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ENGINEERS 4 EUROPE

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SKILLS STRATEGY

ANTICIPATING SKILLS REQUIREMENTS FOR THE ENGINEERING PROFESSION

1 SEPTEMBER 2022 – 31 AUGUST 2025

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ENGINEERS 4 EUROPE


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List of Abbreviations

AI	Artificial Intelligence
AI	Artificial Intelligence
BIM	Building Information Modelling
CPD	Continuing Professional Development
CTF	Common Training Framework
DG	Directorate-General
E4E	Engineers for Europe
ECTS	European Credit Transfer System
EEED	European Engineering Education Database
EESC	European Economic and Social Committee
EHEA	European Higher Education Area
ENAEE	European Network for Accreditation of Engineering Education
EUA	European University Association
EQF	European Qualifications Framework
HEI	Higher Education Institution
HVAC	Heating, Ventilation and Air Conditioning
IEA	International Engineering Alliance
ICT	Information and communications technology
IoT	Internet of Things
ISCED	International Standard Classification of Education - UNESCO
LLL	Lifelong Learning
LRC	Lisbon Recognition Convention
OECD	Organisation for Economic Co-operation and Development
SDG	Sustainable Development Goal
SME	Small or Medium-sized Enterprise
STEM	Science, Technology, Engineering and Mathematics
TU	Technical University
VET	Vocational Education and Training

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1. PREFACE

This document contributes to the overall objective and vision of the Engineers for Europe (E4E) ERASMUS+ project, which has been outlined as follows in the project application:

> ***The objective of E4E is – geared by the new requirements of the world of work – to prepare better equipped engineers through the acquisition of new competences, covering new knowledge, attitudes and leadership skills while focusing on digital, green, resilient and innovative entrepreneurship. E4E will bridge the gap between education and industry while operationalising EU competence frameworks (Dig Comp, Life Comp, Entre Comp, Green Comp) for engineers.***

The Engineers for Europe (E4E) project is not an academic endeavour but an operational answer to the many challenges of the engineering profession in Europe. As a European project for the engineering profession "at large", the methodology we used in the research was not too granular and specific, precisely to identify trends that affect the profession across industries, functions and countries. Unlike thorough literature reviews - required for academic papers or publications - the goal of this document is to describe the challenges of the engineering profession from an operational perspective. The E4E project includes a variety of partners and as such they provides common ground to gauge the dynamics, challenges and opportunities of the engineering profession, culminating in this *European Engineering Skills Strategy.*

The project has been coordinated by **ENGINEERS EUROPE** AISBL as Project Leader and consisted of a consortium with 12 other partners, representing the whole spectrum of Higher Education (HE), Vocational Education Training (VET) and Industry. The consortium partners of the project :

1. Higher Education Institutions

- *Faculdade de Engenharia da Universidade do Porto (FEUP)*
- *Technological University Dublin (TU Dublin)*
- *Katholieke Universiteit Leuven (KU Leuven)*

Fig. 1: *Inauguration of the European Engineering Advisory Group, Residence Palace – Brussels, 11 September 2018: the informal start of the E4E Project.*

2. Vocational Education and Training

- *Institute of Industrial and Business Education & Training (IVEPE-SEV Athens)*
- *Newport Group S.A. (NG Bratislava)*

3. Industry and Engineering Organisations

- *Verein Deutscher Ingenieure (VDI, Düsseldorf)*
- *Engineers Ireland (EI, Dublin)*
- *Ordem dos Engenheiros (OE, Dublin)*
- *European Council of Engineers Chambers (ECEC, Brussels-Vienna)*
- *Association of European Civil Engineering Faculties (AECEF, Prague))*
- *European Federation of Heating, Ventilation and Air Conditioning Associations (REHVA, Brussels)*

Fig. 2: *E4E Consortium Meeting and Establishment of the European Engineering Skills Council, Brussels, 21-22 September 2023*

4. Internal and External Quality Assurance

- *National Agency for Quality Assessment and Accreditation of Spain (ANECA, Madrid) and Prof. Marta Kosior-Kazberuk, Rector of the Bialystok University of Technology (PL)*

Next to those E4E-consortium partners, there was also valuable input from other stakeholder representatives, such as the European Board of Engineering Students of Technology (BEST), the European Young Engineers (EYE), the European Association of Manufacturing Technologies (CECIMO) and several represented companies such as TÜV North (Germany), PROTECNA (Portugal) and the Electricity Supply Board ESB (Ireland). Together they established the European Engineering Skills Council.

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The below mentioned people and institutions have contributed to this document through their involvement in the primary and secondary research, as well as by their expert advice and contributions made during various digital and in-person meetings, held in the light of the E4E Project, in the time September 2022 to June 2025.

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The attached Skills Strategy is the result of joint actions of all these partners. The development (and improvements) of this document required numerous events allowing for discussion, exchange of experiences and establishing common opinions. The events also served to explain the E4E project and to disseminate the content of the Strategy, because this document is intended to serve many beneficiaries, especially outside of the project. An overview of the events to which ENGINEERS EUROPE contributed or took part in over the last three years is added as Annex 3. Project implementation, strategy development and survey research required the development of extensive and wide relationships. In addition, the E4E dissemination events are also largely presented on the E4E LinkedIn account, which at the time of issue of this document, reached almost 10.000 followers.

This Skills Strategy is constructed on the input resulting from Primary and Secondary Research that was conducted by all consortium partners of the project. Two surveys (primary research) and three rounds of literature/data reviews (secondary research) have been undertaken to acquire qualitative data as the basis for the definition of skills gaps and competence requirements. ENGINEERS EUROPE and its 32 National Members conducted primary research by developing and implementing two European-wide on-line surveys between 15 May and 15 July 2023 and between 7 May and 30 June 2024. The first survey consisted of 33 closed questions, whereas the second survey consisted of 10 questions of which some were open. In total, these two surveys received 7.757 completed replies from professionally active engineers and engineering students. While online surveys can have limitations, such as potential self-reporting bias, they offer a high degree of scalability and are especially useful for this type of research. The survey aimed to be concise and clear to minimize time investment for participants. The average time to complete the survey was approximately 20 minutes. The results provide significant input about the current trends and major challenges when it comes to engineering competencies for the future. The methodology used for the secondary research involved a bibliographic review of more than 150 various recent sources: publicly available reports on the internet, academic research papers, conference presentations and their conclusions, digital press releases, interviews as well as publications of public agencies and authorities at national and European level. We also considered the most recent publications from other stakeholders as developed by industry and professional organisations representing the engineering profession. The literature review provided an insight into the trends and directions of discussions about engineering education throughout Europe. An extensive list of references is presented at the end of this document. None of the sources cited predate the year 2020.

The following pages are a direct reflection of the excellent work and commitment the E4E-consortium partners and the Skills Council members have demonstrated and brought to the table over the past three years. Their contributions have not only made the attached document possible but also ensured a strong foundation for the future work of the European Engineering Skills Council. We wish to thank them for their engagement and support and for being such valuable partners. Thanks to their dedication, expertise and collaborative spirit – which were instrumental to build this partnership – we have been able to achieve this significant result.

Ralph APPEL
President
ENGINEERS EUROPE

Dirk G. BOCHAR
Secretary General
ENGINEERS EUROPE
E4E Project Coordinator


living room
kitchen
meeting room
Bathroom
Bedroom

2. INTRODUCTION

The role of engineering in shaping our social and economic interactions has become increasingly important. Nowadays, engineering is crucial in designing and delivering products and services related to health, education, transportation, mobility, infrastructure, water, sanitation and telecommunication. The profession's importance has been further amplified by the digital and green transformations, which have created new opportunities and challenges in Artificial Intelligence, the Internet of Things, the process of green growth, circular economy and decarbonization.

Despite the growing importance of engineering, significant asymmetries, mismatches and polarization have undermined the profession's potential impact. Official statistics, data and empirical evidence illustrate how there is a shortage of engineers in Europe, who are chronically needed to meet the 2030 and 2050 targets. The focus on technical skills for engineers has led to skill polarization dynamics, creating a considerable gap in transversal skills. Employers are increasingly seeking multidisciplinary and soft skills in engineers. There is also a distance between the world of education and the world of work when it relates to engineering. A lack of integration among Higher Education Institutions, VET-providers and Industry when it relates to upskilling and reskilling engineers has further exacerbated these issues. Europe is facing an "engineering innovation and competitiveness challenge" with competitive pressures from USA and Asia and the above mentioned factors make it even more urgent to reinforce the profession and take steps to address these challenges.

The European Engineering Skills Strategy, as outlined by the E4E project, establishes the framework for the operation of the European Engineering Skills Council**.** The objective of this document is therefore to provide an answer to the following questions that are at the core of the E4E project :

- What is the current situation concerning the competence requirements of engineers, the existing skills mismatch and the activities/measures of companies/individual engineers to facilitate competence developments?
- What are the future needs concerning technical and non-technical skills of engineers before the background of global megatrends, i.e. digitalisation, decarbonisation, demographic change and internationalisation?

As the competence requirements of engineers are currently undergoing a major change, the focus of the project was on two major competence areas:

- Technical skills, e. g. green skills and digital competences, as well as data literacy
- Non-technical skills, e. g. communication skills, entrepreneurial skills, interdisciplinarity, life-long learning skills, intercultural and interpersonal skills

This document therefore caters to several Key Stakeholder Groups.

- **Higher Education Institutions** (HEI) : they play a pivotal role in delivering essential engineering curricula and attracting future engineers. In addition, they are more and more developing into providers of continuing professional development (CPD).
- **Employer associations** : they provide crucial input on the competencies required by industry.
- **Professional associations**, chambers and engineering federations : they serve as platforms for communication, discussion and feedback while liaising with political decision-makers.
- **Training providers** : they focus on competence development, encompassing secondary education and vocational training.
- Finally, **political decision-makers** as they hold the authority to transform recommendations into legislation, shaping the future engineering landscape.

This document and the established Skills Council are relevant to all of these for the following reasons:

- It provides Higher Education Institutions (HEIs) with insights from industry considering the necessary

continuous alignment of curricula and labour-market demands.

- It grants professional associations, federations and chambers access to the latest information from HEIs and companies on current competence and curricula developments and enables them to communicate current trends towards their members, partner organisations and political decision-makers.
- It presents political decision-makers with a concise overview on current trends in the development of engineering competencies, enabling them to base political decisions on information from a wide variety of relevant stakeholders.
- This Engineering Skills Council will offer a way for engineering companies to continuously channel their competence requirements to the entire Higher Education sector and - at the same time - receive feedback on current trends in Higher Education in the field of engineering and technology. It will give training providers an idea of current and future market demands, thus enabling them to develop up to date CPD activities and programs.

By gaining insights into the evolving nature of the engineering profession, our research addressed several key aspects. It aimed to identify emerging trends in the industry, such as the increasing demand for digital skills, the integration of sustainable practices, the need for resilience in the face of unforeseen events and the importance of fostering an entrepreneurial mindset among engineers. These trends shape the engineering field's skill requirements, educational strategies and professional development needs. In this way, we hope that our research also provides useful information about the state of the engineering profession across industries, functions and countries.

Understanding the dynamics of the engineering profession will help policymakers, educational institutions and industry leaders to align their strategies and resources to better support engineers.

It is clear that while engineering in the future will still have to be based on a high-quality basic engineering/technical education, the importance of non-technical skills will grow. Interdisciplinarity, entrepreneurial skills, multi-cultural competences, holistic approaches and an understanding of the need for life-long learning, are just a few examples.

Especially the last aspect, the need for continuous professional development (CPD), is identified as a major challenge but also a major opportunity for individual engineers, companies, Higher Education Institutions and engineering training providers.

The research also highlights that before the background of a general lack of highly qualified personnel in engineering, there is a clear need for the diversification of the engineering workforce, i.e. not only by bringing more women into engineering (gender), but also by stimulating the inflow of qualified technical personnel from non-EU countries (ethnicity) and by creating a higher permeability of the educational systems (social).

The structure of this document is in accordance with the overall goals and objectives of the E4E project.

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3. ANALYSIS OF THE DEMAND SIDE

1. Demand of Engineers per Industry Sector and Professional Competences

Triggered by the unprecedented challenge of the pandemic and the need to overcome never-before-faced challenges, the demand for researchers and engineers increased dramatically (7 million in 2022). Most researchers and engineers are employed in the professional, scientific and technical activities sector and in the manufacturing industry[1]. The employment of researchers and engineers increased by another 23 per cent between 2022 and 2035. The diffusion of technological developments across economic sectors will require researchers and engineers to also develop new skills.[2]

By disciplines, engineering professions in most demand are ***Electronic Engineers, Industrial Engineers and Mechanical Engineers***[3]. As trends suggest, analyses of skills required for a job role, will call for skills-based hiring as a basis for evaluation, as opposed to credential-based hiring[4]. "Skills-based organisations", where skills **–** rather than jobs **–** are used as the basis for decision making about work and the workforce,[5] will be the organisations to outperform their peers. As LinkedIn's Workplace Learning Report suggests**,** skillsets for jobs have changed by around 25% in the last 8 years[6]. By 2027, this number is expected to double. Accordingly, ***The Future of Jobs Report 2025***[7] by the World Economic Forum reports that on average, workers can expect that two-fifths (39%) of their existing skillsets will be transformed or become outdated over the 2025-2030 period.

Flexibility and agility have become essential attributes for organisations seeking to thrive in an increasingly complex and unpredictable world. These values are reflected in practices like hybrid work arrangements, decentralized decision-making and iterative processes that enable rapid adaptation to change. ***McKinsey's Workforce Insights 2023*** highlights that agile companies are 1.5 times more likely to meet their performance targets compared to their peers. According to LinkedIn's 2023 Workplace Learning Report 94% of employees indicated they would stay longer at a company that invests in their career development.

The ***2023 Learning and Development Survey***[8] of the Chartered Institute of Personnel and Development however, reveals that only 48% of companies have effective Lifelong Learning (LLL) strategies in place, often due to resource constraints or a lack of structured frameworks. Additionally, organisational inertia and competing short-term priorities can hinder the implementation of comprehensive CPD initiatives. Addressing these barriers requires leadership commitment and the integration of CPD into long-term business strategies, ensuring learning aligns with measurable outcomes.

1) Current Landscape: The engineering profession in Europe stands at a crossroad. While there is a burgeoning demand for engineers, particularly in innovation, technology and renewable energy sectors, there's a concerning trend: the profession is losing its allure among the younger demographic. Despite the anticipated need for millions of skilled professionals by 2030, the appeal of engineering as a career choice is on the decline. In this respect, we also refer to the Draghi Report which will be dealt with later on[9]. In March 2024 the EU Commission published its ***Labour and skills shortages in the EU: an action plan***[10]. It identifies 42 occupations that it considers as EU-wide shortage occupations. At least 6 of those are engineering related.

1 https://www.cedefop.europa.eu/en/data-insights/researchers-and-engineers-skills-opportunities-and-challenges-2023-update
2 https://www.cedefop.europa.eu/en/data-insights/researchers-and-engineers-skills-opportunities-and-challenges-2023-update
3 https://www.euroengineerjobs.com
4 https://www.mckinsey.com/capabilities/people-and-organisational-performance/our-insights/right-skills-right-person-right-role
5 Building tomorrow's skills-based organisation: Jobs aren't working anymore, Sue Cantrell, Michael Griffiths, Robin Jones, and Julie Hiipakka, Deloitte
6 https://learning.linkedin.com/resources/workplace-learning-report-2023
7 https://reports.weforum.org/docs/WEF_Future_of_Jobs_Report_2025.pdf
8 https://www.cipd.org/globalassets/media/knowledge/knowledge-hub/reports/2023-pdfs/2023-learning-at-work-survey-report-8378.pdf
9 Draghi, Mario. The future of European Competitiveness: In-depth analysis and recommendations. European Commission, 2024
10 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A52024DC0131&qid=1738059623002

ISCO code	Occupation
2142	**Civil engineers**
2151	**Electrical engineers**
2211	Generalist medical practitioners
2212	Specialist medical practitioners
2221	Nursing professionals
2411	Accountants
2511	Systems analysts
2512	Software developers
2513	Web and multimedia developers
2514	Applications programmers
2519	Software applications developers and analysts not elsewhere classified
3113	Electrical engineering technicians
3221	Nursing associate professionals
5120	Cooks
5131	Waiters
5321	Health care assistants
7112	Bricklayers and related workers
7114	Concrete placers, concrete finishers and related workers
7115	Carpenters and joiners
7121	Roofers
7123	Plasterers
7126	Plumbers and pipe fitters
7127	Air conditioning and refrigeration mechanics
7212	Welders and flame cutters
7213	Sheet-metal workers
7214	Structural-metal preparers and erectors
7223	Metal working machine tool setters and operators
7231	Motor vehicle mechanics and repairers
7233	Agricultural and industrial machinery mechanics and repairers
7411	Building and related electricians
7412	Electrical mechanics and fitters
7511	Butchers, fishmongers, and related food preparers
8331	Bus and tram drivers
8332	Heavy truck and lorry drivers
9112	Cleaners and helpers in offices, hotels and other establishments
3119	Physical and engineering science technicians not elsewhere classified
2143	**Environmental engineers**
2133	Environmental protection professionals
2145	**Chemical engineers**
2144	**Mechanical engineers**
3115	Mechanical engineering technicians
2141	**Industrial and production engineers**

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2) Skills Evolution and Emerging Profiles: At least six (6) are directly related to engineering as the previous table with ISCO-codes indicates. As technology evolves, so do the profiles in demand. Specialized areas like artificial intelligence (AI), data analytics, cybersecurity and renewable energy**,** are facing a shortage of qualified engineers. According to the World Economic Forum's Future of Jobs Report 2025**,** AI and big data, cybersecurity and technological literacy, are anticipated to be the top three fastest growing skills. While skills requirements in digital and AI basics range from understanding of various technologies and their possible applications and limitations to data analysis and prototyping, additional requirements relate also to innovation and change management skills, including creativity and problem-solving skills. For example, on how to implement digital projects and evaluate their costs and benefits. Other important basic skills relate to analytical thinking, implementing business processes and identifying optimization potential.

3) Transformations and Challenges: The engineering field is undergoing transformative changes, driven by technological advancements, sustainability goals and digitalization. Challenges such as skills shortages coexist with opportunities in infrastructure development and research. Traditional disciplines remain vital, but emerging fields like AI, data science and robotics, are gaining prominence. Apart from the required technical, soft and other related skills, there is the crucial ethical aspect that is particularly important for publicly authorized chartered engineers. A major characteristic of their engineering services in the end is their strong relation to (public) trust and responsibility. As also stressed in the EU AI Act[11], AI may generate risks and cause harm to public interests and fundamental rights that are protected by Union law. Being able to oversee ethical and responsible use of AI is therefore a relevant feature of engineering skill requirements based on the existing frameworks such as the EU AI Act and the OECD Recommendation of the Council on Artificial Intelligence[12]. Besides ethical considerations and approaches, digitalization and AI applications also raise the need for a basic legal understanding, especially when it relates to liability and data sovereignty, including copyright protection under fair trading law and laws on data protection.[13]

4) Identified Concerns and Sectors in Demand: Serious concerns about shortages are identified in ***e****lectrical/ electronic engineering, information and communications technology (ICT), and agronomic/environmental engineering*. Engineers play a pivotal role in leveraging technologies like AI, the Internet of Things (IoT), robotics and automation to enhance productivity and drive innovation across sectors. With a focus on sustainability and renewable energy sources, engineers are also crucial in developing green technologies and contributing to climate goals. High-quality engineering services are essential for achieving the targets of the EU's Green Deal. With the growing applications of generative AI (GenAI), also in engineering sectors, the necessity arises to better understand the distinction between GenAI and foundation models and especially the impacts of that distinction.[14] Another EESC study, presented in 2024,[15] gives an overview of existing digitalization strategies in national housing policies. This as an example of the fact that new digital approaches gain relevance in all branches and even in very traditional parts of engineering. Furthermore, the global shift towards reducing dependence on international supply chains and strengthening domestic production capabilities has also a direct impact on the engineering labour market. In response to recent geopolitical tensions, Europe should be prioritizing reshoring high-tech manufacturing, particularly in semiconductors, battery production and automation technology. This trend has fueled demand for engineers in mechanical engineering, industrial robotics and process optimization, as companies should work to establish new production facilities and reduce reliance on imported technologies. To address these challenges, EU and national policymakers should promote further investments in R&D, tax incentives for domestic production and specialized training programs to prepare engineers for a more localized and resilient industrial landscape.

11 European Commission : Artificial Intelligence Act - Regulation (EU) 2024/1689, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=OJ:L_20240168
12 OECD : Recommendation of the Council on Artificial Intelligence, OECD Legal Instruments, OECD, 2024 https://legalinstruments.oecd.org/en/instruments/%20OECD-LEGAL-0449
13 Haftung und Datenhoheit beim Building Information Modeling, 2025, Oliver Stefan Mandl, ISBN: 978-3-214-26058-3).
14 EESC : Generative AI and foundation models in the EU: Uptake, opportunities, challenges, and a way forward, Study EESC, 2025 https://www.eesc.europa.eu/sites/default/ files/2025-03/QE-01-25-014-EN-N_0.pdf
15 EESC : Affordable sustainable Housing in the EU, Study EESC, 2024 https://www.eesc.europa.eu/en/our-work/publications-other-work/publications/affordable-sustainable-housing-eu

5) Future Trends (-2030): The next five years present significant changes, with sustainability and environmental concerns taking centre stage. Engineers must adapt to the increased emphasis on sustainability, automation and AI, with major areas of innovation in Renewable Energy and Green Infrastructure. Technical competencies related to sustainable design and circular economy principles will be paramount. In the past decade, green transition jobs and skills implications for the labour market have not been analysed in detail. CEDEFOP in 2021 prepared a forecast. Employment growth in architecture and engineering is forecast to be 2.7% higher, which is almost double compared to legal, accounting and consulting services in 2020–30. This reflects increased demand for engineers designing circular economy processes. In sectors such as energy, they will drive green-tech breakthroughs and shape newly emerging high-skilled occupations. Investing in engineering and scientific skills to ensure their availability should be a top policy priority.[16] Lean manufacturing – a production principle targeting the elimination of waste and improvements in efficiency – was the most sought-after green skill for all advertised green occupations in. Environmental engineering – a field of knowledge centered around ensuring that societal development and the use of water, land and air resources are sustainable – was the second most in-demand skill across online ads for green jobs targeting civil engineers[17]. The increasing adoption of automation and AI is reshaping the nature of work, with demand for technological skills expected to grow by 25% by 2030[18]. Roles requiring advanced IT capabilities, data analysis, and social-emotional skills will be prioritised as businesses adapt to digital transformations.

6) Preparing Engineers for the Future: Preparation for future graduates and active engineers should focus on instilling a mindset aligned with UN Sustainable Development Goals (SDGs). The industry will prioritize energy efficiency and sustainability, requiring engineers to implement new technologies and provide expertise to promote sustainable practices, especially among SMEs. Universities and technical schools, in collaboration with industry, play a vital role in developing formal or informal curricula aligned with job market needs. The close cooperation of all stakeholders in engineering education and the profession is necessary to ensure that curricula are relevant and responsive to industry requirements. Effective learning strategies, such as problem-based learning and practice/experiment-based learning, are crucial for preparing engineers to tackle the complex challenges posed by sustainability and technological advancements. The development of skills such as critical thinking, effective communication, and teamwork was in the research highlighted as essential.

