ANNEX 1. BEST PRACTICE EXAMPLES E4E FICHES

1. Digital & Green Skills (Cross-border)

Country	European countries	Country and/or Region - Map
Region	Cross-border	
Name of Institution/Initiative:	REHVA	
URL:	https://www.rehva.eu/	
Focus Area of Skills Acquisition:	Digital Skills/Green Skills	
Nature of Institution/Initiative:	Private	

Contextual Snapshot:	
Relevance of the Focus Area:	In the context of today's rapidly evolving technological and environmental landscape, both Digital Skills and Green Skills have become of paramount importance for REHVA its members, and its stakeholders. 1. Digital Skills: • Digitalization is transforming the HVAC industry by introducing adv*anced* technologies that enhance efficiency, comfort, and sustainability. Digital skills encompass a range of abilities related to working with digital tools, technologies, and data. Here's how they are relevant to REHVA: • Smart Building Systems: The integration of sensors, automation, and data analytics into HVAC systems requires professionals with digital skills to design, install, and maintain these systems effectively. • Building Information Modeling (BIM): BIM involves creating digital representations of buildings, enabling collaboration and efficiency in design, construction, and operation. HVAC professionals need to understand BIM processes to coordinate their work with other disciplines. • Energy Management Systems: Digital skills are crucial for implementing and managing energy-efficient HVAC systems, which play a vital role in reducing energy consumption and greenhouse gas emissions in buildings. • Data Analysis and Visualization: HVAC professionals must be capable of analysing large amounts of data generated by building systems to optimize their performance and identify potential issues. • Remote Monitoring and Maintenance: Digital skills enable remote monitoring and predictive maintenance of HVAC systems, improving their reliability and minimizing downtime. 2. Green Skills: With the growing emphasis on environmental sustainability and energy efficiency, Green Skills have gained immense importance. These skills focus on promoting practices that are environmentally

	responsible and aligned with the principles of circular economy and low-carbon development. Here's how Green Skills are relevant to REHVA: • Energy-Efficient Design: HVAC professionals with green skills can design systems that maximize energy efficiency, reduce resource consumption, and minimize environmental impact. • Renewable Energy Integration: Green skills are essential for integrating renewable energy sources, such as solar panels and heat pumps, into HVAC systems to reduce reliance on fossil fuels. • Indoor Air Quality and Health: HVAC systems play a crucial role in maintaining indoor air quality. Professionals with green skills understand how to design systems that provide adequate ventilation and filtration while minimizing energy use. • Regulatory Compliance: Green skills encompass knowledge of energy and environmental regulations, helping professionals ensure that HVAC systems meet relevant standards and contribute to sustainability goals. • Lifecycle Assessment: Professionals with green skills understand the lifecycle impacts of HVAC systems, considering factors like manufacturing, installation, operation, and disposal.
Current Status of the Focus Area:	Digital Skills: The push for digital transformation has led to increased adoption of technologies like Building Information Modeling (BIM), energy management systems, data analytics, and smart building solutions. Many European countries have been investing in training programs, workshops, and certifications to equip professionals with the digital skills needed to design, operate, and maintain modern and efficient HVAC systems. The focus is on improving energy efficiency, optimizing building performance, and integrating advanced technologies. Green Skills: The building sector, including HVAC professionals, is undergoing a significant shift towards incorporating green skills. This includes knowledge of renewable energy integration, energy-efficient design principles, indoor air quality optimization, and adherence to environmental regulations and standards. Many countries have been implementing stricter energy performance requirements for buildings, driving the demand for professionals skilled in green practices and technologies.
Key Challenges:	• Rapid Technological Advancements: The fast-paced evolution of digital technologies, such as IoT, data analytics, and AI, can make it challenging for professionals to keep up with the latest tools and techniques. • Skill Shortages and Mismatches: There might be a shortage of professionals with the necessary digital skills, leading to a gap between industry demand and the available workforce. • Training and Education: Ensuring that educational institutions provide relevant and up-to-date digital skill training can be a challenge, as traditional curricula might not always align with rapidly changing technology trends. • Complexity and Multidisciplinarity: Green skills require knowledge in various fields such as energy efficiency, renewable

	energy, environmental regulations, and sustainable design. This multidisciplinary nature can make training and education more challenging. • Changing Regulations: Keeping up with evolving environmental regulations and standards can be demanding for professionals, especially when they differ across countries and regions. • Limited Awareness: Some professionals and industries might not fully understand the benefits of green practices or might underestimate the urgency of addressing environmental concerns. • High Initial Costs: Integrating green technologies and practices can involve higher upfront costs, which might deter adoption, despite the long-term benefits in terms of energy savings and sustainability. • Lack of Incentives: In some cases, there might be insufficient incentives, such as government subsidies or tax breaks, to encourage businesses and individuals to invest in green technologies and practices. • Skills Gap: As green technologies evolve, there could be a gap between the skills demanded by the industry and those possessed by the workforce, leading to challenges in implementing new practices.
Government or Institutional Initiatives:	The European Commission has been actively involved in promoting digital and green skills as part of its broader initiatives to drive digital transformation and address environmental sustainability. An example is the Horizon Europe fund: The European Commission's research and innovation framework program, Horizon Europe, includes funding opportunities for research projects related to digital technologies, fostering collaboration between academia, industry, and research institutions.

Brief Description of the Institution/Initiative:

- REHVA actively participates in different EU projects that are promoting digital and green skills across various sectors.
- REHVA Guidebooks: elaboration of practical guidebooks on the latest technologies, and knowledge for professionals within the REHVA Task Force.
- REHVA Networking Events: REHVA organizes events, conferences, and workshops that bring together experts, practitioners, and researchers to share insights and advancements in different skills and sustainable building services.

Examples of Effective Practice in Skills Acquisition:

- REHVA Events, conferences, workshops and experts' talks.
- REHVA EU policy issues, position papers and advocacy
- REHVA Publications and Journals

2. Challenge-based Learning in an Interdisciplinary Environment (Cross-border)

Country	European countries	Country and/or Region - Map 
Region	Cross-border	
Name of Institution/Initiative:	EuroTeq Engineering University	
URL:	https://euroteq.eurotech-universities.eu	
Focus Area of Skills Acquisition:	intercultural and multilingual competences, an entrepreneurial mindset, leadership, sustainability, active engagement within local eco-systems; interaction with different societal actors etc.	
Nature of Institution/Initiative:	Alliance of 6 technical Universities and around 50 associate partners / engineering stakeholders	

Contextual Snapshot:	
Relevance of the Focus Area:	Shared value creation and a common understanding of technology is a relevant factor for societal cohesion in regions, nations and across Europe and extremely important for the provision of excellent responsible engineering services.
Current Status of the Focus Area:	The funding of the project has been prolonged till 2027 which allows for further development/broadening of the initiatives.

Brief Description of the Institution/Initiative:
The EuroTeQ Engineering University brought together six leading universities of science and technology in Europe (Munich, Prague, Eindhoven, Tallin, Paris and Copenhagen), situated in innovation eco-systems and with great collaboration experience, with the aim to introduce a paradigm shift in the engineering education of the future, aspiring to responsible value co-creation in technology.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:
EuroTeQ course catalogue https://euroteq.eurotech-universities.eu/initiatives/building-a-european-campus/course-catalogue/

Examples of Effective Practice in Skills Acquisition:
Collider: As a key initiative of the EuroTeQ Engineering University, the **EuroTeQ Collider** offers students the opportunity to work alongside industry partners on specific challenges and acquire new competencies. This innovative, challenge-based learning experience invites participants to work in an international and interdisciplinary environment and contribute in developing solutions to real-life challenges.

Internationalization in the Skills Acquisition Process:
The Alliance itself enhances cross-border approaches and exchanges / Building of a European Campus / EuroTeQ Collider etc.

Partnership models:
The partnership in the alliance is organized by the following structure: Presidential Strategy Forum / Management Board / Secretariat / Students Council /Local and European Advisory Boards and numerous Working Groups.

