ Involvement of clusters and hubs for matchmaking between industrial needs in terms of innovation and innovation capabilities of HE and research centres.
➢ Collaboration with science, technology and business parks which have experience in stimulating and managing flows of knowledge and information between companies, universities, entrepreneurs and technicians, and provide an environment that enhances a culture of innovation, creativity and quality.

5.3.2. Promotion of funding instruments

➢ Promotion of the funding instruments for skills from NextGenerationEU, namely its centrepiece Recovery and Resilience Facility[8]

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[5]www.education.gouv.fr/les-campus-des-metiers-et-des-qualifications-5075

[6]epale.ec.europa.eu/de/practitioners-in-vet

[7]epale.ec.europa.eu/en

[8]ec.europa.eu/info/business-economy-euro/recovery-coronavirus/recovery-and-resilience-facility_en

> ➢ Promotion of existing funding (regional/national/European) instruments aimed at Business-Science-Education Collaboration including collaborative innovation and research activities (European Green Deal[9], Horizon2020[10]).
> ➢ Analysing the regional development in the field of microelectronics according to the working environment (green energy, digitalisation, automotive industry etc.) for collaborative projects financed by European Regional Development Fund[11], the 'Pact for Skills' initiative[12] or microelectronics related initiatives within the frame of Joint Research Center Thematic RIS3 Platforms[13].

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[9]ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal

[10]ec.europa.eu/info/funding-tenders/opportunities/portal/screen/programmes/h2020

[11]ec.europa.eu/regional_policy/en/funding/erdf/

[12]ec.europa.eu/social/main.jsp?catId=1517&langId=en

[13]s3platform.jrc.ec.europa.eu/thematic-areas

6. Digitalisation in VET and Life-Long Learning

These specific actions for business-science-education collaboration in the ECoVEM platform towards digitalisation of VET and encouragement of life-long-learning (andragogy) focus on the implementation of innovative teaching methods as project-based learning and performance support systems and include: courses for teachers on digital media, repository tools, innovative learning approaches, as well as the organization of teachers into networks for sharing of good digital practices.

6.1. Innovative teaching methods

➢ Collaboration between VET providers and HE institutions for the development of massive open on-line courses (MOOCs).
➢ Training of teachers and trainers on project-based learning approach including teamwork, shared responsibility and smart-assessment.
➢ Development of guidelines for the design and implementation of performance-support systems in work-based training and in education.
➢ Organizing summer schools using digital tools for teaching and training.
➢ Promoting the impact of digital technologies on green economy.

6.2. Teachers' networks for reinforcing the development of key digital competences

➢ Encourage the mobility of trainers between VET centres to learn new teaching methods (through national or European programmes).
➢ On the occasion of the 'International Day of Education'[14] every year, organise discussion rounds between teachers on how to re-design the learning content to make it suitable for online training, promoting creativity and innovative learning approaches and environments.
➢ Promotion of the Digicompedu[15] framework on regional and national level as a general reference frame for digital competence models.

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[14]en.unesco.org/commemorations/educationday

[15]ec.europa.eu/jrc/en/publication/eur-scientific-and-technical-research-reports/european-framework-digital-competence-educators-digcompedu

7. Green Technologies and Microelectronics

These specific actions for business-science-education collaboration aim at tackling the "green transition" challenges in the microelectronics sector by enhancing staff's expertise and knowledge on green technologies as well as promoting the applications of microelectronics for a green transition on an industrial level.

7.1. Include the "green transition" in ECoVEM courses

➢ Development of one curriculum dedicated to the contribution of microelectronics for transition to green economy: photovoltaic cells, sensors for Internet of Things (IoT) applications for ecology etc.
➢ Encourage a "green" way of reasoning by including the themes of circular economy and green economy in ECoVEM courses via micro-modules on energy saving, cycle life of microelectronic products, waste and recycling in the microelectronics production etc.
➢ Training of teachers and trainers in VET to include the concept of IoT as enabler for smart energy, resources and waste management.

7.2. Promotion of the potential of microelectronics and associated applications & technologies in "green transition"

➢ Demonstration of the potential of microelectronics and associated applications & technologies such as IoT in the green transition: use of renewable energy sources, energy and resources consumption management, smart waste management, smart mobility and smart homes, environmental monitoring (in urban areas - pollution and air quality).
➢ Promotion of good practices towards a green economy in the microelectronics sector on the ECoVEM platform. The platform will support the republishing of any pioneering technology that can be applied for the development of green economy in different European countries.

Co-funded by the
Erasmus+ Programme
of the European Union