Fig. 3 : Word Cloud Engineers4Europe survey: Changes needed in engineering education

2. Demand for Soft or Life Skills

There is currently no single universal definition of *professional competencies.* UNESCO resources mainly use the term transversal skills, which is defined as *skills that are typically considered as not specifically related to a particular job, task, academic discipline or area of knowledge and that can be used in a wide variety of situations and work settings (for example, organisational skills).*[19] However, many academic researchers prefer the term *professional competencies.*

The results of our Engineers4Europe surveys indicate that approximately 20% of respondents emphasize the need for soft and non-technical skills when asked about gaps in engineering curricula. The wordcloud above visualizes the

16 https://www.cedefop.europa.eu/files/4206_en.pdf
17 https://www.cedefop.europa.eu/files/9197_en.pdf
18 https://www.euroengineerjobs.com/article/919/what-will-the-job-market-in-europe-look-like-in-2025
19 UNESCO-UNEVOC. Glossary. Retrieved 2025, from https://unevoc.unesco.org/home /TVETipedia+Glosary/ lang=en/show=term/term=Transferable+ skill#start

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most frequently mentioned terms in these responses, with the word-size reflecting the frequency of mentions.

Addressing skills gaps within the engineering profession is essential for meeting the demands of a rapidly changing market. Balancing technical and non-technical competencies is crucial for the success of engineers in the contemporary landscape. The evolution towards interdisciplinary approaches, *soft or life skills* and a focus on sustainability will be pivotal in shaping the future of the engineering profession. Literature has been pointing out the need to rethink engineering programs, introducing intentional and formal opportunities to develop *transversal skills* (non-specific to engineering) that can be transferred beyond academia.

The European Framework for Personal, Social and Learning to Learn Key Competences[20] (LifeComp) outlines a framework for developing key life skills, essential for thriving in the 21st century. Key skills highlighted in the framework include ***Personal*** (self-regulation, flexibility, and wellbeing), ***Social*** (empathy, communication, and collaboration, working effectively in diverse teams and communicating clearly) and ***Learning to Learn*** (a growth mindset, critical thinking, and managing learning). For engineers, who often work in dynamic, interdisciplinary environments, this framework can be particularly relevant. Employers have, however, a role in developing employees' life skills such as teamwork, communication, problem-solving and adaptability. Their investment contributes to a more innovative, efficient and adaptable organisation, which in turn increases employee engagement and loyalty, reducing turnover and enhancing the overall work environment. Digital tools can help promote and facilitate the acquisition of these LifeComp competencies.

20 LifeComp: The European Framework for Personal, Social and Learning to Learn Key Competence

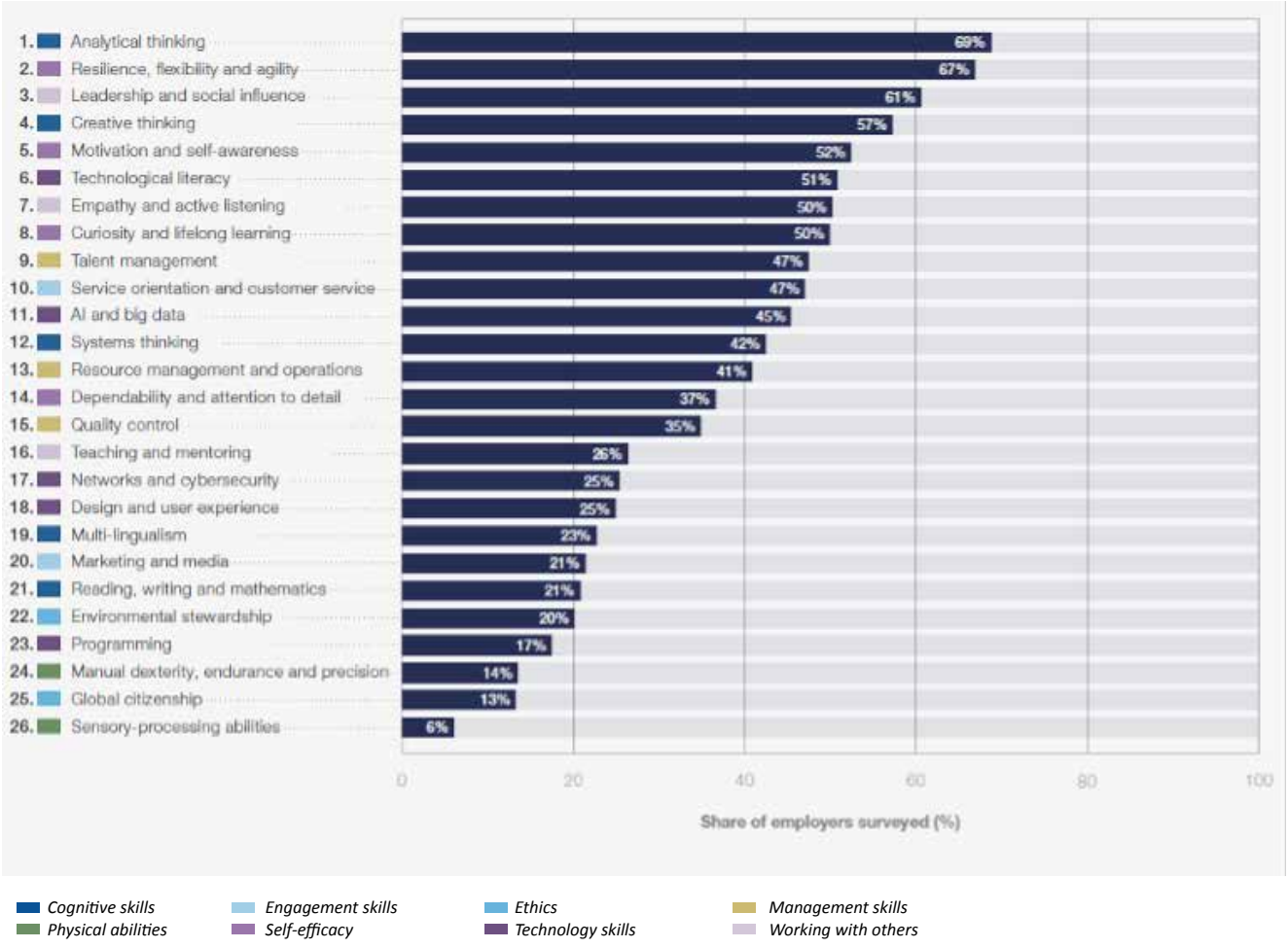

Fig. 4 *: Share of employers who consider the stated skills to be core skills for their workforce (WEF Future of Jobs report 2025).*

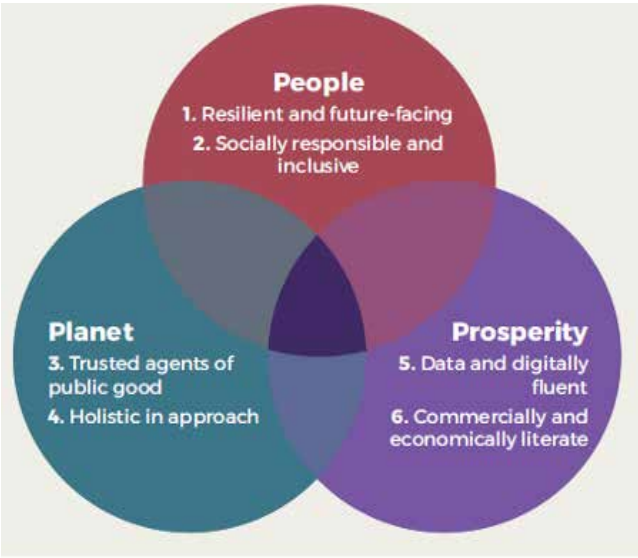

***Fig. 5** : The six principles of the Engineers 2030 report (The Royal Academy of Engineering and the National Engineering Policy Centre, 2024).*

To grasp the latest trends in modern engineering education, it is essential to examine the overall state of the global labour market. According to the ***WEF Future of Jobs*** (2025) report, the following trends exists today:

- Rising cost of living and a general slowdown in economic growth are two facts affecting job creation, which is expected to increase demand for creative thinking and skills of resilience, flexibility and agility.
- Geo-economic fragmentation is also driving the need for people-centred skills such as resilience, flexibility, agility, leadership and social influence, as well as global citizenship. In a world where crises are becoming more frequent, employers need leaders and teams that can adapt to uncertainty and manage complex social dynamics.
- Analytical thinking remains the most sought-after core skill among employers, with seven out of ten companies considering it essential in 2025. It is followed by resilience, flexibility and agility, as well as leadership and social influence (see Figures below). Resilience, flexibility and agility are growing in demand more quickly in Information and Technology Services sectors.
- By 2030, skills such as analytical and creative thinking, resilience, adaptability, agility, and technological literacy are expected to become even more essential than they are today. Equally important will be leadership, social influence, curiosity, lifelong learning, systems thinking, talent management and self-awareness, emphasizing the enduring value of human-centric capabilities in an era of rapid technological advancement. The Royal Academy of Engineering and the National Engineering Policy Centre (2024) also highlight the importance of qualities such as resilience, future orientation, social responsibility and inclusiveness for modern engineers.

3. Demand for Entrepreneurial Skills

In addition, our literature review revealed an increased relevance of the entrepreneurial mindset for future engineers. We analysed in detail the most recent and relevant articles on engineering curricula and the professional skills related to entrepreneurship. Several articles refer to present studies suggesting the incorporation of this skill set in engineering curricula. One of the methodologies used for our research was based on the search of relevant keywords in document databases such as SCOPUS[21] and Web of Science[22]. Key findings indicate that entrepreneurship, became more prominent as a development focus over the last 40 years and experienced one of the most significant incremental changes in the frequency with which it was mentioned in the literature. This suggests also a growing recognition of its importance for engineers. Engineers increasingly turn their research outputs into business ventures, highlighting a practical need for these skills.

There is an increasing global demand for engineers with entrepreneurial skills due to factors like globalisation, uncertain environments and social challenges like the Sustainable Development Goals (SDGs). Engineers are now expected to go beyond technical skills and engage in marketing, management and financing, requiring them to be more entrepreneurial and understand market and business contexts[23]. Reasoning for complexity is a relevant component in both entrepreneurship and engineering education. Scientific thinking can also be a strength in entrepreneurship education, challenging the notion that it is solely the domain of STEM fields, like engineering. Entrepreneurship is a valid discipline for cultivating scientific thinking in students.

21 https://www.scopus.com
22 https://www.webofscience.com
23 Suto, Y., Developing future engineering leaders: Evaluating a novel entrepreneurship education course, International Journal of Management Education, 2025, doi : 10.1016/j.ijme.2024.101084

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Looking ahead, the importance of entrepreneurial skills for engineers is expected to increase[24]. Globalisation will require them to understand and engage effectively with international markets. As the engineering sector becomes more interdisciplinary, entrepreneurial skills will be essential for effective collaboration across disciplines and industries. Engineers will also be challenged to develop solutions that are not only technically feasible, but also environmentally sustainable and ethically sound. At this point, engineers will also need a high level of financial and business literacy to be able to make an even greater contribution to the business success of companies. Finally, an entrepreneurial mindset will be critical to driving innovation, whether in start-ups or established organisations, to develop new solutions and business models.

4. Demand for Digital Skills

The increasing integration of AI, automation and smart manufacturing technologies is transforming the engineering landscape. However, many companies report that university curricula are not keeping pace with industry needs, leading to a mismatch between skills taught and those required on the job market. The demand for engineers with strong digital competencies is particularly high in software engineering, industrial automation and IT security, where companies struggle to fill vacancies.

Digitisation is relevant to all work areas and means a lot more than data analytics, AI and using Teams and SharePoint effectively. It is critical that work can be done faster and more efficiently - particularly as it gets more complex and the demand for output continues to grow while the resources available shrink. Companies must upskill their current workforce to empower them to tackle the challenges of digital transformation. Preparing an already-existing team for digitalisation means utilising a current skill set that already understands the organisation, thus boosting efficiency while retaining and developing talent.[25]

As with many industries, people skills remain critical. Innovation within the technology sector has been fuelled by collaboration; teams using critical-thinking and problem-solving skills in agile configurations to address issues as they arise. Tech graduates nowadays need more than just acumen in the latest technologies, they need to be problem-solvers with conceptual awareness, in an environment that delivers ethical as well as commercial context for their choices.

The European Digital Competence Framework identifies key elements of digital competence and skill development in 5 areas: Information and Data Literacy, Communication and Collaboration, Digital Content Creation, Safety and Problem Solving.

5. Demand for Green Skills

The shift towards renewable energy, energy efficiency and sustainable infrastructure is another key driver for demand for skilled labour. EU's commitment to achieving climate neutrality by 2045 requires an expansion of green technologies, including wind and solar energy, hydrogen infrastructure and electric mobility. As a result, demand for electrical engineers, energy engineers and environmental engineers has surged, making this one of the most affected fields. Additionally, the push for sustainable construction and circular economy principles is increasing the need for civil engineers and material scientists with expertise in eco-friendly designs and resource-efficient production.

At the European level, the European Union has produced a comprehensive conceptual framework under the name GreenComp[26], the European sustainability competence framework. The timing of the document also adds to the urgency that sustainability needs to be adapted in existing industries as well as building a more responsible way of life both as individuals and professionals.

GreenComp rather focuses on describing the areas that need attention and describing competencies under those areas. In general, within the framework, we can find four thematic areas, including embodying sustainable values, enhancing complexity in sustainability, envisioning sustainable futures and acting for sustainability. It is apparent from the framework that the underlying principle is for a holistic approach. It is also apparent that these competencies are not stand alone.

24 EntreComp-The entrepreneurship-competence-framework_en
25 DigComp: the European Digital Competence Framework
26 GreenComp: the European Sustainability Competence Framework

The GreenComp framework cannot exist without a link to other competencies and frameworks. The competencies defined within the framework are not in the traditional sense trainable as they tend to reflect the change of mindset and point of view towards the existing situation. The familiarization, training and building on the GreenComp competencies is a long-term process, that includes a cognitive decision from each individual/organisation to commit in the matters related to the green transition and sustainability and to incorporate the principles in both personal and professional capacities.

Over the past thirty years, climate change has become increasingly urgent, sparking a global movement for climate action. A pivotal moment came in 2015, marking two significant developments in response to the changing climate: the establishment of the ***17 UN Sustainable Development Goals*** and the ***Paris Agreement***. These historic milestones have since shaped national strategies aiming to create societies and economies that are less polluting, less dependent on carbon and ultimately, greener.

The rise of international agreements has spurred regional and national governments to pursue ambitious environmental policies focused on reducing emissions and restoring ecosystems. A prime example is the 2019 ***European Green Deal***, which aims to make Europe climate-neutral by 2050. Alongside initiatives such as the ***EU Green Industrial Plan 2023***, the revised ***Energy Performance of Buildings Directive*** 2024, and the ***EU Bioeconomy Strategy 2018***, these policies emphasized the urgent need for economies and societies to transition towards sustainable, resource-efficient and environmentally friendly practices.

Transitioning to greener initiatives to tackle climate change will yield immediate effects. Under the ***European Industrial Strategy***, the green transition is expected to generate one million new jobs, necessitating the upskilling and reskilling of 120 million individuals. While existing jobs will evolve to become less polluting, new positions will arise in response to this shift, creating an economy that supports environmental health. Additionally, fostering a greener society will require individuals to cultivate a strong environmental awareness and a commitment to sustainability. As the shift toward a greener economy continues to present new challenges, the demand for these skills will inevitably rise across all sectors. Cultivating a more sustainable economy is key, further emphasizing the importance of enhancing our workforce's green skill set.

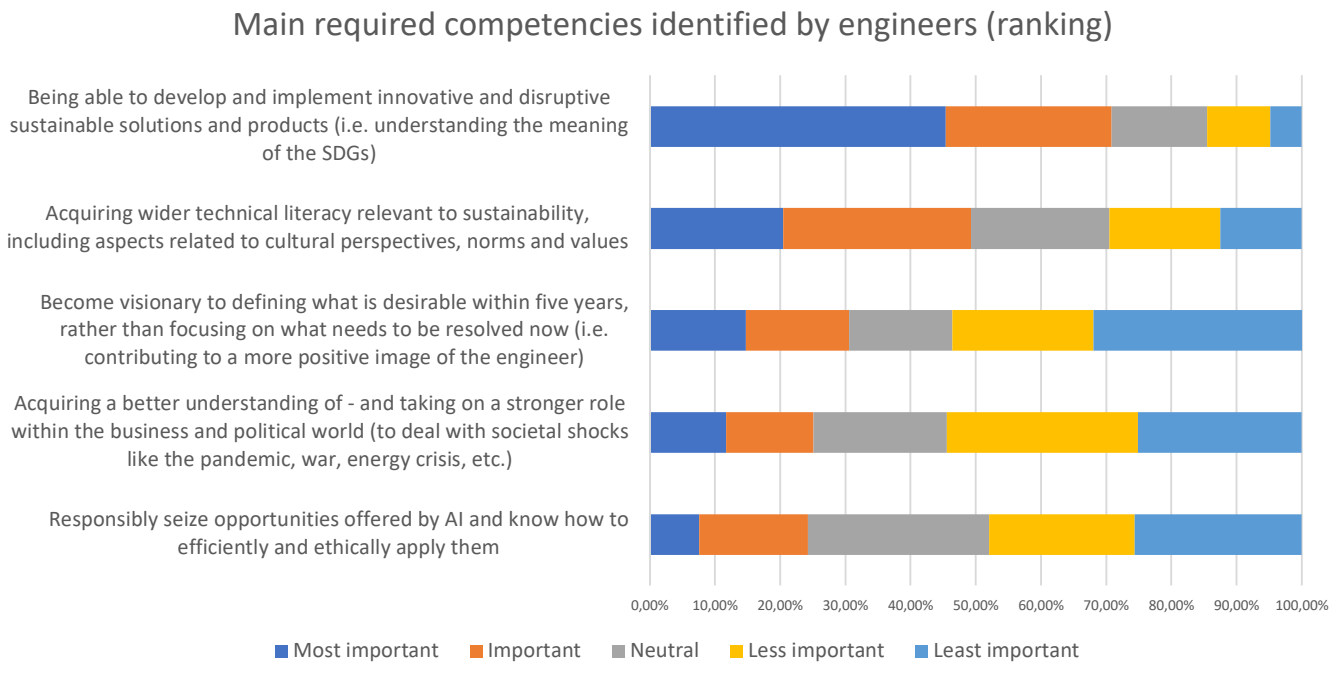

Fig. 6*: The main competencies essential for the future of the engineering profession, Engineers4Europe second survey*

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It aligns with previous complementary efforts such as the previous Council Recommendation on ***Learning for the Green Transition and Sustainable Development***[27], the ***European Sustainability Competence Framework*** or GreenComp as already mentioned, UNESCO's ***Education for Sustainable Development: A Roadmap*** [28] and the ***UN's Education for SDGs: Learning Objectives***[29].

Our on-line research revealed the following main competencies required by future engineers. (see pg21)

6. Demand for Continuous Professional Development (CPD)

Continuing Professional Development (CPD) is timely professional updating. It is the process of lifelong learning for professionals; it is as a transformative mechanism for building workforce adaptability and innovation.

The engineering profession, driven by rapid technological advancements, is undergoing significant changes in content and skill requirements. As university curricula may not fully equip engineers for a professional lifetime, the concept of lifelong learning (LLL), coupled with professional experience, is becoming increasingly vital. The cooperation of universities, professionals, VET institutes (formal, informal, non-formal) and industry is crucial to ensure that different forms of education complement each other.

The engineering profession is at a crossroads, shaped by powerful global trends that are redefining industries and reshaping the way organisations and professionals operate. From the relentless pace of technological advancements to the urgent need for climate action, as well as demographic shifts and growing urbanization, these forces are creating new challenges and opportunities that demand resilience, adaptability and bold leadership. Central to this resilience, adaptability and leadership is CPD, which provides professionals with the knowledge and tools to navigate evolving demands while reinforcing the foundational strengths of their organisations.

The green and digital transitions necessitate the upskilling of engineers in new technologies and processes such as building information modelling (BIM), cloud computing, artificial intelligence, 3D printing, virtual reality, IoT and blockchain technology. Competency-based learning is identified as the most effective approach for engineers.
As an example, climate change requires cutting-edge skills and fresh thinking – exactly what CPD can deliver through focused training programs. Engineers engaged in CPD gain expertise in areas like lifecycle analysis, energy-efficient retrofitting and the integration of renewable energy technologies such as solar panels and heat pumps. Such training ensures they can deliver sustainable solutions while adhering to evolving regulations and EU Green Deal commitments.

CPD equips professionals to adopt low-carbon materials, model energy performance and design for long-term resilience. Training in mastering energy-efficient design and sustainable construction techniques, Building Information Modelling (BIM) and lifecycle assessment, empowers engineers to balance performance, cost and environmental impact in line with Europe's sustainability targets. CPD also addresses the human impact of sustainability. Training in leadership and communication enables engineers to collaborate effectively across multidisciplinary teams and advocate for innovative approaches. These skills are essential as engineers navigate the complex interplay of technical, regulatory and societal pressures in delivering national and European climate commitments.

The new European Commission's recently published communication on the ***Union of Skills*** expresses a strong commitment to build on a solid skills foundation in education and training and engages in lifelong upskilling and reskilling. An initiative on AI in education and training will lay down an AI literacy framework and support the integration of AI in education and training (in 2026)[30].

27 https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=oj:JOC_2022_243_R_0001
28 https://unesdoc.unesco.org/ark:/48223/pf0000374802
29 https://www.unesco.org/en/articles/education-sustainable-development-goals-learning-objectives
30 European Commission, The Union of Skills COM(2025) 90 final
https://employment-social-affairs.ec.europa.eu/document/download/915b147d-c5af-44bb-9820-c252d872fd31_en?Filename= Communication%20-%20Union%20of%20Skills.pdf

7. Demand for Under-represented Groups

Our research indicated that there are proportionally underrepresented groups in engineering, leading to a deficit in the diversity of ideas, perspectives, creativity and overall balance in the profession.

Scholarships are identified as effective tools to attract diverse talent, providing financial support and breaking down economic barriers. Additionally, the development of mentorship programmes is instrumental in providing guidance, support and a sense of belonging for individuals from under-represented groups. Diversity and inclusion training for both professionals and organisations is recognized as a vital step towards creating inclusive environments that welcome diverse perspectives.

Enhancing equality in the engineering profession yields a range of positive effects. Firstly, it would address the shortage of qualified engineers by tapping into a wider pool of talent. Secondly, it would introduce diverse approaches that are essential for reaching sustainable engineering solutions. By incorporating a variety of perspectives and experiences, engineering teams are better equipped to tackle complex challenges and develop innovative solutions. The gender gap in engineering has long been acknowledged as a significant issue. Encouraging more young people, and especially girls, to pursue careers in engineering not only addresses gender inequality but also enhances the diversity of thought within the profession. Research shows that interest in STEM careers is often formed before the age of 14. Strategies such as mentorship, targeted recruitment efforts and creating inclusive environments are essential in this pursuit.

Beyond addressing issues of representation, the issue of diversity and inclusion contributes to the generation of fresh ideas and to increased creativity within engineering projects. This diversity of thought is critical for providing effective answers to societal challenges and driving innovation. The under-representation of certain groups in engineering is therefore an ongoing challenge.