3. Diversity and Equality in Engineering (Cross-border)

Country	European countries (France, Germany, Austria, Slovenia, Spain)	Country and/or Region - Map
Region	Cross-border	
Name of Institution/Initiative:	YesWePlan!	
URL:	https://www.yesweplan.eu	
Focus Area of Skills Acquisition:	Measures to enhance equality and diversity in the profession	
Nature of Institution/Initiative:	Alliance of 5 professional organisations and Universities supported by different European and International stakeholders	

Contextual Snapshot:	
Relevance of the Focus Area:	Diversity and equality in the profession needs to be strongly enforced in the profession on different levels (education, professional representation, employment), therefore the understanding of this topic must be integral part of the understanding of engineers.
Current Status of the Focus Area:	The project finished in 2022 and several of the measures and/or collected best practice examples are currently in implementation / have already been implemented.

Brief Description of the Institution/Initiative:

The EuroTeQ Engineering University brought together six leading universities of science and technology in Europe (Munich, Prague, Eindhoven, Tallin, Paris and Copenhagen), situated in innovation eco-systems and with great collaboration experience, with the aim to introduce a paradigm shift in the engineering education of the future, aspiring to responsible value co-creation in technology.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

https://yesweplan.eu/intellectual-outputs/recommendations/

Examples of Effective Practice in Skills Acquisition:

Raising awareness of the importance / benefits of diversity and equality approaches in engineering as a part of engineering skills acquisition still lacks the urgently needed best practice examples.

Internationalization in the Skills Acquisition Process:

The project itself enhances cross-border approaches and exchanges and the YesWePlan! career tracking survey was based on answers from all over Europe. The YesWePlan! Recommendations were discussed in several European Professional Organizations (ACE, ECCE, ECEC).

Partnership Models:

The project partnership mainly worked on the basis of a steering group supported by different internal and external stakeholders and experts.

Impacts and Outcomes:

Several best practice examples (Female Engineering Awards, Mentoring projects, Awareness raising projects for the public, professional compliance regulations including equality aspects etc.) have been/ are transferred, showing also that awareness/knowledge of students and professionals must be combined with concrete educational, institutional, political measures. Nevertheless, raising awareness of the importance / benefits of diversity and equality approaches in engineering still lacks the urgently needed best practice examples in engineering skills acquisition processes.

4. Debate with Engineering Students (PT)

Country	Portugal	Country and/or Region – Map
Region	Portugal	
Name of Institution/Initiative:	Socratic Debate at CISPEE 23	
URL:	https://cispee2023.uminho.pt/	
Focus Area of Skills Acquisition:	Digital Skills/Green Skills	
Nature of Institution/Initiative:	Academic - Sociedade Portuguesa de Educação em Engenharia SPEE	

Contextual Snapshot:	
Relevance of the Focus Area:	Debate with BEST, ESTIEM and University of Coimbra students their experiences in their university education.
Current Status of the Focus Area:	Using E4E survey questions about the Focus areas Digital and Green skills the opinions about their training.
Key Challenges:	The difficulty was in obtaining suggestions on which were the recommendations for Engineering teachers.
Government or Institutional Initiatives:	Some initiatives were mentioned by students in policy declarations from their universities: UMInho (PT) and TUEindhoven (NL).

Brief Description of the Institution/Initiative:
SPEE accepted, following AECEF SG suggestion, to have in its congress of 2023 a socratic debate with students representing European student associations suggestions about the future. Topics addressed were the DS and GS with questions extracted from the E4E survey. Major outcome was an unanimous recommendation for Engineering teacher training on the topics: https://sigarra.up.pt/feup/pt/pub_geral.pub_view?pi_pub_base_id=634325

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:
Promotion of E4E project was made to underline the needed competences and skills around the DS and GS. The GreenComp competence framework was presented and the use of DigiComp framework was discussed as a guidance for all Engineering students. Another subject that was addressed involved the Ethics education in Engineering and the use of AI tools by teachers and by students in Engineering.

Examples of Effective Practice in Skills Acquisition:
Since major recommendation from students was Vedic aged to the specific training of Engineering taker so they could prepare properly their students one can say that teachers present and SPEE became conscious of these gaps in the institutional and personal training. One major consequence was the verbal compromise from SPEE managers to repeat this debate in future events: https://www.linkedin.com/posts/sociedade-spee_homepage-activity-7018889441494675456-A5L6/.

Internationalization in the Skills Acquisition Process:

It was evident from the discussion of the students is that these are lacking proper training, are looking forward to acquire these competences and were clearly fostering training for their Engineering teachers. The associations present (BEST, ESTIEM) maybe a great platform to define future pathways to improve their preparation for the future of their Engineering professions. And it has to be done as soon as possible.

Partnership Models:

Clearly from the debate it was concluded that students or their associations are crucial to define gaps in terms of their DS and GS education and to provide solutions to change institutions actions, teacher preparation and learning outcomes expected. As mentioned at least SPEE is interested in continuing to debate these issues and to try to influence institutions to change.

Impacts and Outcomes:

Conscience by participants of the urgency to change and to train Engineering staff in DS and GS. It was also evident that students are eager to learn more about these subjects and be better prepared to the Engineering challenges.

5. SDGs in Spanish universities (ES)

Country	Spain	Country and/or Region - Map
Region	Aragón	
Name of Institution/Initiative:	EINA (School of Engineers and Architects)/ University of Zaragoza	
URL:	Https://eina.unizar.es	
Focus Area of Skills Acquisition:	Sustainable Development Goals (SDG´s)	
Nature of Institution/Initiative:	Public and Academic	

Contextual Snapshot:	
Relevance of the Focus Area:	Spain, as a European country, is committed with the development of the SDG´s. Aragon is a region of Spain where the University of Zaragoza is placed and the government of Aragon is strongly committed with the development of the SDG´s
Current Status of the Focus Area:	All areas of the government of Aragon are working in the implementation of the SDG´s and Administration and Companies need engineers compromised with the development and implementation of the SDG´s
Key Challenges:	The main objective of the Government of Aragon with respect to the 2030 Agenda is the improvement in all aspects of the administration with respect to the 2030 Agenda. In particular, three challenges are - Industrial activity - Renewable energy - Education, Research and Innovation These areas are very important in the activity of the School of engineers (EINA)
Government or Institutional Initiatives:	Related with the challenges of the Government of Aragón, they are: - Facilitate the introduction of the SDG´s in industries with economic aids and consulting. - Facilitate the installation of renewable energy production plants. (Aragon is one of the stronger producers of green energy in Spain) - Help the University and in particular the EINA the implementation of studies oriented to the implementation of the SDG´s

Brief Description of the Institution/Initiative:

The EINA is the only public School of Engineers and Architects placed in the region of Aragon. The EINA belongs to the University of Zaragoza in Spain.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

The EINA is the responsible of the teaching of 11 degrees in engineering and architecture, 14 masters and an important number of courses of specialization in different areas of engineering and architecture. As well the School is responsible for research and innovation in all areas covered academically, with lots of European projects supported by the personnel as well as contracts with companies, in the region and abroad.

Examples of Effective Practice in Skills Acquisition:

Examples of good practice are:

- The impetus and interest of the School's educational community in the 2030 Agenda. There are efforts to equip the personnel with the necessary tools to define actions aimed at implementing the SDGs with the involvement of all stakeholders.
- High number of concrete actions carried out by the School over time related to the SDGs.
- EINA announces the award "Actions to transform the world from EINA" which seeks to recognise the contribution to the 2030 Agenda.
- The teaching guides for Bachelor's and Master's degree final projects explicitly include the commitment to the SDGs and in external internships the direct relationship with the SDGs is indicated both by the students and the internship tutor

Internationalization in the Skills Acquisition Process:

The EINA, as European university, exchange students all over Europe with the Erasmus program and with other international countries like USA, Canada or Japan, so the students visiting our School reach the same skills of the EINA students.

