



WP3 – Making VET relevant and addressing sustainable development

D3.2 – Recommendations for alignment of VET courses to Smart Specialisation Strategies (RIS3)

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SECOVE website: secove-project.eu

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Executive summary

The comparative analysis results on the alignment of Vocational Education and Training (VET) with Smart Specialization Strategies (RIS3) in five different European regions—Kosice (Slovakia), the Basque Country (Spain), the Porto Metropolitan area (Portugal), Lazio (Italy), and Attica (Greece)—are briefly summarized in this executive summary.

The principal results are as follows:

- Aligning strategy with regional goals: recognizing the critical role that education plays in meeting particular industry needs for competitiveness and sustainable development, all regions emphasize the necessity of strategically aligning VET programs with RIS3.
- Cooperation & Partnership: it is essential for governments, industry stakeholders, research centers, and VET institutions to work together. A workforce that is progressive and able to adjust to future developments is guaranteed by multi-stakeholder participation.
- Technological Trends and Innovation: it's critical to compare emerging technologies with both RIS3 priorities and VET offers. Finding gaps and overlaps makes it easier to modify VET programs to satisfy particular industry needs and promotes innovation.
- Emphasis on Digitalization and Sustainable Practices: in order to meet the changing demands of various businesses, all regions place equal emphasis on the incorporation of cutting-edge technology, digitalization, and sustainable practices into VET programs.
- Flexibility and Lifelong Learning: it is emphasized that a dedication to lifelong learning, upskilling, and reskilling is necessary for worker adaptability. Program content and methodology must be flexible if students are to succeed in the quickly changing employment world.
- Internationalization and Cross-National Cooperation: in order to solve problems and share ideas in vocational education, Greece and Italy both stress the significance of cross-national cooperation. Cooperation between nations increases competitiveness worldwide.
- Empowerment Through VET: it is well acknowledged that VET plays a critical role in promoting active societal engagement, improving employability, and empowering individuals. Revised curricula take industry demands into account and improve company performance.
- Catalyzing corporate Performance: by encouraging innovation, research, and competitiveness, VET programs have a profoundly positive effect on corporate performance. Attaining this transformative effect requires updated curriculum that take into account the demands of the modern industry.

The comparative analysis demonstrates that European regions have committed to strategically match Vocational Education and Training with local innovation agendas. The results

highlight the dynamic interplay between education and regional development, placing a strong emphasis on cooperation, flexibility, and a forward-thinking strategy to satisfy changing industry demands. The distinct perspectives from every area enhance a more comprehensive understanding of effective educational approaches that foster durability and competitiveness on both a regional and international scale.

1. Introduction

The European Commission has launched a challenge to implement Smart Specialization strategies, emphasizing the importance of concentrating human and financial R&D resources in globally competitive areas. The SECOVE project proposes the development of a European platform of cooperation of Centres of Vocational Excellence (CoVEs) in the field of Sustainable Energy. Each CoVE will be set up as a local/regional Centre of Excellence, in collaboration with local companies and other institutions working in energy, renewable energy sources, efficient use of energy, construction, and local development.

The SECOVE partnership is subdivided into five national partnerships, each working to establish a center of excellence in Vocational Education and Training (VET) for promoting sustainable energy. The aim is to build a platform for Vocational Excellence developing cooperation between Higher Education Institutions (HEIs), VET centers, industry, and public stakeholders for an Energy strategic region.

European regions are increasingly recognizing the pivotal role of Vocational Education and Training (VET) in aligning with Smart Specialization Strategies, commonly known as Research and Innovation Strategies for Smart Specialization (RIS3). This paper presents a comprehensive comparative analysis of recommendations for aligning VET courses with regional innovation strategies in five distinct European regions: Kosice in Slovakia, the Spanish Basque Country, Porto Metropolitan area in Portugal, Lazio in Italy, and Attica in Greece. Key themes emerge from this comparative analysis include strategic alignment with regional objectives, collaborative approaches involving multiple stakeholders, consideration of technological trends and innovation, emphasis on sustainable practices and digitalization, a commitment to lifelong learning, and the recognition of the empowering role of VET in personal and economic development.