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4. ANALYSIS OF THE SUPPLY SIDE

1. Challenges in Ascertaining the Supply of engineering professionals

This chapter considers the challenges and priorities for an effective engineering graduate supply, culminating into a methodology to be employed towards the development of a strategic framework that the Skills Council can utilize in strategizing (iteratively) for better alignment between the demands of industry and the supply capabilities of HEI and VET providers.

Skills shortage is more than discipline capability; it is also exacerbated by a shortage based on quality in the graduate arena. Moreover, focus is required about the supply of further learning (including micro-credentials) to maintain the existing engineering population at the cutting edge.

Advertisements for engineering jobs normally include traditional hard skills, encompassing math and physics, as these are necessary in nearly every engineering field.[31] In addition to mastering core concepts and methods of the discipline, proficiency in using tools and software for modelling, testing, calculations and simulations, are also needed. Depending on the specialisation, knowledge of standards, codes and regulations are required by employers. These are complemented by soft skills, such as problem-solving, communication skills, creativity, and lifelong learning[32]. Stress and pressure resistance, as well as emotional intelligence lay at the forefront of other skills[33].

There are currently 15 million workers in technical and engineering jobs in the EU's workforce. According to CEDEFOP projections, there will be around 8 million job openings (new and replacement needs) between today and 2035. The majority of these jobs will be due to the replacement of current employees (six million job openings), but also around two million new jobs will be created due to the needs of the economy.

2. Supply of Soft or Life Skills

Soft skills such as collaboration, communication and adaptability are identified as vital for success in the engineering profession. Entrepreneurship, leadership and ethics in engineering are ranked highest when considering CPD courses, indicating the importance of holistic skill development. Engineering education should extend beyond science-based tasks, incorporating non-technical skills from the first day. Integrated projects, hands-on problem-solving and exposure to emerging technologies are proposed as effective methods to bridge the gap between theory and practice. Prioritization of skills and related competency requirements will also facilitate an understanding of the different skills, the level of competency a role needs and what steps may be required to help upskill individuals in specific areas, at (inter) national level or organisation level. Such prioritization is a challenge on the supply side. If (soft) professional skills are to be provided without compromise, within more condensed programs, along with the core technical skills, there is a significant challenge because there are requisite credit demands and limited time available. However, employers are reporting that a lack in (soft) professional skills in recent graduates, manifests in difficulties in all aspects of communication (oral presentation, written and even discussion).

3. Supply of Entrepreneurial Skills

A key issue is finding a balance between technical expertise and professional skills. Engineers are expected to possess a strong understanding of mathematics, physics and the specific technical knowledge relevant to their field of specialisation. One common form of skill mismatch is a shortage of specific industrial skills. As industries adopt new technologies and practices, engineers may find themselves lacking the necessary expertise in emerging areas. As opposed to the postulate of a high degree of specialization,

31 Sadraey, M. H. (2022). Engineering fundamentals: An introduction to engineering. Springer
32 https://www.linkedin.com/advice/1/youre-starting-mechanical-engineering-career-tdabc
33 https://www.trend.sk/spravy/zabudnite-technicke-zrucnosti-buducnostou-pracovneho-trhu-je-nieco-uplne-ine?itm_brand=zivot

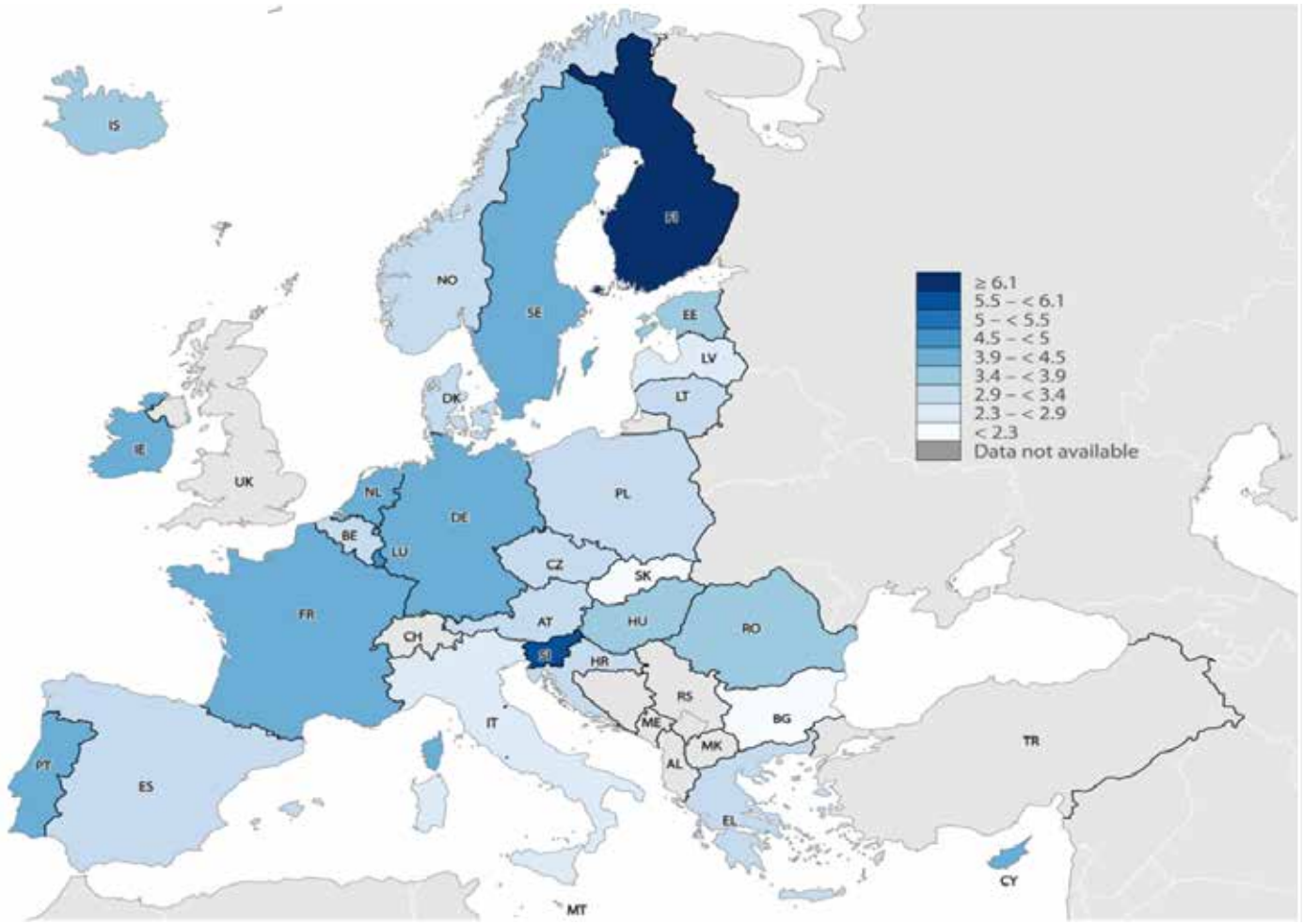

***Fig. 7** : Researchers and engineers as a share of country employment (2021, in %)*[34]

there is the expectation of the interdisciplinary nature of engineers. Evidence indicates that many graduates lack essential practical skills, especially in communication and strategic thinking, leading to a mismatch between academic outputs and industry requirements. Additionally, engineers must develop global competences, which includes an awareness of- and sensitivity to cultural diversity, enabling effective collaboration in international projects.

4. Supply of Digital Skills

The Digital Competence Framework (DigComp) establishes five fundamental areas: ***data literacy***, ***communication and collaboration, content creation, safety and problem-solving***. The following tables from EUROSTAT show the evolution in % of individuals, aged 16-74, with digital competences and businesses engaged with the digital transformation in the period 2021-2024[35].

Sadly, despite efforts to strengthen education and adult training over the last decade in the EU, adult literacy and numeracy skills in EU Member States mostly declined or stagnated, according to the second international ***Survey of Adult Skills*** (PIAAC).[36] According to the ***2024 State of the Digital Decade Package***, the EU has not yet fully achieved convergence on most targets and objectives and the pace of progress on some targets is slower than anticipated. This is particularly true in the fields of skills, high-quality connectivity, the adoption of Artificial Intelligence (AI) and data analytics by businesses, semiconductors and start-up ecosystems[37].

For the engineering profession the AI skills requirements go beyond that of basic users, which is very well illustrated in the ***ARISA AI Skills Strategy for Europe***[38]. ARISA, an Erasmus+ funded project to provide AI knowledge and skills, helps people understand and use AI technology in business and policy contexts while considering privacy, bias and trust. It focuses

34 https://www.cedefop.europa.eu/en/data-insights/researchers-and-engineers-skills-opportunities-and-challenges-2023-update#_employment_and_job_demand

35 https://digital-strategy.ec.europa.eu/en/policies. Last Access March 28, 2025. [EUROSTAT2024] Digital Economy and Society Index, DESI 2024, European Commission, 2024

36 https://employment-social-affairs.ec.europa.eu/news/survey-finds-adult-skills-have-declined-or-stagnated-last-decade-2024-12-10_en

37 https://digital-strategy.ec.europa.eu/en/policies/2024-state-digital-decade-package

38 https://aiskills.eu/wp-content/uploads/2025/04/ARISA_AI-Skills-Strategy-for-Europe_2024.pdf

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	EU 27 Average			
Digital Skills (%)	**2021**	**2022**	**2023**	**2024**
ICT Graduates	3.9	3.9	4.2	4.5
ICT Specialists	4.3	4.5	4.6	4.8
Entreprises Providing ICT Training	19.7	19.7	22.4	NA
Basic Digital Skills	NA	53.92	53.92	55.56
Above Basic Digital Skills	NA	26.46	26.46	27.32

	EU 27 Average			
Digital Transformation of Business (%)	**2021**	**2022**	**2023**	**2024**
SMEs with at least a basic level of digital intensity	NA	54.8	69.1	57.7
Electronic information sharing	34.6	36.7	36.7	42
Social Media	22.4	28.4	28.4	30.6
Big Data in SME	14.2	14.2	14.2	NA
Data Analytics All	NA	NA	NA	33.2
Cloud	NA	34	34	37.9
AI	NA	7.6	7.6	8
e-Invoices	33.2	33.2	33.2	38.6
e-Commerce turnover	9.6	9.1	10.2	11.9

thereby on current and emerging professional roles across four occupational domains : business leaders, technology leaders, technology practitioners and policymakers**.** This was based on an ***AI Skills Need Analyses***[39] and was followed by concrete AI curricula for various kinds of professions. The Need Analyses show the crucial element of individuals possessing the acumen to understand business opportunities and potential use-cases arising from AI implementation. This clearly goes beyond merely technical skills and has a focus on the ability to discern and leverage the potential benefits of AI technologies, which is considered paramount for driving strategic decision-making and enhancing competitive advantage.

5. Supply of Green Skills

The *European Climate Action Progress Report 2023*[40], indicates that 75% of companies and organisations have committed to the sustainability goals, only 43% have clear strategies for achieving them. This gap highlights the critical role of education in equipping professionals with the skills needed to transition from commitment to actionable results and to sustainable decision-making, ensuring that profitability and environmental responsibility can coexist. Training on the circular economy, supply chain sustainability and green certifications further equip professionals to integrate sustainability into every aspect of their work.

The most successful integration of green skills occurs in undergraduate education through active learning, interdisciplinary collaboration and project-based methods across multiple academic disciplines. Green skills flourish when learning is active, integrative and contextual (i.e. or relating to the circumstances that form the setting for an idea). Educators who use hands-on approaches report that :

1) Interdisciplinary and transdisciplinary learning builds systems thinking, environmental awareness and collaborative skills. For example, interdisciplinary collaborations increase student confidence in tackling complex sustainability challenges.

2) Project-based and problem-based methods promote critical thinking and practical problem solving. In several cases, students in modules employing these techniques gain transferable skills and directly apply sustainable practices.

39 https://www.digitaleurope.org/news/arisa-needs-analysis
40 https://climate.ec.europa.eu/news-your-voice/news/climate-action-progress-report-2023-2023-10-24_en

3) Experiential and transformative pedagogies shift the focus from passive content delivery to active, real- world learning. Multiple studies cite enhanced sustainability competencies, such as reduced ecological footprints and improved low-carbon skills. Hands-on, practical approaches to learning are particularly effective in developing green skills. Such approaches appear to bridge the gap between theoretical knowledge and practical application, allowing students to engage with real-world sustainability challenges and develop problem-solving skills in context. The findings of several studies highlighted the importance of integrating sustainability concepts across disciplines and the need for holistic approaches to integrating green skills across the curriculum, rather than confining sustainability education to specific courses or modules.

The construction and building industry accounts for about 45% of carbon related emissions in the world. It is much more than any other sector of society, like automobile, manufacturing or airplane industries. Therefore, the relevance of education – including online courses - for students and for active engineers, especially civil engineers, is about reducing the carbon footprint. The effectiveness of online courses needs careful attention from educational and training institutions. Incorporating practical skills and attitudes by using interactive dialogue, together with knowledge, can improve engagement from learners.

Renewable energy and green infrastructure will be key areas of innovation, requiring engineers with a deep understanding of sustainable design and circular economic principles. As being a major interest for engineers in the future, the global nature of climate challenges implies special major attention. Although Europe's emissions are only 8% of the total of global carbon related emissions, engineers work in projects all over the world and need to provide good examples and case studies. Also, adapting to the use of new renewable technologies on a larger scale could make Europe more competitive.

This change of attitudes, based on new knowledge and on effective skills, should also nurture the incorporation of ethics into engineering education and training, also in continuing professional development (CPD).

This effect could be complemented with updating existing mission statements by professional engineering societies and engineering companies. These activities should follow the need for global cooperation on climate issues, particularly in helping developing countries to progress and develop sustainably. Engineering is global and all countries and societies should cooperate in formal and non-formal procedures and projects.

6. Supply of Continuous Professional Development

Dialogue between VET and businesses remains limited with few initiatives to bridge the gap, however, to address the demands and developments more flexibly, all stakeholders in the engineering labour market – educational institutions and businesses will need to refocus and reinvent their approaches. Also, hybrid employment models will continue to be in demand and the VET sector will need to implement changes more expediently to keep up with the fast pace of global developments. The responsibility for VET lies primarily with Member States, with the EU playing a supporting role. Since 2002, EU national authorities and social partners have taken part in initiatives to improve the performance, quality and attractiveness of VET in Europe. Known as the ***Copenhagen Process***[41], this cooperation has been developed through a series of declarations; the current ***Osnabrück Declaration***[42] expires in 2025. The previously mentioned ***Labour and skills shortages in the EU: an action plan*** of March 2024 addresses labour and skills shortages in the EU and the European Commission committed adopt a new declaration on VET in 2025. This declaration aims to continue the Copenhagen Process by aligning VET policies and reforms with the evolving labour market, particularly in response to technological developments such as artificial intelligence.

The ***European Education Area***[43] initiative also seeks to increase the exposure of VET graduates to work-based learning. The EU supports VET with funding under Erasmus+ and the European Social Fund Plus (ESF+). The EEA Strategic Framework impacts VET by promoting adaptability, quality and inclusiveness in line with labour market needs. It encourages the integration of skills for the green and digital transitions. It also fosters closer collaboration between VET providers, employers, and

41 https://ec.europa.eu/commission/presscorner/detail/en/memo_04_293
42 Guido, N. (2021). Agenda europea per le competenze, Raccomandazione VET, Dichiarazione di Osnabrück.
43 https://education.ec.europa.eu/about-eea/strategic-framework

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***Fig. 8**: EU Summits – European Council Meeting Room*

social partners for the curricula matching real-world requirements. Highlighting the importance of VET, Commission President Mrs. Ursula von der Leyen, in her ***Political Guidelines***[44], emphasized enhancing the status of VET and increasing the number of individuals obtaining a secondary VET degree. Additionally, Mrs. Roxana Mînzatu, the Commission's Executive Vice-President for Social Rights and Skills, Quality Jobs and Preparedness, has been tasked with developing a comprehensive EU strategy for VET, which is part of the broader initiative known as the ***Union of Skills***.

It is through CPD that professionals become empowered to bridge the gap between policy ambitions and practical implementation and in doing so, CPD not only equips engineers with the skills to tackle today's challenges but also ensures they are ready to drive innovation in a rapidly changing world.

CPD also empowers engineers to address critical skills shortages by offering training in high-demand areas like renewable energy and digitalization. By fostering intergenerational learning and creating pathways for upskilling, we must highlight the vital role CPD plays in enabling European engineering-led organisations to thrive, not only in navigating the challenges of today, but also in shaping the possibilities for the future.

Engineers are urged to actively engage in continuous learning through attendance at conferences, workshops and training programs. This proactive approach ensures they stay updated on the latest trends, best practices and technological advancements in their rapidly evolving sectors.

Vocational Education and Training (VET) systems play a vital role in shaping the future workforce, particularly in technically demanding professions such as engineering. Across the European Union (EU), these systems function both as initial entry points into the engineering profession and as mechanisms for reskilling and upskilling engineers in response to technological advancements, industrial transformation, and sustainability transitions.

VET systems vary considerably between EU countries in structure, governance, and effectiveness. Germany's dual system is frequently cited as a model of excellence due to its close integration of on-the-job training and classroom instruction. By contrast, countries like Spain, Italy, and Greece have historically relied more heavily on school-based vocational education with limited industry collaboration, resulting in weaker employment outcomes for VET graduates. Such differences highlight the need for systemic reforms and greater coherence in European VET systems, especially when considering their potential to serve as a credible pathway into engineering. The European Commission has responded with initiatives like the ***European Alliance for Apprenticeships***[45] and the promotion of mutual recognition of qualifications.

Effective VET systems in engineering rely on robust collaboration with industry partners. Austria, Denmark and the Netherlands are notable for involving industry in curriculum development, quality assurance and certification processes. This ensures VET remains aligned with the dynamic needs of the engineering labour market, especially in digitalization and green technologies.

Centres of Vocational Excellence[46] are emerging as key actors in innovation, LLL and regional economic development. These

44 https://commission.europa.eu/document/e6cd4328-673c-4e7a-8683-f63ffb2cf648_en
45 https://efvet.org/european-alliance-for-apprenticeships
46 https://employment-social-affairs.ec.europa.eu/policies-and-activities/skills-and-qualifications/skills-jobs/centres-vocational-excellence_en

***Fig. 9**: Online Promotion of the E4E Micro-credentials in Italy*

centres combine vocational training with applied research and partnerships with SMEs, enabling them to serve as regional hubs for workforce transformation. Their relevance to engineering is especially notable in areas such as green energy, robotics and sustainable construction. A major strength of VET systems in countries like Finland and Sweden is their permeability—students can transition from vocational qualifications into higher education pathways, including engineering degrees. This flexibility enables upward professional mobility while supporting LLL principles, which are essential for engineers to remain relevant in a fast-changing technological environment.

As industrial sectors transition toward green and digital paradigms, engineers need to continuously adapt. VET systems are uniquely positioned to offer flexible, targeted reskilling programs. For example, the automotive industry's shift to electric mobility has led to new VET-based curricula focusing on battery systems and e-mobility engineering. These rapid-response programs are often faster and more adaptable than traditional university programs. Additionally, initiatives such as ***Pact for Skills*** under the EU Skills Agenda[47] promote public-private partnerships to drive large-scale upskilling for engineers in sectors like construction, electronics and sustainable manufacturing.

Also Micro-credentials are a promising tool for enabling flexible, targeted learning and for responding quickly to emerging needs in the labour market. They allow individuals to deepen or expand their expertise in specific areas, making them particularly valuable for working professionals who need to upskill or reskill in response to sectoral developments. This can significantly boost the EU's economic adaptability and competitiveness. Although microcredentials can be a powerful supplement to formal education, we stress that they should not be seen as a substitute for it. Their effectiveness depends on the presence of a solid educational foundation that equips individuals with broad knowledge and critical thinking skills. Micro-credentials can refine and extend this base, but they cannot replace the depth and coherence of a comprehensive educational trajectory. Ensuring that micro-credentials remain anchored in a well-rounded learning path will be essential for creating not only a flexible workforce, but a thoughtful, capable and resilient society. Therefore, micro-credentials are most effective when used for what they are particularly well-suited to: targeted upskilling and reskilling in response to evolving professional demands. However, to truly unlock their potential, it is important to recognise that they are not a standalone solution. Without being grounded in a strong and coherent educational foundation, there is a risk that microcredentials may become fragmented or lack the necessary depth for meaningful, long-term development. Their lasting value and impact depend on being part of a broader, well-rounded learning trajectory that supports both personal growth and professional adaptability[48].

Micro-credentials could be designed and issued by a variety of providers in different learning settings (formal, non-formal and informal learning settings). The procedures for recognition however still have to be developed. Not only is a European procedure for recognition still missing, but also a structure to make engineers aware of the huge range and differences between different micro-credentials. Many providers are already developing tools, but there is no

47 https://pact-for-skills.ec.europa.eu/index_en
48 https://www.ptvt.nl/actueel/position-paper-eu-stem-coalition

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methodology yet to pinpoint the essential characteristics, to publish them and to develop procedures for recognition. The use of artificial intelligence in preparing, in running and in evaluating online courses will probably be the major change in the future of online learning. Training engineering educators on artificial intelligence basics is therefore paramount, urgent and necessary.

7. Supply of Under-represented Groups

The availability of qualified engineers in Europe, their professional development, their skills and their ability to be mobile, are linked. Inter-regional and cross-border mobility for engineers, within and beyond the European Union, is an important issue for engineers seeking international opportunities, as well as for industry and - by extension - Europe's economic competitiveness.

We hereby focus on the recognition of non-EU engineering qualifications, because this recognition provides clarity and assurance to both engineers and employers regarding the equivalency of qualifications, fostering greater confidence and mobility in the international engineering sector. In the European Union context there are several instruments that promote and regulate the recognition and portability of qualifications. The Lisbon Recognition Convention (LRC)[49], jointly drafted by the Council of Europe and UNESCO and adopted in 1997, is the main legal instrument on the recognition of qualifications in Europe. It has, to date, been ratified by more than 50 states. According to the LRC, qualification portability of qualifications is the default and only when significant differences between educational systems apply, should the recognition be refused.

The improvement of inter-regional and cross-border mobility for engineers is supported by various systems of acceptance and academic recognition :

1) the European Qualifications Framework (EQF) as a translation tool to make national qualifications easier to understand and more comparable. The EU Council Recommendation of 26 November 2018[50] on promoting automatic mutual recognition of higher education and upper secondary education, and the outcomes of learning periods abroad, refers to the European Qualification Framework (EQF) as a way to foster transparency and build trust between national education and training systems. With the Council Recommendation, EU Member States made a political commitment to take steps to introduce automatic recognition by 2025.

2) the Bologna Declaration (European Ministers of Education, 1999) with the main goal to deepen relations between European nations to establish a Europe of Knowledge.

3) the European Network for Accreditation of Engineering Education (ENAEE) promotes quality engineering education across Europe and beyond, so that engineering graduates are fully equipped to tackle the issues and rigor that is demanded by modern engineering projects. ENAEE does this by authorising accreditation and quality assurance agencies to award the EUR-ACE[51] label to accredited engineering degree programmes.