Research programs oriented with the spirit of the SDG´s are carried out with researchers from over Europe or even in worldwide area.

Partnership Models:

• The Mobility Plan of the University of Zaragoza is drafted under the collaboration agreement: Zaragoza Metropolitan Transport Consortium + University of Zaragoza. The EINA, through several of its members and as a centre, is considered a fundamental stakeholder in this plan, having already participated in several meetings
• A working group or expert group.
• Organisation of an international meeting on SDGs “The Circe Institute and the Ecological Transition”. CIRCE in the Technological Centre for the Resources and energetic consummation and is placed in the vicinity of the School and with strong links in projects and personnel
• Volunteering opportunities for students through the EINAmOtivaD@S student group/association
• Volunteering opportunities for students.
• Brial Chair in Renewable Energies, Brial is a company/funding entity formed with a group of companies (BRIAL).
Relevance to SDGs: Focused on renewable energies and the SDGs.

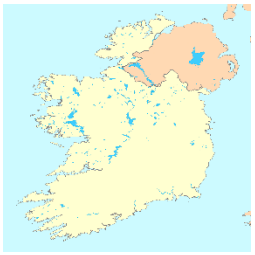
Impacts and Outcomes:

The EINA has stablished an Internal Quality Assurance System (IQAS) that collects and analyses data on the satisfaction of the different stakeholders (students, teaching staff, graduates, employers, administrative and service staff, society, etc.) with the degree of fulfilment of the SDGs set in the centre's strategic plan.

The IQAS has designed and implemented a system for evaluating the degree of satisfaction of the different stakeholders with the training programmes.

In order to know, from a general perspective, the perception, priorities and willingness to actively contribute to the 17 SDGs to all students, PDI and PAS of the School, a survey has been developed and applied by the Vice-rectorate for Prospective, Sustainability and Infrastructure of the University of Zaragoza. The EINA has gained the Certification ALCAEUS, certification of Schools or Universities that shows the compromise with the United Nations 2030 Agenda.

6. CPD Certificate in Professional Engineering (EI)

Country	Ireland	Country and/or Region - Map
Region	North	
Name of Institution/Initiative:	Engineers Ireland/CPD Certificate in Professional Engineering	
URL:	https://www.engineersireland.ie/Professionals/CPD-Careers/CPD-training-offerings-and-services/CPD-Certificate-in-Professional-Engineering-NQF-Level-9-5-ECTS	
Focus Area of Skills Acquisition:	Resilience Skills	
Nature of Institution/Initiative:	Partnership between Professional Body, Third-level Institution and Industry	

Contextual Snapshot:	
Relevance of the Focus Area:	The transition from university or college life to the world of work requires substantial application and attention. Graduates need to understand what is expected of them, how they should behave and what they can do to perform their role, accelerate their professional development and career prospects.
Current Status of the Focus Area:	Employers have observed that whilst engineering graduates demonstrate strong technical knowledge and skills when leaving university many are lacking the non-technical skills and behaviours, such as time management, communication or report writing skills, required to excel as a professional engineer.
Key Challenges:	For many employers, developing their own programme of non-technical skills modules that meets the needs of graduate engineers can be challenging in terms of the cost and time required to design, develop and evaluate a suitable programme.
Government or Institutional Initiatives:	We are not familiar with any significant initiatives undertaken by the government or other institutions in the specific skill area for graduate engineers

Brief Description of the Institution/Initiative:

Following consultation with industry, Engineers Ireland developed a CPD Certificate in Professional Engineering, a six-module program undertaken over six months designed to support employers and graduate engineers in the transition from university to professional life. The modules focus on the core non-technical skills engineers need to develop to successfully perform and develop. Each module includes a learning contract assignment to ensure learning is transferred from the classroom to the workplace. To ensure standards, the program is accredited by TU Dublin at NQF level 9, counting for 5 ECTS.

Engineers Ireland also offers a CPD Diploma in Engineering and Leadership and Management, a 12-month program at NQF level 9, counting for 30 ECTS, and many delegates have completed the CPD Certificate in Professional Engineering before undertaking the CPD Diploma.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

The six modules are:
Essential Skills of a Future Professional
Time Management & Organizational Skills
Communication & Presentation Skills
An Introduction to Project Management
Innovations in Excel for Engineers
Technical Report Writing Skills

Examples of Effective Practice in Skills Acquisition:

The CPD Certificate in Professional Engineering has been delivered to employers and graduate engineers for over ten years now, with programs delivered both exclusively to individual employers and as an open program open to graduates working for different employers. It can be delivered in-person or online. In 2022 there were 13 programs delivered with 190 graduate engineers completing the program. Feedback from both employers and delegates has been extremely positive with most employers using the program each year as part of the graduate development programs.

Internationalization in the Skills Acquisition Process:

As many of the employers concerned are involved in international projects, some of the participants who have benefited from the program have been based outside Ireland while delivering projects.

Partnership Models:

Engineers Ireland has strong connections with engineer employers through our CPD Accredited Employer standard. This has allowed Engineers Ireland to identify industry needs, and in this example a gap with regards to the skills of graduate engineers entering the workplace. Working with industry we were able to design and develop an appropriate program to meet the needs of employers and graduate engineers alike. Engineers Ireland also has a close relationship with TU Dublin, and this facilitated the accreditation of the program, satisfying a need from certain employers and graduate engineers that the program be accredited by a third level institution and count for ECTS.

Impacts and Outcomes:

The success of the programme can be measured by both the repeat business from existing clients as well as the growth in the number of new programmes year on year to meet growing demand. Module evaluation has allowed Engineers Rieland to maintain the high level of delivery of the programme with continuous improvement based on employer, delegate and trainer feedback. The learning contract assignments ensure the skills and knowledge learned in the classroom are transferred and employed at the workplace.
Feedback from both employers and delegates has been extremely positive with most employers using the program each year as part of the graduate development programs. Many positive employer and graduate testimonials are available to confirm the success of the program.

7. Cross-Universities-Business (CUB) platform (DE)

Country	Germany	Country and/or Region - Map
Region		
Name of Institution/Initiative:	TU Dortmund	
URL:		
Focus Area of Skills Acquisition:	Business-university interaction through a web-platform	
Nature of Institution/Initiative:	University	

Contextual Snapshot:	
Relevance of the Focus Area:	Today's world is rapidly changing, and educational institutions face many challenges that have yet to be solved. One of these tasks is the optimal organization of support for students in the matter of their future employment. Possible solutions to this issue could be the development and implementation of the Cross-Universities-Business (CUB) platform for direct communication between students and potential employers. The current initiative is an example of the possible multi-stakeholder partnership model which can help businesses to find potential employees with the skills that best meet their expectations and to avoid skills mismatches.
Current Status of the Focus Area:	Despite the proposed solution is not widely used in the current moment, some of the European universities and other organisations have already implemented using of similar web-platforms into the practice. Some examples of CUB platforms are described below.
Key Challenges:	- the dilemma exists about how to support novice specialists in the issue of their future employment and at the same time to give them maximum freedom in choosing their future professional pass or role. - implementation and subsequent support of the CUB platform will need additional financial and human resources from the universities' side, which also can be challenging.
Government or Institutional Initiatives:	The University of Applied Sciences and Arts (Dortmund) is providing research about the relevance of the development and implementation of the similar CUB platform on the base of the Digital Education Ecosystem (DEE). Some European universities have already developed special platforms for the universities-business cooperation.

Brief Description of the Initiative:

Creating of the cross-university-business (CUB) web-platform for the direct communication of students and employers can improve the quality of university-business cooperation significantly, facilitate the search of needed specialists by employees and help students to find perspective jobs. The CUB platform model should be based on the principle of a social network with a professional focus, including pages of applicants, universities, and employers, with an internal messenger to communicate between participants.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

A unique feature of the CUB platform will be the presence of portfolios of projects on the webpages of universities and companies in which qualified students and graduates can take part, interchanging traditional professional practice with project-based practice.