2. Kosice Region, Slovakia

2.1 Smart Specialisation Strategies

This report aims to make recommendations for aligning VET courses in Slovakia with regional and national innovation strategies for smart specialisation (RIS3). Overall, we rely on three main approaches:

Technological trends and their impact on future qualifications: the key is to identify the prevailing technological advances in the fields of sustainable energy, construction and information technology for their impact on the required qualifications in the green building domain. This approach naturally identifies areas where new VET courses will need to be adapted and developed to meet changing labour market needs.

Regional and local strategies: the labour market, innovation system is predominantly regional and actors cooperate on the basis of proximity, encounters and knowledge spillovers. It is therefore essential to consider trends and strategies outlined at both regional and local levels. Thus the subsequent analysis includes a study of the specific objectives, priorities and initiatives of two regions of Eastern Slovakia - Košice and Prešov self-governing regions, with a focus on the alignment of VET courses with the objectives of RIS-3.

This integrated approach defines a coherent framework of perspectives in order to integrate effectively with the objectives of RIS3 and COVE in the Green Building domain. By means of a comprehensive analysis of the current state of VET courses in Slovakia, existing gaps, challenges and areas for improvement are identified. Concrete recommendations are made for the development of a skilled workforce in COVE, supporting regional strategies for innovation and specialisation.

The graphical visualization illustrates the integrated approach, showcasing the interrelation of perspectives in aligning VET courses with RIS3 and COVE in the Green Building domain.



We define the **green building** as an energy-efficient building that has a high-quality indoor environment, uses water management methods, circular economy principles and sustainable materials, and at the same time has a positive impact on the surrounding environment. It is an environmentally sustainable building, designed, constructed and operated to minimise the total environmental impacts.

The following documents and institutions can be addressed to match COVE with the strategic framework of Slovakia and the Eastern Slovakia region.

I. D3.1 – Trends on technological changes and their impact on qualifications: Document outlines the major trends in green buildings, identifies future qualifications and the skills required. Based on the study, the necessary qualifications in green and eco-friendly buildings are projected from technological advances in sustainable energy. This allows to reveal gaps between current and future educational courses and training offer.

II. The Integrated National Energy and Climate Plan 2021-2030 sets out a number of priorities and targets. The main quantified targets for 2030 are a 20% reduction in GHG emissions; the use of RES in final energy consumption is set at 19.2% in 2030, which is significantly lower than in the EU (32%).

The Integrated National Energy and Climate Plan 2021-2030 sets out a number of priorities and targets. The main quantified targets for 2030 are a 20% reduction in GHG emissions; the use of RES in final energy consumption is set at 19.2% in 2030, which is significantly lower than in the EU (32%). Green building as can be identified in Dimension 3.2: Energy Efficiency and, within it, Renewal of residential buildings, Improvement of thermal performance of residential buildings. The buildings sector will remain a key sector beyond 2020 in terms of the potential for achieving energy savings, in particular by improving the thermal performance of buildings. The Regional Energy Centre measure is one of the most important measures to meet energy efficiency targets. Overall, the focus is mainly on the renovation and insulation of existing buildings, or the change to greener heating. Green building itself is not specifically defined.

III. RIS3 National strategy: research and innovation strategy for smart specialisation of the Slovak Republic 2021-2027 highlights five domains:.

Domain 1: Innovative industry for the 21st century

Domain 2: Mobility for the 21st century

Domain 3: Digital transformation of Slovakia

Domain 4: Healthy society

Domain 5: Healthy food and environment

The priority of sustainable energy is not defined separately, but it is present in partial so called principles in the domains 1,3 and 4.