4) the EUR ING Certificate created by ENGINEERS EUROPE, helps promoting mobility of engineers within and beyond Europe. Candidates must meet certain requirements, both in terms of education and professional experience, in order to be awarded the EUR ING Certificate, in particular, the candidate's course must be part of the European Engineering Education Database (EEED)[52] and the candidate must have minimum professional experience, depending on the level of education. The EUR ING Certificate has a validity of five (5) years but can be renewed upon the provision of CPD-evidence after those five years.

5) the European Diploma Supplement for all higher European education degrees that contain information to be used in different countries for Europe-wide processing, standards, and recognition of qualifications,

6) the Washington, Sydney and Dublin Accords are international agreements among bodies responsible for accrediting engineering degree programs. They recognise the substantial equivalency of programmes accredited by those bodies at three different education levels and recommend that graduates of approved programs be recognized by the other bodies.

49 https://www.coe.int/en/web/higher-education-and-research/lisbon-recognition-convention
50 https://education.ec.europa.eu/education-levels/higher-education/inclusive-and-connected-higher-education/automatic-recognition-of-qualifications
51 https://www.enaee.eu/eur-ace-system
52 https://www.engineerseurope.com/what-engineers-europe-eeed

The European Union has built a system of qualifications recognition which is based on high quality standards, trust and transparency. The legal framework for the recognition and portability of higher education qualifications in the European context is one of the most advanced in the world. Nevertheless, the practical application of European legislation and international agreements is not uniform across Europe. Even though the LRC, as an international treaty, obliges the countries that ratify it to update the national legislation accordingly, reality shows that this is not always the case.

As an example, the number of foreign engineers in Germany has risen significantly in recent years. There are (2024) about 400,000 foreign engineers living and working in Germany, which is about 17 percent of the total engineering workforce. Still, the demand continues to exceed supply. As HEIs and training programs struggle to keep up with the increasing need for technical professionals, targeted immigration policies should be improved. Possible actions are:

- Streamline work visa and residence permit processes for skilled engineers from non-EU countries which could accelerate integration into the labour market.
- Simplifying and expediting the recognition of international engineering degrees could enable highly qualified professionals to work in Europe without unnecessary bureaucratic delays.
- Establishing cooperation agreements with countries that have a surplus of STEM graduates can help attract skilled engineers and mitigate shortages in critical sectors.

Besides career-related benefits, mobility also contributes to the holistic development of engineers, which in turn contributes to the development of society, as engineers enhance their inter-cultural communication skills and their understanding of the world.

There are also a series of educational options that can be strongly recommended, such as spending one semester of practice abroad during a PhD or undertake a bachelor semester designated to expand education in a different field or to apply knowledge in cross-border projects. Short-term internships and projects in companies abroad as part of the master's degree, are other suggestions. However, while these measures are easier to implement and promote between European countries, the feasibility decreases rapidly while trying to implement such projects with non-European countries.

The Directive 2013/55/EU of the European Parliament and of the Council of 20 November 2013 amending Directive 2005/36/EC on the Recognition of Professional Qualifications[53] introduced, amongst others, some mechanisms that can facilitate the mobility of engineers, such as providing ***Partial Access*** when significant differences between qualifications require substantial additional studies, or establishing a Common Training Framework (CTF) as a pathway to automatic recognition for professions that currently do not have it, such as engineers. A CTF could be a path to harmonize the minimum training requirements needed to practice the engineering profession in Europe, in congruence with international agreements, such as the Washington Accord, Sydney Accord and Dublin Accord. This way, it could facilitate the mobility of engineers worldwide. The professional development of engineers, their skills and their ability to be mobile, are linked.

However, inclusion does not only entail the mobility and recognition of non-European engineering qualifications, but also the better involvement of girls and women in engineering as there is clearly a gender imbalance in the engineering workforce. Active identification of female role models in engineering can inspire girls to pursue a career in engineering. While including girls in STEM is certainly an essential goal, everyone will need to meet the challenges posed by the labor market. A contributing factor to the skills gap is the insufficient pace of STEM graduate production, which is failing to keep up with the growing demand in STEM-related jobs. Although the number of STEM graduates has increased from 18.5 per 1,000 individuals aged 20-29 in 2014 to 22 per 1,000 in recent years, this growth remains inadequate.

As a founding member of the ***EU STEM Coalition***[54], ENGINEERS EUROPE also believes that STEM education should not only be about what young people can do for society, but also about how it can empower them to explore their passions, ask difficult questions and build meaningful lives. The prioritization of STEM on the European agenda[55]

53 https://eur-lex.europa.eu/eli/dir/2013/55/oj
54 https://www.stemcoalition.eu
55 https://education.ec.europa.eu/document/stem-education-strategic-plan-legal-document

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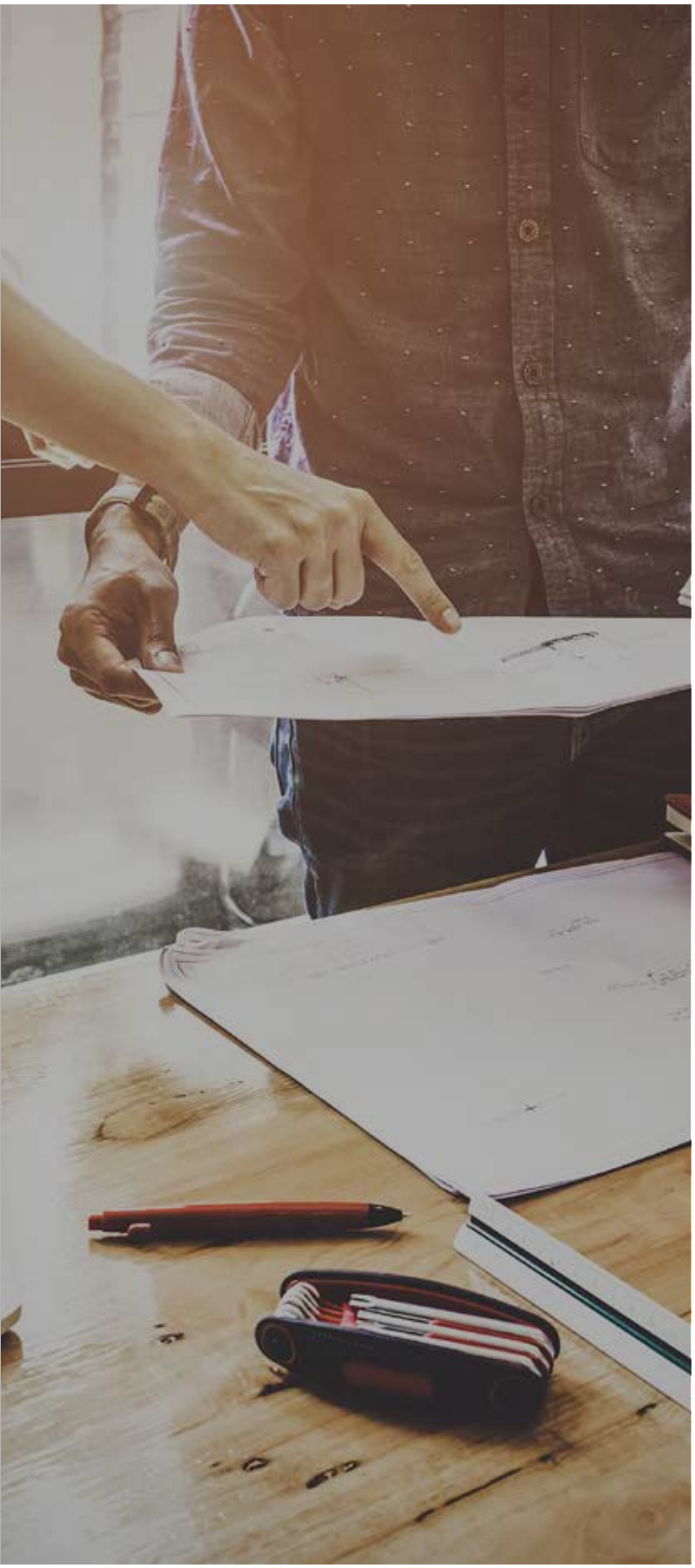

and the ***EU STEM Education Strategic Plan*** of March 2025, will support the EU in achieving its goals related to education and skills.

Europe is currently navigating a wide range of complex and interconnected challenges - ranging from the need to strengthen strategic industrial sectors and adapt to the rapid pace of digitalisation, to addressing climate change and responding to evolving defence and security needs in an uncertain geopolitical landscape. While these challenges are diverse in nature, they share a common requirement: innovative, STEM-driven and crossover solutions. Investing in high-quality, inclusive and future-oriented STEM education is not only desirable, but essential for securing Europe's long-term competitiveness, resilience and social cohesion. This requires also improving basic STEM competencies across the general population.

Initiatives which attempt to implement activities across wide ranges of national or regional borders tend to fail since an approach which may work in one given context does not necessarily work in another. Success or failure of initiatives aimed at developing education will depend to a large degree on local variables such as culture, administrative structures and specific stakeholder ecosystems. For this reason, top-down one-size-fits-all approaches do not work. By empowering local STEM platforms to interpret and implement STEM development approaches themselves, activities become tailor-made for their specific contexts. In this context, the 2030 targets for STEM education set by the European Commission, are welcomed, as they provide a clear direction[56]. Moreover, these targets will help to put the importance of STEM education on the agenda of national ministries, but also at regional and local level. The creation of mentorship programs provide students with real-life experiences and insights as to whether a STEM career would suit them.

The best approaches to involving a fuller spectrum of underrepresented groups, as well as the matter of which groups warrant specific attention, are very contextually dependent. Different regions will apply uniquely adapted strategies, the nature and details of which are best known by actors in the countries in question. For this reason, the importance of supporting a decentralized approach to inclusion in engineering studies requires emphasizing. Empowering a wide variety of regional actors and incorporating contextually specific approaches will yield the most appropriate results.

56 https://education.ec.europa.eu/focus-topics/stem

5. E4E SKILLS STRATEGY AND FUTURE CHALLENGES

What kind of future engineering professional, as a supply output, is required?

A skills revolution is necessary to respond to the impact of the green transition in the short- and medium-term. All workers, across qualification and seniority levels, sectors and occupations need to be trained in an array of skills. Particular focus is necessary for occupations that drive ***greenovation***, which lies at the core of the green transition[57]. Skills-based organisations will rethink traditional workforce practices to move the emphasis from jobs and roles to current and future workforce skills[58]. Applying skills-based hiring will help organisations access new talent pools, thus closing the workforce shortage gap. Yet only a few job postings advocate for this approach.

Educational offerings must prioritize the necessary basic sciences and pillars (priority subjects) within each engineering discipline. Such prioritization should be considered in conjunction with employers, and engineers associations. Companies/industry are fundamental in the development of young engineers and in that regard, they need to have greater responsibility in an engineer's growth. One way is to mandate curricular internships within degree programs to facilitate the acquisition of some of the essential professional skills. Such initiatives represent a way to motivate engineering students to further deepen technical skills.

Another approach to bridge gaps is to foster working conditions such that young engineers can pursue a master's or a postgraduate degree. It is at the level of these training courses that the most specific and technical subjects are taught, and which allow for an acceleration of knowledge and skills in specific areas of engineering. In 4/5 years of higher education young engineers will have scientific knowledge that will help them to be more successful in their tasks. Such an initiative should be synchronized with LLL strategies, incorporating CPD requirements.

Addressing the skills mismatch in the engineering sector requires a multi-faceted approach. By combining strategies, HEIs, VET providers, professional bodies, industry stakeholders and policymakers can work

Fig.10 & 11 *E4E Project Team Meeting, Brussels 22 September 2022*

57 https://www.cedefop.europa.eu/en/data-insights/thyroid-occupations-biogas-technicians
58 https://www.deloitte.com/uk/en/services/consulting/blogs/2025/learning-for-a-skills-based-future.html

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together to bridge the skills gap in the engineering sector and better prepare engineers for the challenges of the modern workplace. The following strategic objectives are proposed :

1) Competency-based Education will provide for clear and measurable learning outcomes. An educational paradigm based on competencies also fosters a greater diversity of career opportunities, as engineers will find themselves equipped with a versatile skill set that expands their range of professional options. Several, internationally recognized, skills frameworks provide a comprehensive understanding of what generic and transversal skills should be developed in each engineering cycle. It was recently launched from the EC, as ResearchComp[59].

2) Challenge-based Education exposes engineering students to real-world problems, bridging the gap between theoretical knowledge learned in academia and its practical application.

3) Regular Curriculum Reviews/Reforms to incorporate the latest industry trends, technologies and skills requirements. Continuous evaluation of the educational offer is an important aspect to mitigate the skills gap and better align the supply with the demand. Such reforms should include beneficiaries (students) but also employers and professionals to ensure all can dialogue on the relevance of the educational offer.

4) Industry-Academia Collaboration that fosters stronger collaboration (HEIs and industry/ companies/business) can be achieved through partnerships, joint research projects, internships and advisory boards. Industry placements are also helping students to develop a better understanding of the skill set required in the workplace. On one hand, it motivates students to develop such skills and on the other, enhances a better understanding of the different career paths of the engineering profession. To the industry, these collaborations represent an opportunity to assess the supply and motivate students to develop the skills needed.

5) Mechanisms for Continuous Feedback from Industry professionals to identify emerging skill needs is crucial for HEIs and VET providers. Industry representatives can contribute to curriculum development, by sharing with HEIs and VET providers the current and future needs, as well as expectations for the engineering workforce, so that these can be incorporated into the curricula. This dialogue is critical to maintain the relevance of the curricula and align job market needs with the educational providers' mission.

6) Industry-endorsed Certifications with HEIs and VET providers working with the industry to develop micro-credentials (short-duration, often delivered online, focused educational units that offer learners the opportunity to acquire/develop a particular competency).

7) VET providers can offer specialized, practical and short duration training postgraduate programs that directly address the competencies required in the engineering workforce. Their educational offer emphasizes hands-on/ practical training, through online courses, workshops, or seminars and this potentially motivates professionals who are already working in the field and need to balance their learning with work commitments. VET providers are thus, fostering a culture of continuous learning among both students and professionals for them to develop a mindset of ***reskilling*** and ***upskilling*** throughout their entire careers, according to the needs of the labour market.

8) Government and Policy Support is fundamental through the provision of regulations that guide educational providers to continuously adapt their curriculum. The existence of the ***European Engineering Skills Council*** will provide a forum to debate the necessary skills for all engineers working in Europe, considering the European job market trends and provide guidelines for all European HEIs and VET providers. Funding will be crucial to promote this initiative that facilitates collaboration between industry and educational institutions.

9) Professional Bodies should work with industry to identify the competencies needed for diverse engineering roles. They should also clearly identify and promote the needed skills to practice engineering in each specific area. On the other hand, they should also dialogue with HEIs and VET providers to ensure that the skills they (professional bodies) validate as core to the engineering profession, are supplied by educational providers.

10) Diversity, Inclusion and Social Responsibility are important to ensure that engineering education is

59 ResearchComp: The European Competence Framework for Researchers

based on diversity and inclusion, as well as on initiatives to attract underrepresented groups (such as women) to pursue engineering careers. A diverse and inclusive learning environment fosters open-mindedness, empathy and communication skills, much needed for team working. Such qualities also foster innovation and creativity, which are crucial elements for the engineering profession where novel solutions are often required.

In January 2025, the Commission presented the ***Competitiveness Compass***[60], a new roadmap to restore Europe's dynamism and boost our economic growth. The compass builds on the analysis of Mario Draghi's report on the future of European competitiveness and spells out how the European Union will boost innovation by :

- Creating a friendly environment for young companies to start and expand, with a dedicated EU start-up and scale-up strategy.
- Helping big companies adopt new technologies such as artificial intelligence (AI) and robotics, thanks to an ***Apply AI*** initiative[61].
- Making it easier for companies to operate across the EU by simplifying rules and laws, with a proposal for a 28th legal regime that will guarantee one set of rules across the EU.
- Supporting the development of new technologies, with action plans for advanced materials, quantum, biotech, robotics and space technologies.

When comparing our analysis with ***Mario Draghi's Report on the Future of European Competitiveness***, there are significant areas of alignment, but also some important divergences in focus and approach. Mr Draghi's findings concerning the skills and labour market (M. Draghi, 2024, pp. 257 -280)[62] relate to the following :

- Future labour markets will be more automated and dynamic, which will put premia on skills that allow workers to complement machines, equip them to master new (digital) technologies and adapt to new developments.
- The shift towards highly skilled occupations will require significant upskilling and reskilling of the workforce.
- An example of a severe shortage of occupation which can impact the EU's competitiveness is science and engineering professionals and associate professionals, which are essential to implement the twin transitions.

COMMONALITIES:

1. Green Transition and Sustainability:

- Draghi emphasizes the urgent need for Europe to transition towards sustainable energy sources, given its heavy reliance on energy imports and the high cost of energy. He stresses that sustainability is crucial for European competitiveness, advocating for innovation in green technology and renewable energy.

- E4E similarly places a strong focus on sustainability, highlighting the necessity of engineering skills in green technologies. The strategy prioritizes upskilling engineers in areas such as renewable energy, energy efficiency, and environmental sustainability to support the green transition.

2. Technological Advancements and Digitalization:

- Draghi highlights Europe's technological lag, particularly in areas like AI and digital infrastructure, where the EU is dependent on non-European technologies. He calls for a robust strategy to close this gap and promote innovation.
- E4E aligns with this by focusing on developing digital skills among engineers. The strategy emphasizes the importance of digital literacy, AI and data analysis for engineers to adapt to the rapidly evolving technological landscape.

3. Skills Gap and Future Workforce Needs:

- Draghi identifies a critical skills gap in Europe's workforce, especially in high-tech and green sectors. He warns that without closing this gap, Europe risks falling behind economically and technologically. His report further acknowledges that the quality and effectiveness of VET systems across the EU are highly inconsistent, and it emphasizes the need for wide-ranging reforms to prepare the workforce for technological advancements. This perspective was echoed during the December 2024 Council meeting (EPSCO)63, where EU ministers adopted conclusions stressing the importance of enhancing upskilling, reskilling and LLL opportunities to ensure that workers are equipped to adapt to the constantly evolving labour market.
- E4E mirrors this concern by addressing the need for

60 https://commission.europa.eu/topics/eu-competitiveness/competitiveness-compass_en
61 https://aiapply.co/
62 https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en
63 https://www.epp.eu/news/epp-epsco-ministers-meeting

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continuous education and professional development (CPD) for engineers. The strategy stresses the importance of equipping engineers with the skills necessary to meet the future demands of the industry, including AI, robotics and sustainable technologies.

DIVERGENCES IN FOCUS:

1. Entrepreneurship and Innovation:

- Draghi, while advocating for innovation, does not explicitly focus on entrepreneurship in his report. His approach is more centred around large-scale structural changes, industrial policy and increasing investment in research and development (R&D), rather than fostering individual entrepreneurial initiatives.

- E4E places significant emphasis on fostering entrepreneurship among engineers. It promotes programs that encourage engineers to start their own businesses, providing support through mentorship, financial incentives and entrepreneurship education. The strategy views entrepreneurial engineers as key drivers of technological innovation and economic growth.

2. Strategic Autonomy and Technological Sovereignty:

- Draghi also stresses the importance of strategic autonomy, particularly in critical sectors like digital technologies and renewable energy. He argues that Europe must reduce its dependency on external suppliers and develop its own technological capabilities to safeguard its economic and geopolitical interests.
- E4E, while focused on equipping engineers with future-ready skills, does not place as much emphasis on Europe's technological sovereignty. The strategy is more oriented towards ensuring that engineers possess the skills needed by industry, without the broader geostrategic implications highlighted by Draghi. The E4E scope is primarily about enhancing competitiveness through skills development, rather than asserting Europe's autonomy in critical sectors.

6. FUTURE WORK PROGRAM FOR THE ENGINEERING SKILLS COUNCIL AS AN OBSERVATORY

1. Actionable Recommendations :

In translating our above comprehensive analysis into Actionable Recommendations for the European Engineering Skills Council, several key areas emerge as critical focal points to address the evolving demands and challenges within the engineering profession.

1) Positioning Statement and Recruitment: Develop a robust positioning statement that clearly articulates the significance and impact of the engineering profession, aiming to inspire young minds.

2) Promotion of the Profession: Support initiatives to expose students to engineering concepts early on, fostering interest and understanding of the profession's real-world contributions.

3) Green and Digital Transition: Advocate the GreenComp framework and Sustainable Development Goals (SDGs) into engineering education programs to align with megatrends like the green and digital transition.

4) Re-evaluation of engineering education : Support and emphasize a holistic approach that considers the societal and environmental impacts of engineering innovations, thereby promoting teaching programmes that bridge the skills gap, ensuring relevance to the dynamic demands of the job market.

5) Holistic Education and Transversal Skills: Screen and collect innovative approaches for the development of transversal skills, integrating hands-on experiences and collaborative learning throughout the education process.

6) Collaboration and Partnerships: Foster partnerships between industry and educational institutions, leveraging collaborative efforts to address skill shortages. Encourage collaboration through networking events, conferences and knowledge-sharing platforms to enhance the intersection of academia and industry.

Fig. 12 + 13 : *Chairman of the European Engineering Skills Council, Mr Hannes TREIER, former Member of the ENGINEERS EUROPE Executive Board, Member of the Swiss National Committee in ENGINEERS EUROPE, Partner REFLECTA AG, Bern (CH), at the E4E Skills Council Meeting, Berlin, 6 December 2024.*

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7) Continuous Learning and Skill Development: Promote continuous learning through engagement with professional societies, facilitating knowledge-sharing among peers. Develop strategies to monitor and contribute to the ongoing evolution of skills required in the engineering profession and give input to CPD upskilling/reskilling training structures.

8) Entrepreneurship and Innovation: Encourage an entrepreneurial mindset among engineers through workshops, seminars and short training courses, demonstrating *Best Practice Examples*. Support engineering entrepreneurship by mentorship programmes and maintain access to industry and employer networks.

9) Diversity and Inclusion: Support diversity and inclusion training for engineering professionals and organisations and develop initiatives or proposals thereto. Support gender balance, ethnic diversity and equal opportunities to enhance diversity within the engineering profession.

10) Environmental Sustainability and Skill Development: Advocate investments in education and skills development, particularly in STEM fields, to support the twin transition. Support and learn from educational programmes covering emerging fields like renewable energy, artificial intelligence, data science and robotics to prepare graduates for the evolving job landscape.

2. Suggestions for Future Consideration

ENGINEERS EUROPE launched an important initiative of which the goal was – together with the E4E consortium partners – to formulate a robust strategy that gives a comprehensive picture of the existing situation, while making recommendations for improvement. We believe this effort should be continued and intensified to meet the needs of the future. The following suggestions may give the European Engineering Skills Council more input and feedback for the future modification and formulation of above action points :

1) Current Skill Set of Engineers: Continuous gathering of detailed information on the current skills possessed by engineers in different sectors and specializations. Data should be collected on the proficiency levels of engineers in emerging technologies (e.g. AI, blockchain, IoT) and their application in real-world scenarios. To address these data gaps, a combination of surveys, interviews, industry reports and collaboration with professional organisations, industry, academia and policy makers within the European Engineering Skills Council - as an ongoing monitoring mechanism - must be continued and employed to ensure relevant information continues to be gathered for a future robust skills strategy for European engineers.

2) Future Skill Requirements: This document reflects the first attempts of the Skills Council to collect and interpret data and formulate strategic action points. Maybe there is a limited foresight into the evolving demands of industries, especially regarding technological advancements and the emergence of new engineering disciplines. Nevertheless, future efforts will need to be focused on collecting data about the anticipated skill requirements for engineers in the context of green and digital transitions, sustainability goals and other megatrends compiling them with the EU guidelines and frameworks, such as GreenComp, LifeComp, DigComp and EntreComp.