Examples of Effective Practice:

It should be noted that such platforms are already being developed by individual universities in Europe. However, in order to understand the differences between today's web solutions, we first need to understand what business processes include the interaction between universities and business today. Thus, V. Galan-Muros and T. Davey distinguish the following main areas of interaction:

- "education (joint development of curricula and training of students in cooperation with business partners; continuous education and training of company employees, further employment of students);
- research (staff mobility between universities and companies; joint research and development);
- valorisation (entrepreneurship among university staff and students, as well as the commercialization of university research and development);
- management (reflects the strategic nature of cooperation between universities and business; however, this area of collaboration is the least developed, since it requires long-term cooperation between universities and enterprises, as well as a high degree of their transparency)" [1].

Depending on which of the above business processes underlies the creation of the platform (except for management, since this type of interaction is the least developed and, as a rule, is not a priority), CUB platforms are divided into the following types [2]:

- "educational platforms, the main purpose of which is to teach students to perform real-life tasks that they will face while working in companies. Such, for example, are the platforms Poliunibus [3], Edusourced [4], Telanto [5] and Ninblebee [6];
- platforms, which main purpose is to commercialize research conducted at universities, such as In-part [7]; Leadingedgeonly [8] or Seedspint [9].
- platforms, the main purpose of which is partnership between the university and business, as well as the possibility of subsequent employment of students. Examples of such platforms are Konfer [10], Knowledgetransferireland [11] and Oipec [12]" [13].

Internationalization in the Skills Acquisition Process:

The CUB platform can give the opportunity to communicate for representatives of universities and businesses from different countries without any borders. It also gives an opportunity for students to search for jobs in companies not only from their original country but all over the world. Representatives of business at the same time can also search for potential employees in universities from different countries.

Partnership Models:

In general, the CUB platform should be modelled on the principle of a social network with a professional focus, including pages of applicants, universities and employers. Also, this platform must have an internal messenger to enable communication between participants. In addition, it is assumed that a unique feature of this platform will be the presence on the pages of universities and companies of portfolios of projects in which students and graduates, whose qualifications correspond to the tasks that must be performed during the project, can take part. Participation in such projects can even become a full-fledged alternative to traditional professional practice since it gives them experience in managing real-life working tasks.

Impacts and Outcomes:

According to the results of the research which took part in the frame of the DAAD program "Eastern partnership from 2020" European employers are very open to the initiative of development and implementation of the CUB platform [14]. Students and universities representatives, who took part in the research also supported the initiative since it can improve the process of students' and graduates' employment significantly. Such an initiative also gives an opportunity for representatives of businesses to check information of potential employees' resumes and to choose professionals with the best qualities in their teams.

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[13] C. Reimann, O. Verenych, P. Repka "The role of the Cross-Universities-Business (CUB) platform in the issue of employment of university graduates". Dortmund International Research Conference 2022, Conference Proceedings, pp.21-33

[14] P. Repka, O. Verenych, C. Reimann "Cross-University-Business platform as a part of the Digital Education Ecosystem". The 12th IEEE International Conference on Intelligent Data Acquisition and Advanced Computer Systems: Technology and Applications, Dortmund, Germany, 2023

8. Dual Education: a Bridge between Education and the Labour Market (SK)

Country	Slovakia	Country and/or Region - Map
Region	Slovakia	
Name of Institution/Initiative:	Dual education at upper secondary vocational schools – Company schools	
URL:	https://siov.sk/en/vzdelavanie/dualne-vzdelavanie/uvod-dualne-vzdelavanie/	
Focus Area of Skills Acquisition:	Entrepreneurial skills, industry-specific knowledge, readiness for work, soft skills	
Nature of Institution/Initiative:	Policy measure	

Contextual Snapshot:	
Relevance of the Focus Area:	Like many countries, Slovakia is grappling with mismatches between education and the needs of the labour market.
Current Status of the Focus Area:	Slovakia had been making efforts to address skill mismatches between education and the labor market. The dual education system was one of the approaches adopted to bridge this gap. The government and Industry and Employers stakeholders have been working to strengthen vocational education and training, aligning it with the needs of industries to enhance employability and workforce readiness.
Key Challenges:	Skills mismatch, involvement of stakeholders, connecting educational measures to labor-market needs, lack of implemental knowledge, lack of practice, the negative impact of not-well-equipped classes
Government or Institutional Initiatives:	The initiative required deep involvement of the government and relevant ministries; however, the initiative came from the part of the Employer´s associations, which lobbied for the reform. The actual system was based on the Austrian system of Dual education, inspired partially by German and Dutch systems of VET at secondary levels. Currently, the system is being established in VET in the school sector at the secondary level. But there are already apparent initiatives to spread its principles also to the system of life-long learning and the Higher-education sector.

Brief Description of the Institution/Initiative:

VET in school education is for the most part provided by public schools. These, however, do not possess the practical industrial production know-how, since production is done mostly by private companies. This causes a significant bridge between the two sectors, which affects the preparedness of the workforce for the labor market.

Dual education as such connects education with the labor market and enables the students to gain practical knowledge in the real-world environment during their studies. This enables them to be better prepared for the challenges of engineering professions. The major outcomes of dual education include enhanced employability, industry relevance, and the development of a skilled workforce adept at seamlessly integrating into the workforce.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

Programs are provided in the study programs at secondary vocational schools, which participate in the System of Dual education (it is not mandatory). The institutionalization of the Dual Education system, based on the examples from West European countries is beneficial, especially for countries of Central and Eastern Europe, who had to overcome the economic transformation of industries and now need to implement the relevant transformation of their VET school systems in order to better reflect the needs of the industries and foreign investors. In other words, while Dual education anchored in legislation and at the institutional level may not be innovative in Old EU countries, it is a necessary requirement for further economic growth in new member states and the Slovak system is in this respect most progressive and may serve as an implementation best-practice in the environment of transforming economies of new member states.

Examples of Effective Practice in Skills Acquisition:

Dual education is a system that fosters a close partnership between education institutions and the practical sector, allowing students to gain real-world experience alongside their education. It enables swift responsiveness to employer needs and offers students valuable knowledge and skills that are hard to simulate within the confines of a traditional classroom. Moreover, students entering the labor market already have the necessary skills that they have earned through practice.

Internationalization in the Skills Acquisition Process:

Internationalization can occur when educational institutions collaborate with foreign manufacturers.

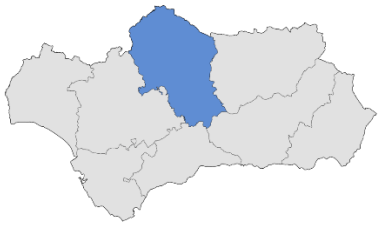
Partnership Models:

Educational institutions design the theoretical curriculum, while employers offer practical training and workplace experience. Government agencies often play a regulatory and financial role. This collaboration ensures that students receive relevant and up-to-date skills aligned with industry needs. Employers benefit from a pipeline of skilled talent, educational institutions gain insights into industry demands, and governments promote economic growth and reduced unemployment.

Impacts and Outcomes:

1. With practical experience integrated into education, graduates are ***job-ready*** without requiring further educational measures.
2. Students gain ***hands-on experience***, enabling them to apply theoretical knowledge to real-world scenarios effectively.
3. Dual education creates a ***seamless transition*** from academia to the workforce, reducing the time and resources spent on additional training after graduation. Employers value graduates from dual education programs for their immediate readiness and ability to contribute productively from day one.
4. The close collaboration between educational institutions and the practical sector allows students to build ***strong networks and connections within the industry***.

9. Digital Transformation Classroom (ES)

Country	Spain	Country and/or Region - Map
Region	Andalucía	
Name of Institution/Initiative:	FIWARE Digital Transformation Classroom / University of Córdoba	
URL:	https://www.uco.es/atdfiware/	
Focus Area of Skills Acquisition:	Digital Skills	
Nature of Institution/Initiative:	Public/University/Academic	

Contextual Snapshot:	
Relevance of the Focus Area:	Spain, as a European country, is committed with the development of the Skills Digital, both through public and private initiatives. Examples of this are the following: Private Digital skills: training to transform - Telefónica https://www.telefonica.com/es/sala-comunicacion/blog/habilidades-digitales-formar-para-transformar/ Public National Digital Skills Plan https://portal.mineco.gob.es/es-es/digitalizacionIA/Paginas/plan-nacional-competencias-digitales.aspx Andalusia is a region in the south of Spain where the University of Cordoba is placed, which is strongly committed to the development of digital skills through various actions of different kinds, training courses, social and cultural projection classrooms, chairs, projects related to these skills, and other activities.
Current Status of the Focus Area:	The Government of the Junta de Andalucía, more specifically the Regional Ministry of University, Research, and Innovation, promotes activities and actions aimed directly at the development of all types of skills (Digital/Green/Resilience/Entrepreneurial). In addition, the Cordoba City Council and the Cordoba Provincial Council actively promote the development of these skills through programmes and grants. Therefore, the University of Cordoba is aligned with this policy by actively supporting it and collaborating through its research groups, university structures, teaching and research staff, administration and services staff, etc....
Key Challenges:	The Andalusian R&D&I Strategy (EIDIA), Horizon 2027, represents the Andalusian Government's firm commitment to R&D&I as the basis for economic growth in the region, a competitive, sustainable and inclusive growth, firmly based on science and knowledge. The plan is structured into three strategic objectives: 1: To increase the weight of science and technology in the Andalusian economy. 2: To increase the percentage of the population dedicated to R&D activities. 3: To increase the levels of knowledge transfer.

Government or Institutional Initiatives:	The Digital Empowerment Plan for Andalusia 2022-2025 establishes the roadmap to be followed by the Regional Government of Andalusia during this period for the design of its policies, initiatives and actions to improve the digital skills of the population. The Plan's mission is to help Andalusian society to acquire the digital knowledge, skills and competences necessary to be able to function normally in the digital world and to be prepared and able to face present and future technological challenges. To achieve this ambitious challenge, six strategic objectives have been established: 1. Improve the digital competences of citizens from a universal approach. 2. Facilitate access to and use of the digital world for those groups most at risk of digital exclusion. 3. To train professionals in Andalusian companies in the use and exploitation of technology. 4. To develop the advanced digital skills of ICT professionals. 5. To improve the digital skills of Andalusian Public Administration staff. 6. Stimulate and promote interest in technology at an early age.

Brief Description of the Institution/Initiative:

The FIWARE Digital Transformation Classroom of the University of Cordoba is an organizational structure of the University, which is composed of a multidisciplinary group of people who promote the use of FIWARE technology (https://www.fiware.org/) through the delivery of training courses, public-private collaborations, development of research projects, development of non-proprietary turnkey solutions, organization of conferences ...

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

The University of Cordoba has several classrooms where the development of digital skills is worked on:

- **FIWARE Digital Transformation Classroom.**
- Free Software Classroom.
- Cybersecurity and Networking Classroom.
- Sustainable and Digital-BIM Engineering Classroom.
- Classroom of Robotics and Free Hardware.

In addition, there are Chairs in which these skills are also developed, such as the EPRINSA Chair of Digital Transformation.

More specifically, the actions carried out by the FIWARE Digital Transformation Classroom can be consulted on its website https://www.uco.es/atdfiware/. Conferences, courses, collaborations, projects...

Examples of Effective Practice in Skills Acquisition:

Here are some examples:

- OnIndustry 2023 (https://www.onindustry.es/) - Presentation Platform fiUCO Powered by FIWARE.
- Conference 9 March 2023. Scientific and Technological Park of Cordoba. Rabanales 21 (https://ptcordoba.es/) - FIWARE Developments. New Business Ideas.
- 1st FIWOO (https://www.fiwoo.eu/)-IoT Challenge - Awarded the Classroom with a proposal on accessible mobility. Control of reduced mobility places.
- At the Centenary of the Patios of the City of Cordoba - Control of Aforos.

Internationalization in the Skills Acquisition Process:

The Aula participates in several European projects contributing its knowledge and expertise. For example, in the field of photovoltaic solar energy, agriculture ... In addition, it has currently collaborated in the drafting of European project proposals related to sustainable construction. She is currently part of a project of ecological and digital transition at national level, but with international relevance, in which a smart trap for the olive fly pest is being built.

Partnership Models:

This is done through collaboration agreements that the University of Córdoba facilitates and that the Aula uses to establish relationships with companies interested in the services of the Aula, either for the development of projects, courses, conferences, etc ... For example, the Aula has agreements with FIWOO, NEC, FIWARE, Telefónica ... among others.

Impacts and Outcomes:

The best place to see the impact of this initiative is on the Aula's website:
https://www.uco.es/atdfiware/.
Awards received, projects developed, proofs of concept, conferences, training, research... everything is documented and updated on the website.

10. Transferable Skills Program (PT)

Country	Portugal	Country and/or Region - Map
Region	Lisbon and Porto	
Name of Institution/Initiative:	Ordem dos Engenheiros (OE) and Faculdade de Engenharia da Universidade do Porto (UPorto-FEUP)	
URL:	https://www.ordemengenheiros.pt/pt/ https://sigarra.up.pt/feup/pt/web_page.inicial	
Focus Area of Skills Acquisition:	Soft skills, micro credentials and accredited continuing education	
Nature of Institution/Initiative:	HEI and Professional Public Association	

Contextual Snapshot:	
Relevance of the Focus Area:	Engineering is a dynamic field that is constantly evolving in response to social, economic, and technological changes. Its challenges have transcended traditional boundaries, to encompass social, environmental, and ethical considerations. While technical expertise remains a foundation of engineering, the increasing complexity of today's challenges demands engineers to possess a broader set of skills that transcend specific disciplines. As a result, cultivating TTS (Transversal and Transferable Skills) throughout an engineer's career is paramount, so that they can succeed in an ever-evolving professional landscape.
Current Status of the Focus Area:	Several engineering HEIs in Portugal are actively working to provide formal opportunities to develop TTS for engineering students. Some are implementing active learning approaches (such as problem-based and challenge-based learning); others are being proactive in contacting industry and companies to collaborate (e.g.: MSc thesis done in company settings), others are creating, in their programs, courses that develop TTS. OE developed, in addition to CPD (Continuously Professional Development) in all regions, a Continuing Education Accreditation System for Engineers - OE+AcCEdE®, for companies and HEIs, with the goal of ensuring the quality of the training offer of interest to its members, encouraging our engineers to pursue CPD.
Key Challenges:	These efforts developed so far in our country need to be further explored and deepened. More HEIs need to embrace this effort, so that it becomes a general endeavour. Also, there's a difficulty in including more skills in HEIs programs, since a 1st cycle needs to be completed in 3 years and a 2nd cycle in 2 years. In regards to CPD, the challenge is to ensure the quality of the courses, post graduations, so that they can meet the expectations of the engineers that enrol. In general, continuous trainings of personal interest should be done in after-work hours, while continuous trainings of interest to companies are done partly in working hours.

Government or Institutional Initiatives:	With the opportunity of the Decree-Law nº 65/2018 that stated the end of the national 5-year Integrated Master's programs in Engineering and the creation of 3-year 1st cycle graduate programs and 2-year 2nd cycle master programs, national HEIs have created TTS courses in their engineering programs. This clearly states that TTS are part of the skills profile of an engineer. Recently, the Portuguese government started a program, called "Cheque-Formação + Digital" (https://www.iefp.pt/cheque-formacao-digital), which aims to support and encourage the development of digital skills and competencies of workers, by opening applications for funding of up to 750 €. OE, through their courses promoted through the various regions of Portugal and the OE+AcCEdE® system, also contributes to this goal at an institutional level.