3) Regional Disparities: Focus on understanding of regional variations in skill demands and shortages across European countries will remain a challenge. There is still lack of data on specific regional challenges and opportunities that could influence skill requirements.

4) Life Skills and Interdisciplinary Competencies: There is a need to conduct even more research on the importance of soft skills and interdisciplinary competencies in different engineering roles. There is still limited data on the correlation between soft skills and project success, innovation and adaptability in the engineering profession.

5) Under-Represented Groups: More intensive research and data collection on the representation of women and other under-represented groups in the engineering workforce needs to be done. Lack of information on the barriers faced by these groups in pursuing engineering careers and potential actions to address these challenges remain subject of further study.

6) Continuous Professional Development (CPD) Needs: Future research needs to be expanded to get more insights into the specific areas where CPD is most needed among engineers. Although there is awareness of several good practices, there is a lack of evidence on the effectiveness of existing CPD programmes and engineers' preferences for CPD.

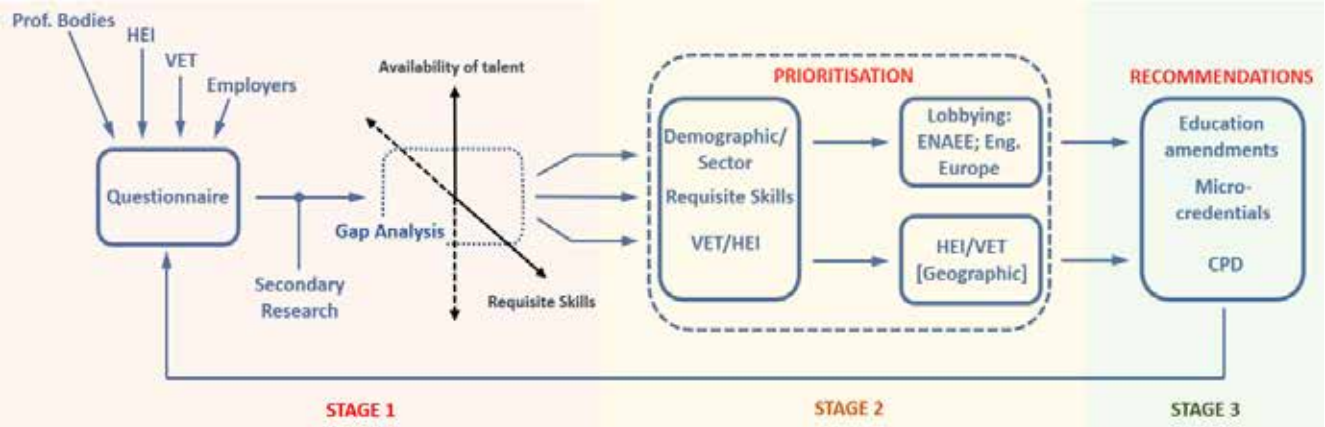

***Fig. 14**: Methodological approach to better align educational opportunities with professional demands for engineers.*

7) Collaboration Between Industry and Education: Lack of data on the extent and effectiveness of collaboration between engineering education institutions and industry partners and the VET world. Insufficient information is available on successful models of industry-academia partnerships that contribute to skill development.

8) Entrepreneurial Skills and Innovation: Enhance our understanding of the entrepreneurial skills needed by engineers to drive innovation and contribute to the growth of startups. Inadequate data on the success rates of engineering entrepreneurs and the impact of entrepreneurial training programmes.

9) Impact of Global Trends: Although we recognize the global trends (such as climate change, digitalization and geopolitical shifts) and the common belief that engineering will play a serious role in these, we have a lack of comprehensive data on the impact of these trends, on engineering skill requirements and insufficient information on the adaptability of the engineering workforce to navigate these global challenges.

10) Evaluation of Existing Educational Programmes: There is an awareness that to some extent existing skills are not aligned between academia and the labour market. But there are still limited data on the effectiveness of existing engineering education programmes in meeting industry demands and insufficient information on the alignment between educational curricula and the skills needed in the job market.

3. Proposed Methodology :

Following on from the considerations presented and the opportunities described above, a methodology is proposed above for the Engineering Skills Council to prioritise and subsequently recommend educational/training curricula reviews that can also facilitate better resource allocation for CPD offerings.

The methodology continues to build on the approach to engage with relevant stakeholders and cross-reference with secondary (literature) research to identify skills gaps (Stage 1). The gap analysis must be cognisant not just about missing competencies; it must be about shortage of numbers too.

In Stage 2, the Engineering Skills Council will prioritize the identified skills gap (acquired in Stage 1) in terms of industry sector/demographic imperatives, required (priority) skills and HEI/VET capabilities. This prioritisation allows a sector/discipline specific emphasis to be achieved.

Then by engaging with professional engineering Organisations (ENGINEERS EUROPE, SEFI, ECEC, ENAEE, etc.) and Faculties of Engineering, a subsequent focus on HEI/VET is possible and could be geographically assigned. Finally, in Stage 3, the focus acquired in Stage 2 will facilitate recommendations in terms of (potential) educational (First Cycle Degree/Second Cycle Degree) amendments, to better align with professional (industry) needs (demands).

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***Fig.15** : WG FUTURE ENGINEERS TU Eindhoven, 8-9 April 2025*

Mindful of inherent inertia within HEIs, micro-credentials can bridge gaps within curricular review cycles (primarily through VETs, but with participation by HEIs where relevant). Finally, the focused prioritisation by the Skills Council will facilitate CPD design that optimises resources with necessary skills, thus closing the circle between education, training and life-long learning.

4. Conclusions:

Now that this Council as a platform, or Observatory, has been established, it is intended that it will be updated and maintained by ENGINEERS EUROPE. It will develop pertinent documents and conduct further research to become a beacon for engineering. Future actions should be based on the provision of information about the engineering profession by and to all stakeholders. It can have academic, professional, social or regulatory components. Future data could include issues like CPD, provision of engineers, remuneration of engineers, qualification frameworks (professional and academic), current trends in engineering development, international agreements, events relevant to the engineering profession, mobility schemes/tools, predicted future employment scenarios, etc.

In terms of membership of the Council, there are a significant number of stakeholders involved in the education, employment, development and professional aspects of engineering education and engineers. These include universities, national engineering academic and professional bodies, VET providers, online engineering course providers, military industry companies, construction companies, manufacturing industries, transport and communication companies, mining and agricultural sector companies, research companies, public organizations, DGs of the European Commission, UNESCO, European engineering alliances, etc. Also, some international bodies have already addressed the question of integrating non-European engineers, such as outlined in the ***Graduate Attributes and Professional Competencies (GAPC) Framework***.[64] Regarding the future, this Observatory may help prioritizing actions like the sustainability response of engineers as prescribed by the ***UNESCO II Engineering Report*** (Engineering for Sustainable Development)[65]. The Engineering Skills Council as an Observatory should continue to amass concrete data for and about engineers in the years to come.

***Fig. 16** : Finalization of the E4E Engineering Skills Strategy, Paris 15 April 2025, Société d'Encouragement pour l'Industrie National*

64 https://www.internationalengineeringalliance.org/about-us/gapc
65 https://www.unesco.org/en/basic-sciences-engineering/report

7. CONCLUSIONS OF THE E4E RESEARCH

Consistent with the research conducted by the E4E consortium partners and their literature reviews, the following important conclusions can be drawn:

1) The demand for engineers in Europe is robust, with a particular emphasis on emerging fields and sustainability. While challenges exist, **the profession is evolving**, offering numerous opportunities for those ready to embrace the transformative journey ahead. The role of engineers is not only in meeting current demands but in shaping a sustainable and innovative future for the continent. Europe's emphasis on sustainability and digitalisation continues to create employment opportunities. Investments in renewable energy and low-emission infrastructure projects are also driving demand for physical and manual labour in construction and related fields.

2) Also, **the job market is evolving** and calls for adaptability, with newly created roles and transformed existing occupations. It is necessary to be prepared for the fact that changes in our environment are inevitable and will occur quickly, which will be reflected in the professional activity of engineers. We should be aware that changes will be caused by technological development, but also by social needs such as the expectation of greater comfort, but on the other hand also unforeseen needs caused by global crises. This evolution is reshaping the expectations and responsibilities of engineers, who are now seen - not only as technical experts - but also as innovators and leaders capable of addressing complex social and environmental issues.

3) The engineering profession is on the verge of an important transformation in the future and **a clear, compelling positioning statement** is needed to communicate its significance to the public. Engaging the younger generation in engineering will require active participation from engineers themselves.

4) Competency-based learning and the assessment of learning outcomes are crucial for engineers, encompassing knowledge, skills, and broader competencies. It is worth paying attention to the ranking of the main competences required based on the results of our E4E Surveys. Success in engineering education will require collaborative, joined-up efforts by all stakeholders.

5) An increasingly widely articulated expectation regarding professional skills is **inter- or multidisciplinarity**, with the importance of the interplay between technology and other disciplines such as social sciences and economics being emphasized. An interdisciplinary approach allows for a better understanding of social trends as well as new and changing technologies, e.g. the use of AI in broadly understood engineering. Additionally, working or studying in multidisciplinary teams is suggested as a method to broaden engineering students' viewpoints. Open-mindedness and thinking outside of the box are beneficial for the engineering curriculum, as well as a holistic approach to projects.

6) Our research suggests that there is a shift in the perception of entrepreneurship, moving from a purely soft skill to a more integrated and accepted competence, often linked with business acumen. This evolution reflects a greater understanding of the value of entrepreneurial thinking and skills for engineers in a changing world. Structured CPD programs can address multiple disciplines to prepare engineers for hybrid roles that combine technical and managerial expertise, leading to the development of managerial capabilities (meeting the growing demand for leadership within technical industries) with capabilities in artificial intelligence and sustainability. Entrepreneurship education, particularly using hands-on learning projects will increase engineering students' mindsets and their intentions. Integrating real-world assignments like internships at startups or established firms also help cultivate a robust entrepreneurial mindset.

7) Partnerships between industry and educational institutions, coupled with increased R&D investment in emerging technologies, offer effective solutions to address digital, green, resilience, and entrepreneurship skill shortages in engineering. Scholarships, mentorship programs and diversity/inclusion training are key tools for attracting

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***Fig.17** : Dissemination Event by AECEF, Prague 11 April 2025*

underrepresented groups to engineering. Moreover, the diverse and inclusive environment benefits everyone and could potentially address part of the labour shortage.

8) Addressing the demand for continuous professional development is pivotal for equipping engineers with the skills needed to navigate the evolving landscape of the engineering profession. From technological transitions to sustainability integration, a holistic and proactive approach to LLL is essential for the sustained excellence of engineers. Despite its strategic importance, VET often suffers from a perception problem in many EU countries, where it is viewed as a second-class option compared to academic pathways. If the EU wants to meet future skills needs - particularly in technical professions such as engineering - VET must become a more visible, flexible and aspirational part of the LLL ecosystem. To address Europe's engineering skills gap, VET systems must not only serve as effective training platforms but also as aspirational, future-facing engines of professional development. By improving their image, ensuring cross-border recognition, integrating green and digital competencies and supporting LLL, the VET ecosystem can become a powerful tool for attracting talent into engineering. Forward-thinking policy interventions, sustained funding and deep industry collaboration are essential to unlocking this potential.

9) The future engineer will require a combination of the following qualities :

- *Advanced Technical Proficiency* : AI and machine learning, robotics and automation, Internet of Things, data science and big data analytics, cybersecurity, encryption and data protection, secure coding practices, sustainability and green engineering.
- *Interdisciplinary Knowledge:* be comfortable working with experts from diverse fields, including computer science, biotechnology and environmental science.
- *Soft Skills and Emotional Intelligence***:** engineers still rely on technical skills, but soft skills have increasingly become valued assets in engineering roles, such as communication, problem-solving, critical thinking, leadership and teamwork, adaptability and learning agility, ethical design and development, regulatory compliance.
- *Project Management and Business Acumen* including time and resource management, business strategy and decision-making).

8. WAYS TO PURSUE FOR THE STAKEHOLDERS

Based on two rounds of Primary and three rounds of Secondary Research, the following recommendations per stakeholder group can be formulated:

1. Professional Organizations :

1) Professional Engineering Organisations can foster an entrepreneurial mindset among engineers by advocating interdisciplinary collaboration, offering entrepreneurship training, workshops and seminars[66].

2) Communication about the profession and motivating children from a young age are effective strategies. It is also important to ensure training and inclusion programs tailored to engineers with long careers.

3) Promoting LLL, continuous improvement of professional competences under the conditions of changing needs, promote upskilling and reskilling, by organizing and coordinating specialized (tailor-made) trainings for engineers from various industries, including certified trainings.

4) Organizing industry conferences and seminars to stay updated on the latest trends and advancements in engineering. Creating and moderating discussion forums on the needs in the scope of current and future engineering competences.

5) Provision and recognition of new forms of education, such as micro-credentials. New learning paths need to be flexible, properly delivered and quality assured.

6) Play a role in the transnational mobility of engineers by assessing their knowledge, skills and competencies and thus determine who can be considered a qualified engineer.

7) An undervalued issue relates to engineers and their encouragement to exercise political influence and engage in exercising political power, especially when it relates to law-making and regulations affecting their profession (engineers know their profession best, not other professionals), but also the society at large. Political decision-making should in some societal domains be based on the technical expertise, advice and recommendations of engineers. A liaison group at EU-level, consisting of experienced engineers from various disciplines, could facilitate and improve political decision-making processes.

8) Disseminate the results of European funded projects addressing shortcoming and deficiencies of the application of the Lisbon Recognition Convention (LRC), such as the Spotlight on the Recognition project self-assessment tool,[67] ***LIREQA's*** practical recommendations[68], Focus on Automatic Institutional Recognition (FAIR)[69] report and the ENIC-NARIC online training platform from the Streamlining Institutional Recognition: a Training Platform for Admissions Officers (STREAM)[70] project. Expand the application of the LRC, addressing the governments of countries where the implementation is incomplete.

2. Policy Makers :

1) To address the persistent shortage of engineers, Europe must take further steps to promote STEM education among young people. Continuous popularization of the engineering profession and STEM education in society, including at the early stages of education. Awareness campaigns showing the importance and opportunities within the engineering profession.

2) Diversity and inclusion policies, along with problem-based learning opportunities, foster ethical decision-making skills and broader talent representation.

66 A useful starting point for this strategy has been the Education and Innovation Practice Community (EIPC), a joint effort of the OECD and European Commission to build a platform of education policymakers and practitioners across the OECD and EU to advance the understanding of the competencies that help trigger and shape innovation for the digital and green transitions, as well as "deep-tech" innovation, and the mechanisms through which higher education can contribute to developing these competences, https://education.ec.europa.eu/event/education-and-innovation-practice-community-webinar-on-digital-and-green-competenci

67 https://www.eua.eu/publications/reports/improved-recognition.html

68 https://www.enqa.eu/news/lireqa-publishes-recommendations-on-integrating-academic-recognition-and-qaulity%20assurance

69 https://www.nuffic.nl/sites/default/files/2020-08/fair-experimentation-protocol.pdf

70 https://www.enic-naric.net/page-stream

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***Fig. 18**: E4E at the EU Parliament Brussels, 10 April 2025 at the invitation of the Consiglio Nazionale dei Periti Industriale (CPNI) with MEP Mr Pietro FIOCCHI and Mr Martin LE VRANG, Head of Unit, DG EMPL.*

3) To fulfil its mission and to respond adequately, sustainable funding for higher education, enhancement and adjustment of existing policies and instruments, and the development of new ones are needed. This includes new modalities of education provision, such as micro-credentials, the enhanced use of joint programs, and support for the entrepreneurial and innovation capacities of higher education institutions. Many VET institutions lack modern labs, digital infrastructure, or faculty development budgets. To remain relevant, they need funding akin to that of universities.

4) Increase the number of international students : attracting more international students to European HEIs can help mitigate skill shortages, for instance by policies focusing on simplifying visa processes, providing more scholarships and mentoring programs to ease settling into the respective national labour markets and culture.

5) An important aspect to ensure an easy and encouraging process for engineering cross-border mobility would be a centralized platform like the one of Erasmus+, where EU-employers can attract non-European engineers and vice versa. This could be a further development of the recently developed ***EU Talent Pool***.[71]

6) Create a European platform for engineering-specific micro-credentials that are stackable, industry-recognized, and linked to the EQF. VET providers should be funded to co-develop these in partnership with chambers of engineers and trade unions.

7) An AI competence framework in initial education and training is vital for adequately preparing new learners for the future AI-driven job market and should also be a core priority in adult learning and continuing vocational training.

8) Systemic support for engineering fields of study, e.g. through projects for HEIs in cooperation (consortium) with industry, encouraging to undertake studies in engineering fields, counteracting the phenomenon of drop out -

***Fig. 19** : EuroTeQ Presidential Strategy Forum, TU Munich, 22 November 2023, Mrs Antoaneta ANGELOVA-KRASTEVA, EU Commission's Director on Innovation, Digital Education and International Cooperation, with ENGINEERS EUROPE Secretary General (Photo @ Andreas Heddergott / TUM)*

71 https://home-affairs.ec.europa.eu/networks/european-migration-network-emn/emn-asylum-and-migration-glossary/glossary/eu-talent-pool_en

abandoning studies before obtaining a diploma, supporting the development of dual studies.

9) Raise awareness and improving knowledge about Green Skills must be a priority. This can be achieved through targeted educational campaigns, industry-led seminars, but also by government-supported initiatives.

3. HEIs and Education Providers :

1) repare engineers for the challenges of the 21st century, sustainability principles must be incorporated into formal engineering education and continuous professional development. Changes in education curricula and CPD programmes are essential to support the integration of Sustainable Development Goals (SDGs) into engineering practice. Make green and digital skills **core** elements of all VET curricula by 2030.

2) Search for the opportunities to introduce the new pedagogical frameworks such as Education 4.0,[72] which integrates digital tools and active learning strategies to enhance student engagement and learning outcomes, preferably in cooperation with industry. The teaching process should shape the competences of engineers and not only the content of the program.

3) There is a need for more practical and hands-on activities in training curricula to bridge the gap between theoretical knowledge and real-world application. Micro-credentials, post-graduate programmes and education initiatives should be designed to address skill shortages and equip engineers with the latest trends and developments.

4) Training programs should also be diversified to meet various professional needs. While university degrees provide in-depth theoretical knowledge, practical vocational training and apprenticeships ensure hands-on experience, which is crucial for successful implementation.

5) STEM mentorship programs can play a crucial role in increasing the number of students pursuing engineering careers.

6) Program courses that develop several entrepreneurial/ entrepreneurship competencies in engineering students, including marketing skills, learning skills and attitudes (to accept uncertainty), opportunity skills, strategic skills, financial and economic literacy and interpersonal skills.

7) Enter into partnerships with engineering companies to create lasting forms of practical education for students that can involve study visits, knowledge sharing through voluntary associations, or spending time at different employers or in associations. Such initiatives are particularly relevant for skill sets that draw expertise from multiple sectors.

8) Creation of university labs together with industry to ensure industry-grade equipment and tools to ensure realistic up-to-date training environments and constant update of labs resources.

72 https://www3.weforum.org/docs/WEF_Defining_Education_4.0_2023.pdf

Fig. 20 : *EuroTeQ General Assembly Meeting, TU Munich, 22 November 2023*

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9) Systemic approach to training (increasing competences) of teachers in the field of new technologies as well as in the field of didactic methods adapted to the perception and expectations of contemporary students. Supporting teachers in gaining experience in industry and business (or acquiring such teachers from the industrial environment).

10) Promote cooperation with foreign institutions for the purpose of cultural integration of students and faculties to facilitate work in an international and intercultural environment.

11) Develop student and teacher exchanges to foster cooperative networks and facilitate the sharing of best practices across Europe.

12) Enforce consistent implementation of EQF-aligned qualifications and modular learning units that allow engineers-in-training to move freely across EU member states while accumulating credits.

4. Industry:

Recruitment challenges are reshaping the engineering profession, with a demand for specialised talent far outpacing supply and across multiple disciplines. Global competition, demographic shifts, and rapid technological change have amplified these issues, forcing companies to rethink how they attract, develop, and retain their workforce. Engineering-led companies must adopt multi-pronged strategies, such as :

1) Practical experience through internships and apprenticeships is a recognized need for engineering students. Focusing on projects and real work-related situations, along with applicable regulations and technical standards, is suggested to gain more hands-on experience. Universities and the industry must collaborate on tailored curricula to meet market demands, with businesses taking a lead role in reskilling and upskilling efforts.

2) Implementation of collaborative projects with HEIs and VET providers, concerning practical education of engineers as well as innovative R&D projects, involving students. Establish graduate schemes and apprenticeships to attract and nurture young professionals

3) Continuous improvement of the system of professional internships, e.g. by establishing mentorship programs where experienced industry professionals guide and support students and new graduates.

4) Organise competitions for students for solutions/concepts needed by the company to engage students in professional skill development, with funding scholarships for the most talented students of the selected engineering branch.

5) Develop in-house training programs to close skills gaps in high-demand areas such as renewable energy and digitalization.

6) Encourage, incentivise and promote employees to enter upskilling, reskilling and knowledge updating programs, in cooperation with HEIs and VETs. Given the pace of technological change, mid-career engineers require rapid, accessible ways to upskill. Micro-credentialing - a system of short, verified learning units - can complement full qualifications and enable continuous learning.

7) Keep employees in the workforce beyond retirement which can include flexible retirement models, part-time employment options and targeted training programs to help experienced professionals stay updated to ever-faster technological advancements

E8) xpand recruitment pipelines to include underrepresented groups, leveraging CPD to support their integration and growth within the sector. Increase female participation in STEM careers with targeted outreach programs, mentoring initiatives and structural workplace changes, such as family-friendly policies and equal pay measures.

9) Encourage career changers to enter engineering through fast-track training programs and industry-funded apprenticeships.

By embedding CPD into their recruitment and retention strategies, engineering companies can create sustainable solutions to skills shortages. Equipping professionals with the competencies needed to navigate complex projects, ensures not only corporate success but also the long-term resilience of the industry.

While there is a high demand for engineers in energy, electrical and digital fields, the supply of skilled professionals is not keeping pace with industry needs. The shortage of skilled workers, coupled with declining student enrollment in engineering disciplines, underscores the importance of up-skilling, lifelong learning and international recruitment efforts. To sustain Europe's engineering excellence, policymakers and industry

leaders must take proactive measures. Strengthening STEM education, easing immigration pathways for skilled workers and investing in reskilling initiatives will be crucial in ensuring that the engineering workforce remains competitive.

Looking ahead, the engineering sector's success will depend on its ability to embed a culture of continuous learning while staying aligned with broader economic and environmental goals. By doing so, Europe's engineers can not only rise to the challenges of today but also shape a future defined by sustainable growth, technological excellence and global leadership. To address the skills mismatch, it is crucial for engineering professionals, educational institutions and industry stakeholders to collaborate and adapt to changing skill demands by updating curriculums, creating and disseminating courses, expanding engineering networks and engaging policymakers. The European Engineering Skills Council exactly aims at this joint work, with a large representation of all stakeholders, because identification of current requested skills and future upgraded skills are extremely important, especially in the context of curriculum modernization. Cyclic verification of expected hard and soft skills for specific industries is also desirable.