Brief Description of the Institution/Initiative:

UPorto-FEUP has its origins in 1837 and has 14 BS programs and 28 MSc. UPorto-FEUP is proactive in contacting industry and companies and collaborating with them to make learning more meaningful and engaging. It develops active learning methodologies to develop TTS such as challenge-based learning. It also integrated in its engineering programs, mandatory courses of TTS (soft skills, entrepreneurship, digital and green skills).

OE has accredited important courses for its members, since 2002, and created the OE+AcCEdE® System in 2014, in order to better assure the quality of the actions accredited. This system accredits courses for universities, such as post graduations from ISEL and FCT, and for enterprises since 8h - 150h formation, for instance EPAL and Comunilog.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

UPorto-FEUPs transferable skills program is grouped into 4 types, in accordance with the project E4E taxonomy.

Skills group	Skills
Resilience	Communication, Conflict Management and Negotiation, Lifelong Employability, Leadership, Ethics, Philosophy
Green Skills	Decarbonize the Building Sector to achieve Energy Sustainability, Engineering for sustainability, Challenges of sustainable development, Electrical Power Systems for the Sustainability and Energy Transition
Digital Transformation Skills	Excel, Python, Introduction to Robotics, Mini projects on machine learning and control systems, Automated laboratory data acquisition
Entrepreneurship Skills	Opportunities for innovation, Strategic management of innovation

Since the academic year of 2021/22, Uporto-FEUP has registered 4.000 participations per year, in TTS courses integrated in its BS and MSc engineering programs. OE, only this year, has already accredited 12 courses and has the accreditation of more than 9 courses in progress, in the areas of facility management, HVAC, railways, water and sewage building networks, safety at work, renewable energy management, etc. OE also promotes some courses in soft skills, such as communication, leadership, management, emotional intelligence and wellbeing at work, etc. To be a member of OE, it's mandatory to attend a course in ethics.

Examples of Effective Practice in Skills Acquisition:

UPorto-FEUPs pedagogical model incorporates active learning approaches that favour the development of TTS such as challenge-based learning (UPorto-FEUP has created 10 TTS courses based

on challenges/competitions). UPorto-FEUP is also proactive in contacting industry and companies and collaborating with them to make learning more meaningful and engaging, for example, through MSc thesis done in company settings (UPorto-FEUP has 74 active protocols with companies and 35% of its dissertations are done in a company setting). UPorto-FEUP is focused in developing soft skills with a particular emphasis on "communication and collaboration skills" (UPorto-FEUP created a mandatory 1,5 ECTS course on "Professional Communication" offered to all undergraduate students in all its engineering programs).

TTS development can be achieved by infusing such skills in the engineering curricula, along with all other technical content of the courses program OR considering an integrating/embedded approach to TTS development by creating specific courses, in the engineering programs, devoted to develop such skills OR even the bolting-on approach with TTS learned extracurricular (UPorto-FEUP created 23 mandatory 1,5ECTS TTS courses offered in the scope of its BS and MSC engineering programs (integrating/embedded approach) and 8 extracurricular/bolted-on courses where students can enrol voluntarily).

By adopting these measures, our engineers are better prepared to face the professional landscape, being able to better adapt and face the challenges provided by technological, social and economic evolution. Our HEIs programs are increasingly more solid and balanced between soft and hard skills, providing a more solid foundation for professional engineers, that can complement their knowledge throughout their careers as needed with courses that are provided, for instance, by/through OE+AcCEdE® system or some of the courses/workshops organized by OE.

Internationalization in the Skills Acquisition Process:

Courses for the first and second cycle of studies at UPorto-FEUP are included in the curriculum of engineering BSc and MSc programs and are only offered for regular students. With a few exceptions, most are taught in Portuguese. Third cycle of studies course units are offered to PhD candidates and researchers and are, in general, taught in English.

The training provided by OE is shared with the professional associations of the Portuguese-speaking countries (Cape Green, Angola, Mozambique and Brazil), allowing their members to have continuous training. Since OE is an EURACE accreditation agency, we also contribute to core engineering training at national level, such as UPorto-FEUP, IPL, ISEP and other HEIs, and at international level, through the Lusophone countries.

Partnership Models:

HEIs are being proactive in contacting industry and companies to collaborate with them to make the learning process more meaningful and engaging, for example, through MSc thesis done in company settings. OE has a business exchange with over 200 companies, to which more than 500 CPDs have been accredited over the years.

Impacts and Outcomes:

Through the activities promoted by UPorto-FEUP and OE, it's possible for students of engineering to leave university better prepared for the demands of today's work world, and for those engineers who are already working, it's possible to adjust more easily to the demands of the working world by enrolling in a course correspondent to their needs that has a quality assurance from OE.

11. Community of Practice (DE)

Country	Germany	Country and/or Region - Map
Region	Germany	
Name of Institution/Initiative:	„Stifterverband: Transformative Skills für Nachhaltigkeit“ (Transformative Skills for Sustainability)	
URL:	https://www.stifterverband.org/transformative-skills-fuer-nachhaltigkeit	
Focus Area of Skills Acquisition:	green skills, sustainability, interdisciplinarity	
Nature of Institution/Initiative:	Civil Society Institutions, Foundations, Companies, Higher Education Institutions	

Contextual Snapshot:	
Relevance of the Focus Area:	Before the background of sustainability as a (international) megatrend, the ability to develop sustainable solutions is becoming a conditio sine qua non for scientists in general and engineers in specific.
Current Status of the Focus Area:	Competences of students/graduates in the field of sustainability and interdisciplinarity are still on a low level and must be further developed.
Key Challenges:	The transfer of feedback from companies into the engineering curricula concerning the required mind- and skillsets of current/future scientist and practitioners is to slow.
Government or Institutional Initiatives:	Federal and state governments, engineering associations, employer federations, and foundations have over the past years started several initiatives to facilitate the flexibilization of curricula and support the adoption by students/young professionals of green skills and a sustainability mindset.

Brief Description of the Institution/Initiative:

The initiative aims at creating a „community of practice“ of 20 HEIs. Its goal is to drive the facilitation of transformative skills for sustainability in study programs to ensure the incorporation of these „future skills“ into the curricula.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

All German universities were invited to participate in this network initiative. It works "challenge-based", i.e. HEIs identify challenges in the development and implementation of their teaching-learning concepts for sustainability competences and develop solutions. The spectrum is deliberately open. In concrete terms, the network initiative supports the selected HEIs in designing new teaching modules or further developing existing ones that are dedicated to teaching sustainability skills, with the aim that they are integrated into the curricula.

Examples of Effective Practice in Skills Acquisition:

The kick-off for the initiative was 26 June 2023, so it is in a very early phase. Four curriculum workshops are at the center of the work. In exchange with and supported by the know-how of sustainability experts, the universities work on individual solutions. The workshops are user-centered and oriented towards the needs of the stakeholders involved and work collaboratively on solutions. The university network that comes together in the curriculum workshops can also consult with each other in this framework on a peer-to-peer level.

Internationalization in the Skills Acquisition Process:

This is a national initiative that does not include any international activities. However, the HEIs that are part of the program will spread knowledge and experience via their international networks in research and teaching.

Partnership Models:

The basis of the initiative is a “community of practice” between Stifterverband and 20 German universities.

Impacts and Outcomes:

The planned outcomes are study programs that have competences for sustainability embedded in them. Thus, the competence development will have an impact on as many students as possible from a wide range of subjects.

12. New Digitalisation/Green Energy and Microelectronic Skills (ES)

Country	Spain	Country and/or Region - Map
Region	Madrid	
Name of Institution/Initiative:	UNED / Projects/Educational Activities to Improve Digital Skills in the SMEs and Industry	
URL:	http://www.ieectqai.uned.es/ https://ecovem.eu/ http://ecovem.ieectqai.uned.es/moodle2/	
Focus Area of Skills Acquisition:	Digital Skills/Green Skills/ Entrepreneurial Skills	
Nature of Institution/Initiative:	Public/University	

Contextual Snapshot:	
Relevance of the Focus Area:	Inside the Spanish University for Distance Education (UNED) and as part of their social engagement and impact of those activities we are moving on in several synergized areas: SME workers education and green technologies and Industry 4.0/Connected Industry literacy and penetration. Those new areas are so important at Spanish Autonomous Community levels, National Spanish level and European Union level.
Current Status of the Focus Area:	Current state of microelectronics arena in Europe is highly dependent of outside technical industry and development, we had inside Europe several waves trying to upscale the knowledge and industry awareness, but we fail in all of them, and we need again to reinforce our presence and workforce/industry capability. Regarding mobility and Industry 4.0 awareness, as this is a newer technical approach and action oriented, our Industry is better positioned but we need to spread up the actions and education approach to increase to have a wide impact in all public and private sectors.
Key Challenges:	Major challenges in Europe in those technical areas are: 1, sensibility to sustainability and green technical impact, and 2, update knowledge on new techniques and social skills in SMEs.
Government or Institutional Initiatives:	We follow guidelines from: • the European Union Erasmus Plus initiative following KA3 proposals, Centres of Vocational Excellence. • the Spanish Mobility Ministry to gain access to the technical (and non-technical) workers (and unemployed) to the mobility, logistics and infrastructures as well as we have a grant to jointly efforts in the jointly course delivery.

Brief Description of the Institution/Initiative:

UNED is the Spanish University for Distance Education, the first and leading University institution in Spain (and in Spanish speaking countries) to incorporate Grade, Master and Doctoral Studies in a hybrid model during its 50 years history, starting as a post mail University and following evolution to a distance/online University global University.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

New task-oriented courses for Green Electronics/Clean Energies/Microelectronics for the Microelectronics European Market.
New Master on Connected Industry for Spanish speaking students.
New Professional courses on Logistics/Mobility/Connected Infrastructures for Spanish speaking working and unemployed students.

Examples of Effective Practice in Skills Acquisition:

We focus on the acquisition of new digitalization/green energy and microelectronics skills. Those are done though lifelong learning and Master courses, following different approaches having in mind in all:

- Industry oriented courses,
- Task based education,
- Market oriented approach following the path of the public sector/companies regarding revitalization and new engagement of students in those sectors.

Internationalization in the Skills Acquisition Process:

The Electrical and Computer Engineering Department of UNED started 40 years ago the evolution and activities in international projects, that have focused on European Union academic groups/industry partners collaboration with more than 30 international research and educational projects. Before the pandemic time we were selected as one of the partners of the ECoVEM project, to revitalize and mold the microelectronics European sector to allow a new time of more workers and a new vision for this productive sector. During the pandemic time and having the Ukrainian war as a new unestablished international factor we are in the last part of this project deployment defining new models of governance and collaboration as well as new bunch of short courses to attract and reinforce the profiles of microelectronics workers that is of a mandatory need in Europe as the Chips Act shown in the last year. Our group have been in relation with more than 50 European groups (and more than 20 other worldwide groups) in the last 40 years in this process of research and educational activities collaboration, including in this last project several courses and actions regarding the green electronics importance, horizontal knowledge like circular economy or smart industry, interpersonal skills and activities, etc., or diversity and equity importance inside this technical area of Microelectronics.

Partnership Models:

We have two models to have the best partnership inside any of those projects,

1. Research and Educational International/Europe Union projects, we have a wide partnership with more than 50 partners in the European framework as well as more than 20 partners worldwide outside EU.
2. International and National technical Associations, like: IEEE (the largest worldwide engineering association with more than 400,000 members, having more than 20% of them as engineering students); TAEE (the Spanish Association of Electronics teaching); IGIP/IAoE (international Association of Teaching and Learning in Engineering), IFEES (International Federation of Education Engineering Societies), etc.

Impacts and Outcomes:

At this moment the more tangible outcomes are the courses deployed or under development,

- Microelectronics sector, may be found in the following URLs,
    - UNED repository, http://ecovem.ieectqai.uned.es/moodle2/
    - TUS repository, https://moodle-tus.ecovem.eu/
    - ECoVEM general course shell, https://courses-ecovem.eu/
    - ECoVEM website, https://ecovem.eu/
- Industry Connected Master website (in Spanish)
    - http://portal.uned.es/portal/page?_pageid=93,71749821&_dad=portal&_schema=PORTAL&idTitulacion=280701

- UNED and Mobility Ministry courses (in Spanish),
    - Competencias digitales para el sector de la movilidad y el transporte, https://formacionpermanente.uned.es/tp_actividad/actividad/competencias-digitales-para-el-sector-de-la-movilidad-y-el-transporte
    - Digitalización sostenible en el sector del transporte, movilidad, logística e infraestructuras vinculadas. Automatización, marketing y aplicación, https://formacionpermanente.uned.es/tp_actividad/actividad/digitalizacion-sostenibleen-el-sector-del-transporte-movilidad-logistica-e-infraestructurasvinculada
    - Tecnologías y Herramientas claves para la transformación digital en el sector del transporte, movilidad y logística, https://formacionpermanente.uned.es/tp_actividad/actividad/tecnologias-y-herramientas-claves-para-la-transformacion-digitalen-el-sector-del-transporte-movilida

The impact on the courses of the Microelectronics sector will be starting to have a pilot courses report around November 2023. The Master will start on October 2023, and the courses for the Mobility Ministry will start on February 2024.

13. Rethinking Engineering Education in Ireland: REEdi (EI)

Country	Ireland	Country and/or Region – Map 
Region	Province of Munster	
Name of Institution/Initiative:	**REEdI** - *Rethinking Engineering Education in Ireland*	
URL:	https://reedi.ie/ The Higher Education Authority (HEA) in Ireland also provides contextual information **here**.	
Focus Area of Skills Acquisition:	Digital Skills However, *as an educational initiative the approach could also be applied to sustainable engineering*	
Nature of Institution/Initiative:	University/Academic *The REEdI Industry partnership is comprised of manufacturing organisations across multiple sectors- AgriTech, MedTech, Pharma, Electronic, Automotive and General manufacturing.*	

Contextual Snapshot:	
Relevance of the Focus Area:	The REEdI is looking at how best to utilise state of the art technology in an educational/research/industry symbiosis. Where education is partnered with industry not only in the development of programmes but also in the delivery of the curricula. Moreover, the REEdI offers students more frequent opportunities to apply their learning through a work placement model that encompasses the final two years of their bachelor's degree where they can "*hone their technical or soft transversal skills*"[1].
Current Status of the Focus Area:	The REEdI is currently focused on digital skills that are applicable to mechanical engineering. However, the framework could also be applied to green skills and entrepreneurial educational initiatives.
Key Challenges:	To adapt the framework into one that is applicable to sustainability, the optimal educational approach for integrating SDGs needs to be better understood and appreciated.
Government or Institutional Initiatives:	The Human Capital Initiative (HCI) is delivering an investment targeted towards increasing capacity in higher education in skills-focused programmes designed to meet priority skills needs[2]. The Human Capital Initiative Pillar 3 funding has facilitated Munster Technological University to "*innovate and come up with a new model of not only engineering education, but also an educational model that can be adopted across a number of disciplines*"[3]

[1] HCI Pillar 3 (2022, 0:48) *HCI Pillar 3 – REEdI* [Video]. YouTube. https://www.youtube.com/watch?v=q6KxsNIaiao

[2] https://hea.ie/skills-engagement/what-is-human-capital-initiative-hci/

[3] HCI Pillar 3 (2022, 1:10) *HCI Pillar 3 – REEdI* [Video]. YouTube. https://www.youtube.com/watch?v=q6KxsNIaiao

Examples of Effective Practice in Skills Acquisition:

The REEdI project is focused on the development of an agile and innovative framework for the design, development and delivery of engineering; transformative programs where self-directed and self-scheduled learning effectively equip the next generation of engineers.