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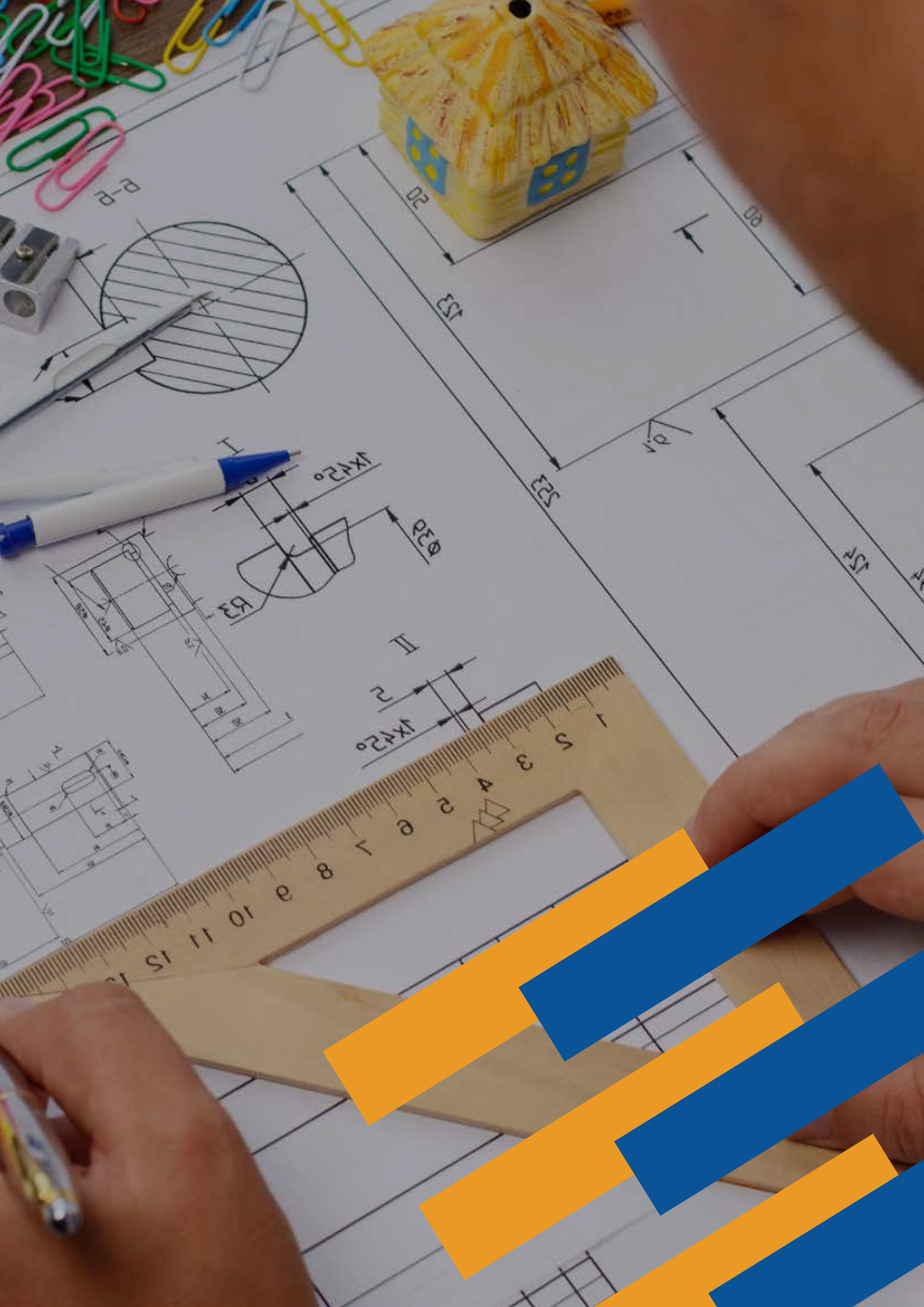
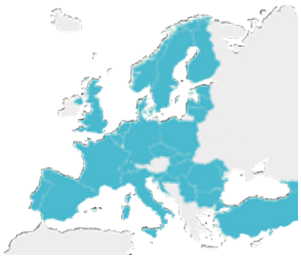


ANNEX 1:
BEST PRACTICE EXAMPLES

1. Challenge-based Learning in an Interdisciplinary Environment (EU)

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 ecosystems 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:

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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.

2. Diversity and Equality in Engineering (EU)

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.

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 ecosystems 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 Organisations (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 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.

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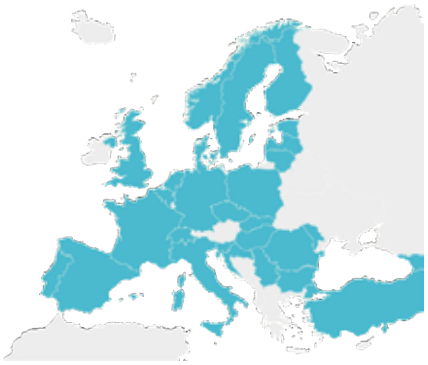
3. Green Skills for the HVAC (Heating, Ventilation, Air Conditioning) Industry

Country	European countries	
Region	Cross-border	
Name of Institution/Initiative:	REHVA	
URL:	https://www.rehva.eu/	
Focus Area of Skills Acquisition:	Green Skills for the HVAC Industry	
Nature of Institution/Initiative:	NFP Umbrella Association	

Contextual Snapshot:	
Relevance of the Focus Area:	The HVAC industry is undergoing a significant transition towards sustainability, emphasizing energy-efficient building design, renewable energy integration, and smart automation systems. With increasing regulatory requirements and market demand for greener technologies, Green Skills have become essential for HVAC professionals.
Current Status of the Focus Area:	A recent survey conducted by REHVA highlighted that while familiarity with Green Skills is moderate to high (66.66% of respondents rated their knowledge level at 4 or 5), there remain significant gaps in awareness and training. The industry is shifting towards digitalization and sustainability-driven competencies.
Key Challenges:	• Lack of awareness and knowledge • Resistance to change in companies • Lack of clear policies and incentives • High cost of training • Shortage of qualified trainers
Government or Institutional Initiatives:	• Employer-led training initiatives to enhance Green Skills. • Development of standardized Green Skills certifications. • EU cooperation for training tools and knowledge sharing. • Integration of hands-on, real-world training experiences in educational programs.

Brief Description of the Institution/Initiative:

REHVA represents over 120,000 HVAC professionals across 26 European countries. It aims to advance Green Skills in the sector through research, policy recommendations, and targeted training initiatives. REHVA conducted a survey to assess the industry's readiness for Green Skills adoption and identified key barriers and opportunities for upskilling.

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

Online Webinars	Virtual training sessions on Green Skills and energy efficiency.
Vocational Training	Hands-on workshops for HVAC engineers and technicians.
Certification Programs	Standardized certifications for Green HVAC competencies.
University Partnerships	Collaboration with academic institutions to enhance Green Skills curricula.
Industry Seminars	Networking events to discuss sustainability and technological advancements.

Examples of Effective Practice in Skills Acquisition:

- In-person workshops and vocational training were rated as the most effective learning formats.
- University degrees and certifications were also seen as valuable.
- Online learning and webinars provided accessible training options.
- Integration of AI-driven simulation tools for hands-on experience.

Internationalization in the Skills Acquisition Process:

- REHVA collaborates with industry leaders, universities, and policymakers across Europe to promote Green Skills.
- The initiative fosters EU-wide cooperation through standardized training modules and best practice sharing among HVAC professionals.

Partnership Models:

- Collaboration with universities to integrate Green Skills in engineering curricula.
- Industry partnerships to co-develop training content and certification frameworks.
- Government and EU-backed initiatives to support funding and policy alignment.

Impacts and Outcomes:

- Increased awareness and knowledge of Green Skills in the HVAC sector.
- Development of standardized Green Skills certifications for industry professionals.
- Greater employer investment in training and upskilling initiatives.
- Enhanced cooperation across European stakeholders to drive sustainability in HVAC practices.

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4. Learning Pathway for professional competencies (BE)

Country	Belgium	Country and/or Region - Map
Region	Flanders	
Name of Institution/Initiative:	KU Leuven, Faculty of Engineering Technology Learning Pathway for professional competencies	
URL:	https://iiw.kuleuven.be/english/cooperation/learning-pathway-professional-competencies/index.html	
Focus Area of Skills Acquisition:	Professional competencies	
Nature of Institution/Initiative:	Higher Education	

Contextual Snapshot:	
Relevance of the Focus Area:	The faculty of Engineering Technology (KU Leuven) wants to reduce the skills gap experienced by professional engineers after graduation.
Current Status of the Focus Area:	Implemented and running.
Key Challenges:	Finding the right teaching staff to integrate the professional competencies in the regular courses

Brief Description of the Institution/Initiative:

The engineering technology programme at KU Leuven trains versatile and resourceful engineers who provide concrete, context-oriented solutions to specific industrial or societal problems. In addition to basic technical knowledge and skills, professional competencies and personal development are essential to work as an engineer in a rapidly evolving world. The industry has been indicating this need for quite some time.

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

The learning pathway departs from challenges aimed at making the world a better place, which are addressed per stage. Through an integrated approach, the various professional competences receive meaning, across courses and learning activities. It focuses on six competences that are introduced step by step via seminars and applied in various projects.

Examples of Effective Practice in Skills Acquisition:

Six different professional competencies are selected:

1. *Team Dynamics*

Team Dynamics refers to the dynamics within a team that benefit its functioning and promote the achievement of team goals. In a dynamic team there is leadership, and everyone understands their roles and tasks. Team members know both the short- and long-term goals of the team project and consult with each other regularly. Team members seek and give feedback to each other in a constructive and respectful manner, and conflicts are resolved promptly. Students learn about the different dynamics of multidisciplinary or international teams, where empathy for different perspectives or cultures is essential. All these elements of a dynamic team are covered in the Team Dynamics pathway.

2. *Project Management*

   Project Management deals with the creation of project plans with associated deadlines, risk analysis, adjustments, planning software, etc.

3. *Professional Communication*

   In Professional Communication, the basic framework taught in stage 1 serves as the foundation for professional and effective communication tailored to the target group. Stage 2 builds on this by focusing on connective communication within the team and towards external target groups, such as clients.

   Students are given several tools in stage 1 which they can later refer to for various applications, such as writing and information processing skills and the use of the vade mecum. Besides training in effective, goal-oriented communication and the use of various registers and tools, students also learn to practically master some forms of communication, such as presentations (stage 1), visual communication (stage 2) and scientific reasoning (stage 3).

4. *Innovation and Creativity*

   In stage 1, students gain knowledge of techniques to generate ideas based on an assignment, to find meaningful connections between these ideas and to focus on the most powerful option. The creative aspect and originality of the project is still rather limited as the assignment is still very clearly defined. Students are mainly introduced to the terminology and stages of a design cycle.

   Stage 2 builds on the techniques of stage 1. The assignment provides more room for interpretation of the problem definition and selection of a solution to work on. Design Thinking provides structure in this more free-flowing course. Students learn the benefits of working with very rough and quickly assembled prototypes at an early stage. The techniques are limited to the internal design process, within the team, within the company, although a minimum of consumer empathy is essential.

   By stage 3, students have a solid foundation in their field. This time the assignment involves more interaction with external parties. Consumer research and stakeholder analysis are necessary to arrive at a good solution. Rough prototypes are not enough; ideas should be presented more carefully to gain credibility with outsiders.

5. *Entrepreneurship*

   In stages 1 and 2, students acquire the theoretical knowledge necessary for an entrepreneurial engineer to understand financial statements, evaluate an investment proposal, calculate production costs and justify policy decisions. In stage 3, the focus shifts to applying this knowledge to an entrepreneurial project. Entrepreneurs look for business opportunities by monitoring social trends and technological developments. Students learn to brainstorm opportunities and challenges for business. They learn to develop and elaborate ideas for different target groups, each with its own characteristics. The business model canvas is used as a

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guide with principles of strategic management. Finally, it also focuses on the types of attitudes that help entrepreneurs succeed, such as initiative, courage (calculated risk), perseverance, professional communication and problem solving.

6. *Ethics and Society*

   Ethics and Society is about ethical conduct as an engineer to sustainable design and development. These topics are offered in separate courses (OPOs).

All these professional competencies are first introduced during seminars/courses and afterwards there are dedicated activities to give the students opportunities to train these competencies and get feedback. For more information, see https://iiw.kuleuven.be/english/cooperation/learning-pathway-professional-competencies/index.html.

Internationalization in the Skills Acquisition Process:

This model has yet been presented at several conferences and publications in English and Dutch are available. For example:
Langie, G., Craps, S. (2020). Professional competencies in engineering education: the PREFERed-way. InfTars - Information Society, XX (2), Art.No. 10, 142-153. doi: 10.22503/inftars.XX.2020.2.10

Partnership Models:

Several other universities in Europe are also aware of the importance of professional competencies and to integrate them in regular technical courses to make students aware of their value. In June 2024, for example, there was the 3-day symposium at UCL (London) about Integrated Engineering Education. People from all over the world participated and collected ideas to improve engineering education.

Impacts and Outcomes:

The integration of professional competencies in the engineering curriculum is important and has impact. Many scientific articles have described the results, but also the challenges associated with this integration. A selection:

- Beagon, U., & Bowe, B. (2023). Understanding professional skills in engineering education: A phenomenographic study of faculty conceptions. Journal of Engineering Education, 112(4), 1109-1144. https://doi.org/10.1002/jee.20556
- Beagon, Ú., Niall, D., & Ní Fhloinn, E. (2018). Problem-based learning: student perceptions of its value in developing professional skills for engineering practice. European Journal of Engineering Education, 44(6), 850–865. https://doi-org.kuleuven.e-bronnen.be/10.1080/03043797.2018.1536114
- Kristina Edström & Anette Kolmos (2014) PBL and CDIO: complementary models for engineering education development, European Journal of Engineering Education, 39:5, 539-555, DOI: 10.1080/03043797.2014.895703
- Naukkarinen & Susanna Bairoh (2021): Gender differences in professional identities and development of engineering skills among early career engineers in Finland, European Journal of Engineering Education, DOI: 10.1080/03043797.2021.1929851
- Mitchell, J. E., & Rogers, L. (2019). Staff perceptions of implementing project-based learning in engineering education. European Journal of Engineering Education, 45(3), 349–362. https://doi-org.kuleuven.e-bronnen.be/10.1080/03043797.2019.1641471
- Mitchell, J. E., Nyamapfene, A., Roach, K., & Tilley, E. (2019). Faculty wide curriculum reform: the integrated engineering programme. European Journal of Engineering Education, 46(1), 48–66. https://doi-org.kuleuven.e-bronnen.be/10.1080/03043797.2019.1593324

5. CirQuality OWL Plus (DE)

Country	Germany	German Federal State of North-Rhine-Westphalia 
Region	North-Rhine-Westphalia	
Name of Institution/Initiative:	CirQuality OWL plus	
URL:	https://www.cirqualityowl.de/	
Focus Area of Skills Acquisition:	Qualification of future technical experts and managers for Circular Economy (Green Skills, Holistic Approaches)	
Nature of Institution/Initiative:	Industry innovation networks, business associations, local authorities, research institutions, Higher Education Institutions	

Contextual Snapshot:	
Relevance of the Focus Area:	The global trend towards sustainability is leading to a growing need to further develop from a linear into a circular economy. Technical solutions are essential here, so the change of skills- and mindset of engineers is pivotal.
Current Status of the Focus Area:	Stakeholders are working across sectors to identify challenges, develop concepts and test processes in order to jointly create circular solutions.
Government or Institutional Initiatives:	Institutional initiative to support the development of circular solutions on a local and regional level

Brief Description of the Institution/Initiative:
The aim of CirQuality OWL plus is to accelerate the transition to an economic system that maximizes the use of resources, minimizes waste, and promotes the reuse of materials and raw materials.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills:
In the field of qualification of future specialists and managers for the circular economy, CE courses are to be developed for students at Bielefeld University of Applied Sciences and integrated into curricula. A platform will be set up to make training and further education in the various regions of Germany more accessible. Innovation potential will also be tapped into through corporate learning partnerships.

Examples of Effective Practice in Skills Acquisition:
The initiative started 01 January 2024 and has since organised and implemented a wide variety of formats and activities from a wide range of technical fields to support skills acquisition.

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These activities are e. g. :

- workshop on the role of norms and standards to achieve circularity (with VDI in Jan 2025),
- expert exchange on the role of sustainability in the health sector (with experts from the health management sector, Nov 2024),
- “Makerthon” with students to support competence development (with VDI in Oct 2024),
- workshop on circularity in the building sector (Aug 2024) or
- networking events for companies and resource efficiency and recycling in the field of plastics (with VDI, Sep 2024).

Aim of each activity is to support decision-makers and managers, entrepreneurs, engineers and technical personal on the local and regional level in the further development of their knowledge and skills in the field of circular economy.

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:

With CirQuality OWL plus, 11 partner organisations from East Westphalia-Lippe have joined forces to tackle current practical issues. Industry innovation networks, business associations, local authorities and research institutions have come together to form a partner network that works cooperatively, collaboratively and across sectors.

Impacts and Outcomes:

CirQuality OWL plus is creating a broad alliance of experts, drivers and practitioners and gives them the opportunity to work on specific challenges in the transformation to a circular economy.

The focus here is on knowledge transfer and testing practical concepts. The main questions that are being answered, are:

- What concepts already exist for this challenge and how can they be tested in your organisation? (Best-Practice Transfer)
- Where do you already have experience that can be transferred to another area or sector?
- What solutions do you know, and would you like to transfer them to your area?

6. Community of Practice: Transformative Skills for Sustainability (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.

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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 centre 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-cantered 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.

7. 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*"[74].
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-

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

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	focused programmes designed to meet priority skills needs[75]. 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*"[76]

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 centres 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).

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[75] https://hea.ie/skills-engagement/what-is-human-capital-initiative-hci/
[76] HCI Pillar 3 (2022, 1:10) *HCI Pillar 3 – REEdI* [Video]. YouTube. https://www.youtube.com/watch?v=q6KxsNIaiao

8. CPD Accredited Employer standard (EI)

Country	Ireland	Country and/or Region - Map 
Region	Nationwide	
Name of Institution/Initiative:	CPD Accredited Employer Standard	
URL:	https://www.engineersireland.ie/Businesses/Training-development/CPD-accredited-employer-standard	
Focus Area of Skills Acquisition:	Professional competences	
Nature of Institution/Initiative:	Nationwide accredited standard	

Contextual Snapshot:	
Relevance of the Focus Area:	Continuous up- and reskilling of engineers
Current Status of the Focus Area:	The CPD Accredited Employer Standard supports engineers to keep up to date with industry standards through their employer.
Key Challenges:	Employees keeping up with CPD when working.
Government or Institutional Initiatives:	Private initiative from Engineers Ireland with support of the Dept. of Further and Higher Education, Research, Innovation and Science.

Brief Description of the Institution/Initiative:
The standard is held by more than one hundred of the leading engineering-led organisations in Ireland in both the public and private sectors, in industries from construction to energy to biopharma to manufacturing, in indigenous and FDI organisations, and in small, medium, and large employers. The standard consists of seven criteria that contribute to the development of engineers and ensure that CPD plays a strategic role in supporting organisations to achieve their vision and objectives.

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

1. CPD Management: Strategy, Policy, Committee
2. Skills and Competence Frameworks
3. Aligning development plans to organisational strategy
4. Mentoring during key transitions
5. Continuous improvement through creative problem solving and innovative solutions
6. Knowledge Sharing and Knowledge Management
7. External Learning Linkages

The standard is built on three levels; Primary, Advanced and Transformational, with organisations advancing along this matrix based on the pace of change in the industries they are in and the expanding requirements of clients and projects.

Impacts and Outcomes:
Improved attraction, development and retention of engineering talent, benchmarking of CPD practices, networking and knowledge sharing, and a robust, holistic, and effective approach towards CPD.

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

Country	Spain	Country and/or Region - Map
Region	Madrid	
Name of 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.	
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), as part of its social engagement 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 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 need to reinforce our presence and workforce/industry capability. Mobility and Industry 4.0 awareness is a newer technical approach and action oriented. Now our Industry is better positioned but we need to speed up the actions to increase the impact in all public and private sectors.
Key Challenges:	Major challenges in Europe in those technical areas are : sensibility to sustainability and green technical impact, and update knowledge on new techniques and social skills in SMEs.
Government or Institutional Initiatives:	We follow the 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.

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 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.

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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 of the courses on the Microelectronics sector started with a pilot course report around November 2023. The Master started in October 2023 and the courses for the Mobility Ministry started in February 2024.

10. 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: <u>Private</u> Digital skills: training to transform - Telefónica https://www.telefonica.com/es/sala-comunicacion/blog/habilidades-digitales-formar-para-transformar/ <u>Public</u> 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

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	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 organisational 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, organisation 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:

- 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.

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11. 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:	Htps://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
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.

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12. Talent 50+: Professional Association of Telecommunications Engineers (ES)

Country	Spain	Country and/or Region - Map
Region	Madrid	
Name of Institution/Initiative:	Official Professional Association of Telecommunications Engineers (COIT)	
URL:	www.coit.es	
Focus Area of Skills Acquisition:	Upskilling and re-skilling of 50 aged professionals	
Nature of Institution/Initiative:	Professional	

Contextual Snapshot:	
Relevance of the Focus Area:	The program is an important initiative by the COIT to support its more experienced members and ensure that their talent and expertise continue to contribute to the development of the telecommunications sector.
Current Status of the Focus Area:	Two editions of the course have been held with a high impact.
Key Challenges:	Re-Skilling and Upskilling. Reintegration into the workforce
Government or Institutional Initiatives:	Although there are several initiatives by professional associations, none are known to be implemented in a regulated manner.

Brief Description of the Institution/Initiative:

The COIT aims to promote talent and reintegrate individuals over 50 into the job market through this program. In this regard, a career reinvention and development program are being launched, focused on providing the necessary tools to navigate the changing work environment, adapt to new market demands, and maximize each participant's potential. Centered on self-awareness and strategic planning, the program offers a unique opportunity for participants to reflect on their professional journey, explore career options aligned with their profile, and learn how to communicate their value effectively in an ever-evolving work environment. The sessions are designed to be highly practical and constructive. The program began in September 2024, is free of charge, and consists of six preferably in-person sessions, each lasting two hours, spread over three months.

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

This program is designed to support telecommunications engineers over the age of 50, providing tools and resources for professional and personal development at this stage of their careers. Talento50+ focuses on several key objectives:

Skills Update: Offers courses and workshops for updating technical competencies and soft skills, ensuring participants stay up to date with the latest trends and technologies in the sector.
Networking: Facilitates events and activities that foster the creation of professional networks, allowing engineers to connect with colleagues and potential employers.
Employability: Provides advice and resources for job searching and reintegration into the labour market, helping engineers take advantage of new professional opportunities.
Scholarships: Offers scholarships to support the continuous training and professional development of veteran engineers, facilitating their adaptation to new sector demands.

Examples of Effective Practice in Skills Acquisition:

Participants could:

- Get to know themselves and reflect on aspects of their profile (using advanced tools employed by institutions such as MIT in Boston and Harvard University).
- Understand the current transforming context and identify professional alternatives.
- Define a professional goal aligned with their profile and preferences.
- Design a hidden market strategy to explore job opportunities that are not visible and learn how to access them.
- Highlight their personal brand attributes to define their storytelling.
- Position their profile on LinkedIn and optimize it to expand their network.
- An expert mentor provides personalized feedback, complementing the introspective approach of the program.