One of the key outputs of the project was a Bachelor of Engineering (Hons) in Mechanical and Manufacturing Engineering- the "REEdI Engineering degree". This program is an agile and innovative blended 4-year degree where student engineers get to learn using immersive technologies, such as virtual and augmented reality, and cutting-edge models of engineering education. The student engineers' time is equally divided between on-campus activities and industry (enterprise) placement. Students will spend the first two years on campus and the final two years at a host industry partner gaining the essential industry skills and personal attributes an employer looks for in a graduate engineer. The industry partners include a variety of manufacturing sectors- MedTech, Pharma, Automotive, General Manufacturing and AgriTech.

The REEdI project will provide an alternative framework for engineering education and indeed, other undergraduate and post graduate programs.

Internationalization in the Skills Acquisition Process:

The educational framework being advocated through REEdI is applicable in an international context. The international academic partners on the project are Charles Sturt University (NSW, Aus) and Harper Adams University (Newport, UK).

Partnership Models:

The REEdI project has a consortium of 23 industry/ enterprise partners (to date), across a variety of manufacturing industries. Also involved is a network of research centers as key partners, including Science Foundation Ireland's Confirm Smart Manufacturing Centre, SFIs Lero Software Development Research Centre, the IMaR Research Centre, and the AgriTech Centre of Excellence (ACE).

Impacts and Outcomes:

The REEdI project capitalizes on its enterprise partners through their input on program design, development and delivery (e.g., program validation panels, guest lecturing), facilitating student taster days at their manufacturing facilities, hosting students on work placement, part of the REEdI steering committee, champions for the project, collaborative outreach initiatives, donation of production parts for "teardown analysis" for our students, and mentoring initiatives. Further, the project has established an industry/ enterprise mentorship network, which enables knowledge sharing of the strengths, weaknesses, opportunities and threats in relation to student work placement.

The approaches (framework) advocated through REEdI could be applied to education that is focused on sustainability and entrepreneurship. Moreover, the REEdI could be extended to integrate all three elements (digital skills, sustainability and entrepreneurship).

14. Professional Roles for young engineers – the PREFER project (BE)

Country	Belgium	Country and/or Region - Map
Region	Flanders	
Name of Institution/Initiative:	KU Leuven, European Project PREFER	
URL:	https://www.kuleuven.be/kuleuven https://iiw.kuleuven.be/english/prefer/prefer	
Focus Area of Skills Acquisition:	Transversal skills in general	
Nature of Institution/Initiative:	University	

Contextual Snapshot:	
Relevance of the Focus Area:	Not all professional engineers need the same skills set and the variety of engineering jobs is wide. How can universities prepare their students for the labour market?
Current Status of the Focus Area:	Engineering graduates are often unaware of the range of possibilities in the labour market. Moreover, they tend to underestimate the importance of certain professional skills for particular engineering positions. The PREFER-project aimed at facilitating the labour market entry of young engineering graduates in close collaboration with industry.
Government or Institutional Initiatives:	KU Leuven is the coordinator of the European project PREFER | Professional Roles and Employability for Future EngineeRs. With partners from industry and the engineering federations, we aimed to facilitate the labor market entry of engineering graduates. The PREFER role model is already implemented in three universities in Flanders and at some universities worldwide.

Brief Description of the Institution/Initiative:

Thanks to Dr. Craps' PhD work three professional roles were identified for young graduates (focus on innovation, optimization and customer-tailored solutions). Through a series of expert panels in different companies, essential non-technical competencies were identified that are required to be successful in each role. PREFER presents a model and two tests to get insight in the personal preferences and essential competencies.

In close collaboration with industry, the consortium within the European PREFER-project has developed 23 cases from the everyday professional practice. The student is asked to rate the appropriateness to different reactions to the situation.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

Two tests were developed based on the 3 professional roles and identifying non-technical competencies, in close collaboration with BDO Human Capital. Prefer Explore is a personal preference test that initiates reflection on professional interest. Prefer Match is a set of 3 situational judgment tests (one per role) that gives feedback on role alignment and strengths and weaknesses. See https://iiw.kuleuven.be/english/prefer/instructor/prefer-tests

Examples of Effective Practice in Skills Acquisition:

The tests are structurally implemented at the Faculty of Engineering Technology (KU Leuven), test cases are running at UAntwerpen and UGent and also the University of Beijing is implementing the PREFER model. The University of Melbourne is preparing the implementation.

Partnership Models:

These instruments are the result of an Erasmus+ project with partners from academia, industry and engineering federations.

Impacts and Outcomes:

"I find it reassuring that different types of engineers are needed on the job market. The model gives me more insight into what is possible when I graduate and what I would like to do most." (Master student in Electronics-ICT Engineering)

"The model can help to think about what you want in the future and to make the right choices to get there. It's not hard to find a job as an engineer, but I think it is hard to find a job that fits you best." (Master student in Chemical Engineering).

15. Identifying and Amplifying Non-Technical Skills in Software Engineering Education (BE)

Country	Belgium	Country and/or Region - Map
Region	Flanders	
Name of Institution/Initiative:	KU Leuven	
URL:	https://www.kuleuven.be/kuleuven https://set.kuleuven.be/LESEC/groups/study-career-guidance-of-steam-students/copy_of_template_project	
Focus Area of Skills Acquisition:	Transversal skills	
Nature of Institution/Initiative:	University	

Contextual Snapshot:	
Relevance of the Focus Area:	SOFTWARE ENGINEERING IS DEFINED as the systematic appliance of engineering methods to software development. These engineering methods are without a doubt technical: software engineers daily have to juggle techniques such as continuous integration, deployment pipelines, microservices, horizontal and vertical slice architectures, automated testing, load balancing, and so forth. As a result, in higher education, software engineering curricula are overflowing with technical courses to acquaint students with a multitude of engineering methods. And yet, according to industry experts, software engineering syllabi seem to be falling short of delivering great software developers. Several surveys, including our own, that ask professionals "what makes a great software engineer?" specify personal characteristics, communication, decision making, and creative problem solving next to technical knowledge as vital skills. It is clearly no longer sufficient to be technically proficient. Computing accreditation programs for higher education struggle to follow suit. Even with the attempts of task forces and institutions to improve software engineering education, the gap between academia and industry persists. The demand for software development talent is much higher than the number of graduates universities can deliver each year, putting even more pressure on the skill gap problem.
Current Status of the Focus Area:	This project aims to answer the following questions: 1. What are the non-technical industrial requirements of modern software engineers? 2. How big is the gap between those requirements and engineering education? 3. How can we improve upon education to reduce that gap?
Government or Institutional Initiatives:	KU Leuven, Campus Diepenbeek

Brief Description of the Institution/Initiative:

In the dissertation of Wouter Groeneveld (KU Leuven), those non-technical industrial requirements of modern software engineers are identified. Focus is also on how big the gap between those requirements and software engineering education is, and how the educators can amplify students' non-technical skills in order to reduce that gap. We first focus on non-technical skills in general before zooming in on creativity as one of the key attainable skills to becoming a great software engineer. A framework for mastering seven creative problem-solving skills is developed: technical knowledge, communication, constraints, critical thinking, curiosity, creative state of mind, and creative techniques. A self-assessment tool called the Creative Programming Problem Solving Test was derived from that to help gauge your current creativity mastery level in context of a software development project. Finally, a practical approach to creativity in software development is explored, specifically geared towards software engineering professionals. This work contributes to computing education research by helping shed light on the non-technical academia-industry skill gap and by bringing research on creativity from the field of cognitive psychology closer to the field of computing education.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:

A practical guide can be found in the following book written by Wouter Groeneveld: https://www.manning.com/books/the-creative-programmer