Internationalization in the Skills Acquisition Process:

This program is designed for professionals in the Spanish field, providing tools and resources for professional and personal development at this stage of their careers.

Partnership Models:

The model is developed by the Professional Association COIT and collaborations are established where the in-person workshops are conducted. In the edition held in Zaragoza (Spain), in addition to the support from the Zaragoza City Council, there has been support and collaboration from CEOE Aragón, Alianza +STEAM Aragón, Zaragoza Chamber of Commerce, and the clusters TECNARA, CLENAR, ARAHEALTH, CAAR, and AERA. Additionally, with the International University of La Rioja (UNIR), the possibility of accessing 6 scholarships for members over 50 years old in unemployment has been integrated, with discounts of 45% in key programs such as the Master's Degree in Cybersecurity (with 2 scholarships), the Master's Degree in Artificial Intelligence (with 2 scholarships), and the Master's Degree in Visual Analytics & Big Data (with 2 scholarships).

Impacts and Outcomes:

Two editions have already been held, one in Madrid and another in Zaragoza, each reaching the allowed capacity of 20 people. Although feedback on the employability rate is not yet available, participants rated the in-person sessions very positively, highlighting the relevance of the content and the impact it has had on their careers.

Some comments from participants that reflect the depth of this experience:

- "The program has given me practical tools to position my profile and communicate my value in such a competitive market."
- "I have gained a lot of confidence in my abilities to face new challenges. Additionally, the practical approach helped me set clear objectives."

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13. IACES Debate (GR)

Country	Greece	Country and/or Region - Map
Region	Europe	
Name of Institution/Initiative:	IACES Debate	
URL:	https://iaces.network/events.html	
Focus Area of Skills Acquisition:	AI, Climate change, Ethics and Inclusiveness	
Nature of Institution/Initiative:	International Association of Civil Engineering Students	

Contextual Snapshot:	
Relevance of the Focus Area:	Debate and workshop about E4E project and how the skills chosen can be addressed by Civil Engineers: AI, Climate change and Ethics and Inclusiveness.
Current Status of the Focus Area:	Topics were obtained from consultation of published announcements of jobs in media and networks. IACES students also analyzed the current curricula from the respective universities.
Key Challenges:	The difficulty was in obtaining suggestions that could be relevant to improving contents and learning outcomes of current university curricula and provoke creation of CPD courses for active engineers.
Government or Institutional Initiatives:	Some initiatives were mentioned by the IACES students concerning regulations, recommendations from the European Union concerning Lifelong Learning and initiatives concerning Sustainability and access to higher education from minority groups.

Brief Description of the Institution/Initiative:

The workshop and open debate allowed participants the opportunity to learn and contribute to a significant European Union funded project on the future of engineering education and of engineers' qualifications. The workshop presented key goals to allow participants to engage in the three topics: AI, Climate change and Ethics and Inclusion. These involved stakeholder engagement, training, debating, dissemination and monitoring of engineers. The workshop was divided into three parts with the first dedicated to information about the project E4E. The second was intended for an open debate about future steps. The third part was dedicated to reporting and to synthetizing session conclusions.

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

The impact of the introduction of Artificial Intelligence to the studies and practice of the profession of civil engineering is expected to play an important role in our everyday lives. This includes the studies and the practice of the profession of engineering. The impact of climate change on both the adaptation and mitigation level, to the design, operation, and maintenance of engineering structures have been identified at an increasing rate during the last decades. It is expected that these impacts will increase in the immediate future and affect civil engineering structures and plans. The challenge of ensuring ethics and inclusiveness in the practice of the profession of engineering has always been a great difficulty for the implementation of scientific projects, including civil engineering organisations and activities.

Examples of Effective Practice in Skills Acquisition:

Questions that were placed and debated were: a) what will be the extent of the impact of AI in engineering and what measures need to be taken in order to maximize the positive and minimize the negative impacts? b) what measures need to be taken on an adaptation level (how civil engineering works respond to climate change, for example floods, draughts, extreme heat waves etc.) and on a mitigation level (reduction of greenhouse gas emissions)? c) what rules need to be applied in order to ensure the ethical status of the profession of engineering? d) which measures need to be taken to ensure inclusiveness and the reduction of discrimination in the profession of engineering?

Internationalization in the Skills Acquisition Process:

The workshop worked on defining skills fundamental for each of the three topics. Concerning ethics and inclusiveness the main competences addressed gender equality (wage gap), education (modernization of curriculum, ethics as a subject), rights (inclusion of disabled people, integration of smart technologies to make construction sites safer) and integrity (corruption awareness, "speak up" mentality, practice before work). Addressing AI, the competences to be acquired or to consider were use of AI in universities and jobs, critical thinking, knowledge, verifying the kind of information one receives from AI, programming skills, trusting source in order to give accurate data/information, proper use of AI, being mindful of the consequences, morality and integrity. Concerning climate change the competences agreed were being open minded, keeping ecology in mind, recognizing responsibility, exploring climate change, optimization in analysis, trying to see the whole picture with (city design and planning and using communication as key attitude.

Partnership Models:

Clearly from the debate it was concluded that students and their associations are crucial to define competences needed. Cooperation with professional engineering organisations, with academia, with unions, with companies and with official agencies is an essential part of partnerships. Mandatory subjects and activities include preview from what is done to what will be done, promote seminars, debates, flexible teaching, teacher preparation and training, create engineering specializations in university for these topics, exchange of information between engineers and academia and have workshops to teach engineers and academia on how to influence politic and decision making at all levels.

Impacts and Outcomes:

A total number of 75 students participated in the event. These students are members of different branches of the International Association of Civil Engineering Students who came to Thessaloniki to participate in the "MTM 2024-SKG Edition". This is an annual event organized by IACES and hosted by one of their branches. The 2024 event was hosted by the Aristotle University of Thessaloniki under the auspices of the Department of Civil Engineering. The students who joined the event, in person, came from universities from Europe and beyond. More specifically students came from Portugal, Romania, Germany, Turkey, Bosnia and Herzegovina, Serbia, France, Hungary, Egypt, and Greece. The students were very excited to participate in this event organized by AECEF and by E4E project.

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14. Skills4Jobs Initiative (GR)

Country	Greece	Country and/or Region - Map
Region	Nationwide, with regional emphasis in the industrial areas (Attika, Central Macedonia, Thessaly, and & Thrace)	
Name of Institution/Initiative:	SEV (Hellenic Federation of Enterprises) & IVEPE-SEV / SEV's Workforce upskilling and employment initiative	
URL:	https://www.sev.org.gr/protovoulies-kampanies/skills4jobs/	
Focus Area of Skills Acquisition:	Integrated intervention on technical, digital and life skills and employability enhancement for young graduates aiming for careers in key industrial technical/engineering sectors.	
Nature of Institution/Initiative:	A collaborative private sector-led initiative led by SEV. Partnership between Social partner/Industry Representative, VET/lifelong learning Centres and private sector (private funds, private sector companies and regional industrial associations)	

Contextual Snapshot:	
Relevance of the Focus Area:	Greece's economy has long suffered from a mismatch between the qualifications of the workforce and the actual skills required by employers, particularly in manufacturing and industrial services. This is a cause that also negatively affects unemployment rates, even though there is an increased demand for technical professions and engineers. Transformation of the "world of work" requires new skillsets that are currently underrepresented in the workforce. The industrial sector requires a workforce equipped with technical digital and transversal / professional/life/ soft skills to meet evolving demands. Skills4Jobs initiative addresses this gap by offering tailored, demand-driven training programs.
Current Status of the Focus Area:	The skills mismatch persists despite gradual economic recovery and there is a growing need for specialized training programs that align with industry requirements to facilitate the transition of graduates into the labour market. While public employment schemes exist, Skills4Jobs is one of the few private-sector-led programs targeting direct labour market integration with active business involvement.
Key Challenges:	Bridging the gap between education and industry needs by providing practical, hands-on training experiences, since in many cases there are outdated or overly theoretical academic curricula

	Enhancing employability of young graduates in technical fields since there is a lack of structured pathways from education to employment. Limited access to practical, job-oriented training for graduates
Government or Institutional Initiatives:	While complementary to national upskilling strategies, Skills4Jobs operates independently under SEV's leadership, leveraging private sector agility and expertise. In Skills4Jobs, SEV collaborates with various stakeholders to design and implement training programs that address these challenges. IVEPE-SEV lifelong training centre plays a pivotal role as the training expert in the design and implementation of the customized programs.

Brief Description of the Institution/Initiative:

Skills4Jobs is an initiative by SEV (Hellenic Federation of Enterprises) that provides free specialized vocational training programs designed by industry for industry. The initiative aims to boost the employability of young jobseekers and support the competitiveness of Greek enterprises in high demand sectors. The programs are designed to facilitate attendees (young graduates) to acquire both technical and soft skills.

The initiative includes:

- Technical Skills Development: Training in areas such as industrial maintenance, electrical automation, and IT applications in alignment with industry needs.
- Artificial Intelligence Training on AI topics provided by companies like Google that can assist attendees to effectively integrate them into the execution of their daily tasks.
- Soft Skills and career/job seeking preparation-counseling with workshops conducted by experienced HR professionals.
- Opportunities to familiarize attendees with the work environment through visits to companies and getting to know the work ecosystem with the aim of offering a job after the end of the program. Up to now, the program achieved a high rate of placement in member companies of SEV upon successful completion of the program.

IVEPE-SEV, SEV's official training provider, is the main training provider for the design and implementation of the training process, including:

- Curriculum development based on real business needs
- Delivery of high-quality, hands-on learning modules
- Certification in collaboration with accredited bodies
- Career coaching and matching with employers

Table of Services/Programs provided focusing on the Acquisition of Specific Skills (indicative programs):

Program Name	Sector Focus	Type of Skills	Modules	Certificate of Completion / Micro-credential
Industrial Maintenance Engineer/ Technician Training	Industry: Manufacturing & Maintenance	Technical, Practical Engineering,	1. Development of Technical Skills (Technical - Mechanical Design, Metrology, Tolerances, Lubrication of Industrial	Yes

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Program Name	Sector Focus	Type of Skills	Modules	Certificate of Completion / Micro-credential
		Life Skills, Digital Skills	Equipment, Organisation of Maintenance CBM, Motion Transmission, Failures: Diagnosis, Prevention and Radical Treatment, Equipment Sealing, Pump Technology and Maintenance, HSE) 2. Life competencies/ Soft skills development 3. Artificial Intelligence training 4. Introduction to the work environment 5. Employment opportunities / study visits in local industries and connecting beneficiaries with recruitment departments 6. Career guidance consulting	
Electrical - Automation Engineer/ Technician	Industry: Industrial Automation – Process Control	Technical, Practical Engineering, Life Skills, Digital Skills	1. Development of Technical Skills (Automation, PLC programming, Electrical Installation and Legislation, Instrumentation, Industrial Processes Control, Drives, Electrical Design, HSE) 2. Life competencies/ Soft skills development 3. Artificial Intelligence training 4. Introduction to the work environment 5. Employment opportunities / study visits in local industries and connecting beneficiaries with recruitment departments 6. Career guidance consulting	Yes

Examples of Effective Practice in Skills Acquisition:

- Business-Designed Programs: Each training pathway is co-developed with member companies of SEV, ensuring real-world relevance and alignment with industry needs.
- Adoption of International Standards: Training programs incorporate best practices and standards recognized globally with integration of micro-credentials for rapid upskilling.
- Comprehensive training, combining technical training with digital and transversal / life skills development and job-readiness coaching (CV writing, interviews, communication with HR depts etc)
- Hands-On Learning: Use of labs, simulators, and site visits to gain insights into the real-world work environment.

Internationalization in the Skills Acquisition Process:

- Training content aligns with EU frameworks such as LifeComp and DigComp, and skills aligned with ESCO taxonomy and EQF levels designed by industry standard VET provider in Greece IVEPE-SEV.
- Global tech companies like Google participate in the delivery of digital and AI-related modules.
- Trainees receive continuous professional development based on EU best practices.

Partnership Models:

Owner of the initiative is SEV, the Hellenic Federation of Enterprises
Lead Implementer is IVEPE-SEV (SEV's official vocational training institute

Strategic Partnerships: Regional industrial associations, SMEs, VET/ Lifelong learning Centres, multinational private companies
Funding and Support: SEV members from private sector and foundations such as the John S. Latsis Public Benefit Foundation and the Bodossaki Foundation and other major sponsors including companies such as MYTILINEOS, Coca-Cola 3E, and ELVIAL S.A. HELLENiQ ENERGY Holdings SA etc.

Impacts and Outcomes:

- Hundreds of young professionals trained within the first phases implemented as pilot programs to create best practices and lead to proposals to policy makers of public sector to adopt and implement the idea on a large scale.
- **Enhanced Employability:** Participants acquire skills that increase their competitiveness in the job market. High placement rate in participating companies (up to 70%) and high absorption in industry jobs related to the training (92%)
- **Industry Benefits:** Companies gain access to a pool of trained and skilled candidates ready to meet industry demands.
- **Regional Development:** Programs implemented in various regions contribute to local economic growth and workforce development.
- **Strengthened links** between associations, industry and training providers
- Increased trust in **private-sector-led skills development**

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15. Beethoven Project Brainport (NL)

Country	Netherlands	Country and/or Region - Map
Region	Brainport - Eindhoven, Brabant	
Name of Institution/Initiative:	Project Beethoven	
URL:	https://brainporteindhoven.com/en/strategy-organisation/agenda-with-the-government/project-beethoven-2024	
Focus Area of Skills Acquisition:	Technical skills in microchip sector	
Nature of Institution/Initiative:	Private initiative funded by the Dutch government	

Contextual Snapshot:	
Relevance of the Focus Area:	Collaboration with regional industry
Current Status of the Focus Area:	The Technical University of Eindhoven (TU/e) has already been working together closely with semiconductor company ASML but lacked sufficient talent.
Key Challenges:	Attracting and retaining talent in the Dutch semicon sector
Government or Institutional Initiatives:	The national government invests 1.73 billion euros and the regional government 778 million euros, of which 1.03 billion euros is allocated to the "Talent acquisition" pillar.

Brief Description of the Institution/Initiative:

With the Beethoven project, the Dutch national government, province of Brabant and Eindhoven region are investing 2.51 billion euros in public facilities in Brainport Eindhoven and the surrounding area. This includes a national talent plan to ensure sufficient talent in the microchip industry until 2030. The project aims to manage the growth of Brainport Eindhoven, maintain the business climate in Brabant and improve the quality of life. It will strengthen the microchip sector in the Netherlands, focusing on the Brainport region.

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

3 pillars:

- Talent development for the Dutch chip industry
  - Reinforcement technical education in high schools in 4 regions
  - More technical education in primary and secondary education
  - Stimulation of CPD and LLL for the high-tech sector
- Mobility by improving the infrastructure in the Brainport region
- Acceleration of housing construction

Examples of Effective Practice in Skills Acquisition:

Project Beethoven aims to facilitate overall industrial growth by addressing the shortage of highly trained professionals from the bottom up, rather than directly allocating resources to industry representatives. By focusing on primary and secondary education, as well as retaining talent through affordable housing and improved mobility, the project adopts a holistic approach.

Internationalization in the Skills Acquisition Process:

The Beethoven project aims to attract and retain talent in the Brainport region, while also working together with the ecosystems in Leuven (KU Leuven, IMEC) and Aachen (RWTH) to develop new educational programmes, mainly focusing on AI.

Partnership Models:

TU/e and the Brainport region work closely together with ASML, Dutch multinational semiconductor corporation and other industrial partners.

Impacts and Outcomes:

The TU/e has calculated a growth of 70% in the number of master students in Mechanical Engineering, Electrical Engineering, Applied Physics, and Mathematics & Computer Science over the next few years. The university plans to introduce new master programs in the semiconductor area and offer more scholarships to attract talent. Additionally, TU/e will hire more personnel, both academic and administrative, and construct innovative buildings and facilities.

Furthermore, the university is working on increasing the progression from bachelor's to master's programs and the stay rate of students after graduation. By doing so, TU/e aims to retain talent in the Brainport region and, consequently, in the semiconductor industry to enhance competitiveness.

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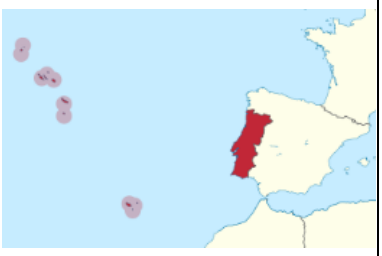
16. University of Porto – Faculty of Engineering (PT)

Country	Portugal	Country and/or Region - Map
Region	North, Porto district	
Name of Institution/Initiative:	Faculty of Engineering, University of Porto	
URL:	www.fe.up.pt	
Focus Area of Skills Acquisition:	Entrepreneurship skills EntreComp skills framework	
Nature of Institution/Initiative:	The Faculty of Engineering of the University of Porto (FEUP) is a public higher education, research-based institution with almost 10.000 students and 600 professors/researchers. Entrepreneurship skills are embedded in all study programmes, at all levels (BSc-MSc-PhD). This initiative is part of a broader commitment to integrate adaptative and innovative thinking into engineering curricula, ensuring that students are equipped to identify opportunities, create value and manage innovation.	

Contextual Snapshot: In today's rapidly evolving technological landscape, engineering graduates must possess solid technical skills and strong entrepreneurship competences. The global economy increasingly demands professionals who can innovate and adapt, who can contribute to and thrive in entrepreneurial ventures or innovation-driven environments. FEUP addresses this need by integrating or embedding entrepreneurship skills development throughout its undergraduate (1st cycle), master's (2nd cycle), and doctoral (3rd cycle) programs.	
Relevance of the Focus Area:	1. Economic growth: Entrepreneurship drives economic innovation and job creation. Engineers created many companies. 2. Global competitiveness: By fostering a culture of entrepreneurship, institutions nurture adaptable and resilient graduates ready to enter the global workforce and contribute to national and European competitiveness.

	3. Engineers are mostly problem-solvers. Entrepreneurship skills such as opportunity recognition, risk assessment, value proposition design, and innovation management, transform technical ideas into real-world solutions, products, and services. 4. Embedding entrepreneurship skills into engineering curricula bridges academia, industry, and society into a collaborative ecosystem.
Current Status of the Focus Area:	FEUP has successfully integrated entrepreneurship skills training across all levels of its engineering programs. The curricula include specific 1,5 ECTS courses aimed at enhancing entrepreneurial thinking: • 1st cycle (Bachelor's Degree): Courses such as "Creating Opportunities for Innovation" and "Strategic Management of Innovation" lay the foundation for entrepreneurial mindsets. • 2nd cycle (Master's Degree): Includes E4E module ''Entrepreneurship 4 Engineers'' (face-to-face pilot and online MOOC) that further delves into innovation management and real-world business application. • 3rd cycle (Doctorate): Courses like "Innovation Management and Knowledge Transfer" and "From Intellectual Property to Business Creation" focus on translating research into viable business solutions.
Key Challenges:	• Balancing curriculum load: Adding courses not integrated into engineering under or graduate programmes can increase the overall academic load, leading to potential student resistance. • Evolving content: Keeping course content current with rapidly changing market demands is a continuous challenge that requires ongoing curriculum reviews.
Government or Institutional Initiatives:	• As of 2022, all Engineering undergraduate programmes at national universities have integrated or embedded transversal skills courses that include entrepreneurship. • EntrepreComp and ResearchComp European frameworks are addressed in all Entrepreneurship courses • FEUP's proactive engagement with partnerships and initiatives, such as the E4E (Engineering for Entrepreneurs) project, amplifies the importance of interconnecting education and entrepreneurial activity. These collaborative efforts create a more cohesive ecosystem for supporting aspiring entrepreneurs.

Brief Description of the Institution/Initiative: Integration of entrepreneurship skills in all levels of study.

Table of Services/Programs provided focusing on the Acquisition of Specific Skills: entrepreneurship courses are available to all 10.000 students

Examples of Effective Practice in Skills Acquisition: all courses (except MOOCs) have ECTS credits

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Internationalization in the Skills Acquisition Process: several programmes and courses are taught in English and included in the offer to incoming mobility students.

Partnership Models: Erasmus bilateral agreements are the prevalent mode of partnership. Other partnerships result from the EUGLOH alliance and international projects such as E4E.

Impacts and Outcomes: Through the activities, courses, and programmes dedicated to entrepreneurship, FEUP's students leave the university better prepared for the demands of today's business world.

17. 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

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	more skills in HEIs programs, since a 1st cycle needs to be completed in 3 years and a 2nd cycle in 2 years. In regard 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, 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 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 labouratory 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

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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.

18. Integration of AR/VR Technologies into the vocational training (SK)

Country	Slovakia	Country and/or Region - Map
Region	Slovakia	
Name of Institution/Initiative:	Integration of AR/VR Technologies into the vocational training	
URL:	https://www.volkswagen.sk/ https://www.virtuplex.cz/sk/	
Focus Area of Skills Acquisition:	Industry-specific skills, digital skills, immersive technical training, soft skills, technology literacy, problem-solving	
Nature of Institution/Initiative:	Technological innovation in vocational education and training	

Contextual Snapshot:	
Relevance of the Focus Area:	Digitalisation and Industry 4.0 are driving demand for new technical and digital skills. AR/VR technologies offer immersive learning that bridges the gap between theory and practical experience in technical and engineering professions.
Current Status of the Focus Area:	AR and VR technologies are being progressively implemented in Slovak vocational education, with some examples in the automotive and technology sectors. Volkswagen Slovakia and Virtuplex represent one of the pioneers in applying immersive technologies for practical training.
Key Challenges:	• High initial cost of software • Need for teacher training and digital skills development • Initial resistance to adoption • Infrastructure and compatibility issues
Government or Institutional Initiatives:	The Ministry of Education supports modernization via EU-funded projects and strategic partnerships, but most schools/educational organisations cover the hardware themselves with the help of exchanging curricula and best practices through domestic and European grants.

Brief Description of the Institution/Initiative:

Immersive technologies are technologies that create an immersive experience by mixing the physical world with digital or simulated reality. Immersive technologies are also called augmented reality technologies. Augmented reality and virtual reality are the two main types of immersive technologies. These technologies share many of the same qualities. Their list includes virtual and augmented reality, as well as 360° video. They provide the effect of full or partial presence in an alternative space and thereby change the user experience in completely different areas.

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Detailed simulations are particularly invaluable for VET disciplines associated with inherent risks in the case of inadequate training or insufficient qualification. For instance, trainees can safely practice handling dangerous equipment, conducting surgical procedures, or piloting aircraft within a controlled virtual environment.

Advantages and Challenges of Using VR and AR in Education

Advantages	**Challenges**
Safe and controlled learning environment without the risk of real-life consequences. Ability to learn from mistakes without fear.	The need for an appropriate approach, methodology, preparation of teachers, technical expertise
Customised to suit individual learning needs	
Accessibility (easy to buy)	
Cost-effectiveness	The costs for developing the curriculum
High engagement and motivation of trainers	VR can be too immersive, leading to disorientation or motion sickness among learners
Ensure minimal distractions	
Ability to simulate real situations, that may be difficult or impossible to replicate in traditional learning	

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

- VR/AR-enhanced dual education programs
- VR/AR-based simulation training for operational tasks
- Customer interaction and service simulations
- Remote collaboration and safety scenario training

Examples of Effective Practice in Skills Acquisition:

Volkswagen Slovakia integrates AR tools (e.g., Vuforia, Teamcenter) into its dual vocational training programs, providing real-life simulations of assembly processes and customer service scenarios. The simulations include the virtual model of the production with the possibility to work with the whole product as well as with certain details of the construction.

Czech company, Virtuplex operates one of the largest VR labs in Bratislava (700 m2) and for 2022 the biggest VR lab in the world, offering immersive 1:1 scale simulation for technical training across various industries (real estate, architecture, machinery, automotive, development, etc.). Companies use the services of the VR lab for training the workers and for testing/development of the production.

Internationalization in the Skills Acquisition Process:

Internalization in the AR/VR utilization in VET is possible by sharing the educational programs, modules and curricula, as basic hardware is very accessible and the main focus therefore is on the fulfillment of the education programs, which can be exchanged.

Partnership Models:

Educational institutions provide theoretical training, while industrial partners deliver AR/VR-based practical training, mostly with the help of specialised providers.

More often, the VR/AR training centre provides hardware and software for companies and their training initiatives. For example, Virtuplex collabourates with businesses to tailor VR labs to specific industry requirements, they adapt the software for certain training and provide the space for the up-skilling and development for the clients.

Impacts and Outcomes:

- Students graduate with high readiness for digitalized work environments
- Companies report better-trained new hires requiring less onboarding
- Long-term cost savings from reduced physical lab infrastructure
- Strengthened partnerships between schools and industry stakeholders
- Increased student motivation and engagement through immersive experiences
- Better understanding of complex systems (e.g., car assembly, diagnostics)
- Scalable and customisable VR training modules adapted to sector-specific needs

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19. 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 labour 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 labour-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 labour market.

Dual education as such connects education with the labour 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 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 labour 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.

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20. Sustainable Skills at the University College London (UK)

Country	UK	Country and/or Region - Map
Region	Europe	
Name of Institution/Initiative:	University College London	
URL:	https://www.ucl.ac.uk/ste-app/study/how-change-world-0	
Focus Area of Skills Acquisition:	Sustainability	
Nature of Institution/Initiative:	How to Change the World is a unique hands-on training programme that equips rising engineering talent with the skills to develop creative and technically robust solutions to 21st-century challenges.	

Contextual Snapshot:	
Relevance of the Focus Area:	Throughout their degrees, students are taught the key technical skills they need to be leaders in their field. How to Change the World aims to teach students the skills they need to apply this knowledge to specific real-world problems in a meaningful way through scenario-based learning. Students work on open-ended problems, considering social and cultural contexts, and the different ways business and governments are motivated to engage with these changes.
Current Status of the Focus Area:	Active
Key Challenges:	Creating time to fit into current teaching syllabus
Government or Institutional Initiatives:	Institutional Initiative

Brief Description of the Institution/Initiative:

Teams of students are presented with a broad, open-ended societal challenge, ranging from issues such as supplying energy services to rural African locations, to finding solutions to congested transport systems in urban centres. All challenges are focused on real-world topics and are created in partnership with external experts, from policy, industry and the third sector. In facilitated workshops, students engage with the social, political, and economic dimensions of the problem and use frameworks that enable them to narrow the scope and produce innovative design concepts, whilst benefiting from feedback and input from external partners. On the final day, students display their work at an Innovation Showcase and pitch their concepts to a panel of experts.

Examples of Effective Practice in Skills Acquisition:

Students learn to:

- Harness their technical capabilities to help solve grand societal challenges.
- Scope out and design socially, politically and economically feasible design solutions.
- Respond creatively and quickly to tough challenges.
- Communicate effectively with their peers and experts from industry and policy.
- Engage directly with global industry and academic experts and benefit from direct feedback.

Internationalization in the Skills Acquisition Process:

UCL have partnered with universities and workplaces across the globe in the roll out of this initiative

Impacts and Outcomes:

Since 2017 there has been a 36x increase in companies setting sustainability targets. Unfortunately, only 17% of these companies say they have employees with the skills they need to start even making progress towards reaching these targets, meaning that up to 150 million employees will need to learn sustainability skills within the next decade. Meanwhile, an additional 395 million new jobs could be created by 2030 if companies prioritise the 'nature-positive' solutions we know are needed.

Given the accelerating demand for sustainability and green skills, it's no wonder that 84% of higher education students want much more sustainability knowledge and skills provided throughout their courses, and 70% want more sustainability-focused experiential learning!) The green transition is an opportunity for the next generation to make its mark building a more sustainable and equitable world!

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ANNEX 2:
TESTIMONIALS

"Every 5 to 7 years our basic requirements, regulations and laws and even the (sustainable) materials change completely and therefore we all have the obligation staying up to date – especially for the Green and Blue Deal. As liberal professionals with an industrial background we all need professional skills – even in business development or public relations – that's why projects like E4E are essential for the profession."

Klaus Thürriedl, 6 February 2025
Chartered Engineering Consultant for Environmental Engineering and Water Management
Secretary General of the European Council of Engineers Chambers
Vice President of the Austrian Chamber of Chartered Engineering Consultants
Austria

"For quite some time we have been facing a lack of highly skilled personnel in the field of technology and engineering. The megatrends of decarbonization, digitalization and demographic change have added to the challenge. The recent decision for investments in infrastructure and security will increase the gap. The European Engineering Skills Council set up as part of "Engineers for Europe" (E4E) is an instrument to address the issue on a European level and at the same time considering national peculiarities. This "Think Tank" represents the can-do-attitude of engineers. It brings together experts from education, industry, associations, and CPD-providers to develop short-, mid- and long-term solutions for the skills gap and skills mismatch. It thus strengthens Europe's position as a technology hub! We must become better in attracting young people into STEM by communicating the important role of engineering and technology in solving our global challenges. At the same time, we must constantly remind engineers of their responsibility towards society! I am thrilled to be a part of this initiative and honoured to represent VDI on this Council."

Dr. Astrid Petersen, 31 March 2025
L. Possehl & Co. Ltd.
Member of the Supervisory Board

Germany

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"Thank you for the opportunity to share my experience with the "Strategic Shift: Professional Development for the Engineer of the Future" course. This program's alignment with the LifeComp Framework—particularly its focus on self-regulation, growth mindset and managing learning—provided invaluable tools for my professional growth.

Most Relevant Components:

Self-Regulation (P1): The modules on managing stress responses (P1.2) and nurturing resilience (P1.3) transformed how I approach high-pressure engineering projects, enabling me to maintain focus and adaptability.

Growth Mindset (L1): The emphasis on embracing feedback (L1.3) and viewing learning as a lifelong journey (L1.2) reshaped my mindset during recent project reviews, where I confidently received all feedback with much more ease, thanks to my participation in this very important course.

Managing Learning (L3): The strategies for goal setting (L3.2) and reflective practice (L3.3) helped me structure a personalized upskilling plan in sustainable design, bridging gaps in my technical expertise.

Professional Impact:

I've applied these competencies directly in my role—for instance, using stress-regulation techniques during critical project deadlines and leveraging feedback literacy to improve team collaboration. The course's EU-aligned framework also deepened my appreciation for holistic engineering leadership in tackling global challenges like sustainability and digital transition.

This program is a catalyst for engineers striving to balance technical excellence with personal and social growth.

Thank you for creating such a forward-thinking initiative!"

Abdul-Rashid Iddi, 28 March 2025

Leibniz Universität Hannover
Institut für Mehrphasenprozesse
Germany

“I recently completed the Engineers4Europe online course, "Strategic Shift: Professional Development for the Engineer of the Future." This is part of a series of online courses facilitated by Engineers4Europe.

In today’s dynamic and fast-paced environment, it is becoming increasingly important for Engineers at all levels to remain current with trends, innovations and changes in our industry. This process of continuous and on-going development is vital for all of us in the Engineering profession. I found this course useful, interesting and helpful and highly relevant to me personally as an Engineer engaged and involved in the Engineering Consultancy and Construction industry as a professional Civil Engineer.

Change is inevitable and the future is uncertain, so participating in and completing courses like this helps us to put a framework around how we approach this interesting, often difficult and challenging issue.

I would certainly recommend it to others as part of their broader CPD (continuous professional development process) and as a "trigger" to constantly consider what the future holds for us and our industry.”

John de Villiers, 28 March 2025

APAC Major Project Delivery Lead Jacobs
Rail, Civil and Aviation
Belgium

Jacobs Challenging today. Reinventing tomorrow.

john de villiers Digitally signed by john de villiers DN: cn=john de villiers, o=private, ou=private, email=john.devilliers@jacobs.com Date: 2025.04.01 09:26:01 +08'00'

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"My name is Juan Carlos López and I'm University Professor at the University of Castilla-La Mancha and also Vice President of the Spanish Official Association of Telecommunication Engineers.

I have nearly forty years of extensive experience in the sector of Information and Communication Technologies combining university teaching, research and project development with companies and other institutions. So, due to my dual academic and professional profile I've had the opportunity to get first-hand knowledge of the needs of the sector.

I have been aware of how the skills and competencies required for engineers have evolved towards more multidisciplinary profiles. Maintaining deep technical knowledge, social skills, innovation and the ability to navigate an increasingly digital world, are now fundamental for professional success.

This is why projects like "Engineers 4 Europe", aimed at aligning training competences with the needs of companies, had to be considered essential for all the different stakeholders. All of this contributes to improving the economic, technological, but also, strategic capabilities of the European Union especially at this geopolitical crucial time. I found the so-called "Skills Council" and the results presented in the "Skills Strategy" documents particularly enlightening, as they provide an essential follow up on the evolution of training needs. Moreover, the four micro-credentials resulting from the curriculum study on such relevant topics as entrepreneurship, digital, social skills and sustainability serve as a model for lifelong learning.

Finally, I sincerely believe that this is a highly useful project for improving the training of future engineers and so allowing to reach the current most demanding skills.

Thank you!"

Prof. Juan Carlos López, 31 March 2025

Universidad de Castilla-La Mancha
Vice President of Spanish Official Association of Telecommunications Engineers
Spain

"As representatives of the International Hellenic University, we had the privilege of hosting and supporting the "E4E Roadshow: Future Skills for Engineers" event at the School of Engineering on 6 March 2025. This experience was truly enlightening and reinforced our belief in the importance of such initiatives in preparing the next generation of engineers for the rapidly evolving demands of the industry.

One of the standout aspects of the event was its ability to bring together key stakeholders, including students, faculty members, industry leaders, and representatives from ENGINEERS EUROPE. The presentations and discussions provided invaluable insights into the skills that will define the future of engineering, ranging from technical proficiencies in cutting-edge technologies to soft skills that enhance adaptability and collaboration in multidisciplinary teams.

What struck us the most was the engagement and enthusiasm of the students. With over 200 participants actively involved, the event created an environment where aspiring engineers could network with professionals, seek career guidance and explore skill development opportunities. The free training programs introduced through the Engineers 4 Europe (E4E) project were particularly noteworthy, offering a structured pathway for young engineers to enhance their competencies in alignment with European industry standards.

The E4E initiative also plays a crucial role in equipping young engineers with essential future-ready skills. The training programs cover a diverse range of competencies, including digital literacy, sustainability in engineering practices, project management and innovation-driven problem-solving. By integrating these skills into their learning journey, students can confidently navigate the challenges of the modern workforce and contribute effectively to the global engineering landscape.

We found the open Q&A session to be one of the most impactful segments of the event. Students had the opportunity to directly interact with experts, raising thoughtful questions about the future of engineering and how they can best position themselves for success. This level of interaction underscored the event's role as a bridge between academia and industry, helping to close the gap between theoretical knowledge and practical application.

We wholeheartedly endorse the E4E initiative and encourage academic institutions, industry partners, and students to actively participate in similar programs. The event was a testament to the power of education, mentorship and skill-building in shaping the future of engineering. We look forward to seeing the continued impact of this initiative and hope to contribute further to its mission in the years to come."

Prof. Dimitrios Papakostas,
Dean, School of Engineering, International Hellenic University

DIMITRIOS PAPAKOSTAS
2025.04.02 13:16:23 +03'00'

Prof. Konstantinos Diamantaras
Vice-Rector, International Hellenic University
Greece

KONSTANTINOS
DIAMANTARAS
02.04.2025 13:32

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"It has been a growth experience to be a member of the Skills Council which is at the heart of the E4E project. The opportunity to work collaboratively with educators, professional body representatives and industry representatives from across Europe has broadened my understanding of our shared concerns in relation to the engineering skills deficits in the EU. It has also given me great hope that, if we continue to work together, we can find ways to address those deficits and ensure that Europe is well positioned to engineer our future in a sustainable and competitive way."

Majella Henchion BE MSc CEng FIE, 20 March 2025
Senior Manager, Technical Capability, Engineering and Major Projects, ESB
Ireland

"The Engineering Skills Council has been an important initiative as part of the Engineers 4 Europe (E4E) project. It has brought together different perspectives, different disciplines, experience levels, and different nationalities. The structure of the Skills Council ensured participation of key academics, industry experts and engineering professional bodies. It was an excellent professional experience to engage with such an expert group, and I thoroughly enjoyed the opportunity. It was well-managed, and the diverse and positive contributions from the members of the Council made it a valuable resource for the E4E project. As is so often the case when we are in environments that enable discourse, we recognised that we have shared concerns and common goals in addressing engineering skills deficits across Europe."

Prof. Em. Mike Murphy, 11 April 2025
TU Dublin
Ireland

"I followed the construction process of the E4E project proposal from the beginning when I was Vice Dean for the Pedagogical Affairs Council of FEUP (Faculty of Engineering, University of Porto, Portugal). Being FEUP, one of the leading institutions in the training of engineers, I realised that it would be essential for the institution to accept the invitation to join the project, which it did. Later and since this realisation had been confirmed, I started more direct contact with the project, becoming a member of its Skills Council.

The E4E project aims to promote innovation and resilience among EU engineers by permitting them to acquire new skills. The project Skills Council has followed its development in detail and expressed its opinion on the lines of action and procedures used in the research carried out in the project context. There is now potential for the Skills Council to continue beyond the duration of the project, which would greatly help schools and professional associations to guarantee the quality of the engineers of the future, in particular by ensuring education in the EU competence frameworks (DigComp, LifeComp, EntreComp).

Created by the project, the "Engineers 4 Europe Learning Platform" currently has a set of four courses designed in collaboration with renowned universities and institutions associated with the project. This is an excellent embryo for future actions, namely, creating new courses with other trends and topics. The next few years will be challenging for the practice of engineering in general; new technologies are beginning to change procedures and working methodologies and consequently, it is vital that new courses come to light to promote quality lifelong education in the engineering fields.

With my experience in the pedagogical management of an important engineering school and as a member of the E4E Skills Council, I see the results obtained by the project as being of enormous value. Therefore, the information gathered must be passed on to professional associations and - directly or indirectly - to engineering schools. This is necessary to ensure its applicability in training new engineers and more importantly, in their lifelong learning."

António Augusto de Sousa, 3 April 2025
Associate Professor of FEUP
Portugal

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"I hereby wish to testify to the importance of the short courses offered by the E4E program in the context of lifelong learning, particularly for engineers who have been active in the profession for many years.

In a professional environment that is constantly evolving, where technical and technological demands advance at an accelerated pace, the need for continuous knowledge updating has become essential. However, many experienced professionals face challenges such as lack of time or difficulty balancing training with intense work responsibilities. It is precisely in this context that the E4E short courses prove to be of invaluable importance.

With a manageable workload of approximately 12 hours, and the possibility of being completed mainly online, these courses offer a practical and efficient solution for updating in Digital, Green, Life and Entrepreneurial skills. They allow engineers in practice to acquire new knowledge, stay abreast of sector innovations and remain competitive in the job market, all in a flexible and accessible manner.

More than simple learning moments, these E4E courses serve as strategic tools for promoting professional engagement and enhancing careers of those who have already achieved significant experience, recognizing the importance of lifelong learning.

Therefore I strongly recommend the E4E short courses to all engineers who wish to stay updated and prepared for increasingly demanding challenges of the future."

António Morgado André, 24 April 2025

Civil Engineer - PhD
Managing Partner Protecna
Portugal

"As head of the technical department, I found the E4E DigiComp course to be clear, practical, and relevant to our school's needs. It strengthened my understanding of digital skills and gave me concrete ideas for integrating them into vocational training. I recommend it to any teacher who wants to stay up to date with digital education."

Ing. Jaromír Murcinko, PhD., 22 April 2025
Head of Technical Department,
Súkromná stredná odborná skola DSA Trebisov
Slovakia

"As a school network manager, I believe that continuous professional development is essential, especially in today's fast-changing digital world. That's why I decided to complete the E4E DigiComp course.

The experience was eye-opening. The course provided a clear introduction to key areas of digital competence – from online safety and digital communication to critical thinking and responsible content creation. I appreciated how closely the curriculum follows the European DigComp framework, making it highly relevant and applicable in our educational environment.

It gave me fresh ideas for improving digital education in our school and inspired me to encourage our teachers and students to follow the same path.

I recommend this course to educational leaders. It's a smart, accessible way to build confidence in digital skills – something we all need to support the next generation."

Anna Sládeková, 22 April 2025
School Network Manager
Deutsch-Slowakische Akademien
Slovakia

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ANNEX 3:
E4E DISSEMINATION EVENTS
(SEPTEMBER 2022 – MAY 2025)

1.	E4E 1st Consortium and Kick-Off Meeting	Brussels, 22-23 September 2022
2.	ENGINEERS EUROPE WG Future Engineers	Brussels, 9 February 2023
3.	ENGINEERS EUROPE General Assembly	Cannes, 9 June 2023
4.	Meeting at CNI	Rome, 28 June 2023
9.	Fifth World Congress of Education	Sapporo, 15-17 November 2023
1.	E4E 1st Consortium and Kick-Off Meeting	Brussels, 22-23 September 2022
2.	ENGINEERS EUROPE WG Future Engineers	Brussels, 9 February 2023
3.	ENGINEERS EUROPE General Assembly	Cannes, 9 June 2023
4.	Meeting at CNI[73]	Rome, 28 June 2023
5.	E4E 2nd Consortium and 1st European Engineering Skills Council	Brussels, 21-22 September 2023
6.	EU STEM Coalition General Assembly	Amsterdam 25 September 2023
7.	WFEO[74] World Engineers Convention	Prague, 11-13 October 2023
8.	Joint International Conference EUCEET[75]/AECEF[76]	Pisa, 19-20 October 2023
9.	Fifth World Congress of Education	Sapporo, 15-17 November 2023
10.	Technical University München: EuroTeQ Presidential Strategy Forum	München, 22 November 2023
11.	DAAD[77] Erasmus Mundus Conference	Brussels, 30 November 2023
12.	Conference of the CAAAE[78]	Almaty, 8 December 2023
13.	ENISE[79] Erasmus Mundus Joint Master	Saint-Etienne, 5 February 2024
14.	EU STEM Coalition: “STEM for the Future of Europe”	Brussels, 29 February 2024
15.	WFEO World Engineering Day	Lisbon, 4 March 2024
16.	E4E 3rd Consortium Meeting	Madrid, 14-15 March 2024
17.	OAV[80]: “Engineering the Future”	Hamburg, 15 March 2024
18.	ENGINEERS EUROPE WG Future Engineers	Brussels, 16 April 2024
19.	E4E 2nd European Engineering Skills Council Meeting	Brussels, 16-17 May 2024
20.	IACEE[81] World Conference on Continuing Engineering Education	Comillas, 20 May 2024
21.	ENGINEERS EUROPE General Assembly	Dublin, 31 May 2024
22.	SEFI[82] Deans Convention	Sheffield, 12-14 June 2024
23.	E4E Dissemination Event: “Competences in Engineering”	Lisbon, 17 September 2024
24.	E4E Dissemination Event: “Global Environmental Problems – Part I”	Bratislava, 7 November 2024
25.	UEEIV[83]: “The future of Railway Interoperability”, Railway Forum 2024	Sofia, 8-9 November 2024

73 CNI, Consiglio Nazionale Ingegneri
74 WFEO, World Federation of Engineering Organisations
75 EUCEET, European Civil Engineering Education and Training Association
76 AECEF, Association of European Civil Engineering Faculties
77 DAAD, Deutscher Akademischer Austauschdienst
78 CAAAE, Central Asian Association for Accreditation of Education
79 ENISE, Ecole Nationale d’Ingénieurs St.-Etienne
80 OAV, German Asia-Pacific Business Association
81 IACEE, International Association for Continued Engineering Education
82 SEFI, European Society for Engineering Education
83 UEEIV, Union of European Railway Engineer Associations

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26.	DEFI[84]: "Which and How Many Engineers for Tomorrow"	Brussels, 27 November 2024
27.	E4E 4th Consortium and 3rd Skills Council Meeting	Berlin, 5-6 December 2024
28.	E4E Dissemination Event: „Kompetenzen für die Ingenieur*innen der Zukunft"	Berlin, 6 December 2024
29.	20th Birthday Celebration of the EESC[85]	Brussels, 11 December 2024
30.	E4E Dissemination Event: "Future Skills for Engineers – Part I"	Athens, 17 December 2024
31.	E4E Dissemination Event: "Empowering Engineers: Bridging Competency and Lifelong Learning for Professional Excellence"	Mechelen, 6 February 2025
32.	H/Advisors opening event: "The Future of Europe"	Brussels, 18 February 2025
33.	UK Embassy: "UK-EU Trade and Cooperation Agreement", Meeting with UK Minister of Trade, Mr. Douglas ALEXANDER	Brussels, 24 February 2025
34.	E4E Dissemination Event: "Future Skills for Engineers – Part II"	Thessaloniki, 6 March 2025
35.	E4E Dissemination Event Engineers: "Sustainability Competences – Nature or Nurture?"	Dublin, 27 March 2025
36.	ENGINEERS EUROPE WG Future Engineers	Eindhoven, 8-9 April 2025
37.	CNPI[86]: "Reform of the professions and the role of technical professionals"	Brussels, 10 April 2025
38.	E4E Dissemination Event: "Engineering the Future Engineer"	Prague, 11 April 2025
39.	ACA[87]: "The Future of Europe = The Future of Erasmus+"	Brussels, 29 April 2025
40.	E4E Dissemination Event: "Global Environmental Problems – Part II"	Bratislava, 30 April 2025

84 DEFI, Conférence des DirecteurS des Ecoles Françaises
85 EESC, European Economic and Social Committee
86 CNPI, Consiglio Nazionale dei Periti Industriale
87 ACA, Academic Cooperation Association

ENGINEERS CHANGE THE WORLD. THEY COME FROM DIVERSE BACKGROUNDS AND WORK IN MANY FIELDS, FROM SATELLITES TO SURGERY. SOME IMPROVE BILLIONS OF LIVES AROUND THE WORLD. THEIR IMPACT CANNOT BE UNDERESTIMATED. ENGINEERS USE PRECISION, VISUALISATION, CONNECTION AND CREATIVITY TO FIND SOLUTIONS TO GLOBAL CHALLENGES. THEY PRACTISE WAYS OF THINKING THAT ANYONE CAN USE.

BY THINKING LIKE AN ENGINEER, YOU CAN CHANGE THE WORLD TOO.

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ENGINEERS 4 EUROPE

ENGINEERS EUROPE Central Secretariat AISBL c/o REGUS EU Commission

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