Priority area 1-4: Increasing energy efficiency in the economy

Priority area 1-5: Efficient waste management

Priority Area 1-6: Energy Security of the Slovak Republic

Priority area 3-3: Intelligent energy systems

Priority area 5-4: Sustainable use of natural resources (soil, water, air, biodiversity, ecosystem)

While it is true that RIS3 does not specifically focus on the building and construction industry, the principles outlined in RIS3 can still be applied to the field of green building from the point of view of energy efficiency and intelligent energy systems. Green building aligns with broader sustainability and innovation goals, which are rather central to RIS3 national strategy of Slovakia.

IV. Regional innovation strategy of the Košice region, while not prioritizing sectors or industries fitting to the smart specialization concept, still plays a significant role in fostering innovation in the region. Two significant entities within the strategy are:

The Regional Innovation Center of the Košice Region (implementing a regional innovation strategy and stimulating the development of an innovation ecosystem; developing talent in secondary schools, acceleration programmes for start-ups and helping SMEs improve their international business potential, <https://ickk.sk/>)

The Cassovia New Industry Cluster (an association of legal entities from the public and private sector, the main goal is to create a new, knowledge-based industry in the region of Eastern Slovakia <https://cnic.sk/en/>)

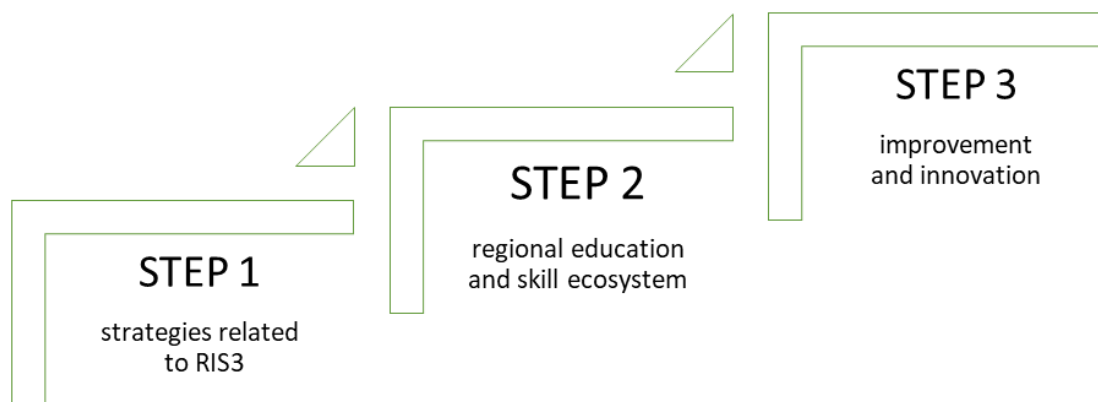
V. Innovation Partnership Center: The COVE is aimed to cover the broader NUTS II region of Eastern Slovakia, including also Prešov self-governing region. The main prospective partners would be Innovation Partnership Center in Prešov and Prešov regional government. Currently, the Prešov region does not have a specific innovation strategy in place, but we can rely on the main strategic document of the region to coordinate our activities.

Summarising the strategic framework in Slovakia, the KSK Innovation Centre (ICKK) can play a crucial role as a strategic partner of the Centre of Vocational Excellence (COVE), to enhance talent development, particularly at the secondary school level.

2.2 Fitness Analysis

The fitness analysis aims to assess the extent to which the VET/COVE center in Slovakia aligns with the strategies outlined in the Regional Strategy for Smart Specialization (RIS3).

The analysis consists of 3 steps.



- ✓ **STEP 1** The first step focusses on identifying the course, activities and strategies related to RIS3 priorities in Slovakia.
- ✓ **STEP 2** The second step defines the study branches, training programs, and activities offered in Slovakia including specific sectors, secondary schools, universities or areas that are considered crucial for the green building sector.

- ✓ **STEP 3** The third step is related to evaluation of possible improvement and innovation and it is based on the identification of gaps and opportunities in green building sector.

STEP 1 The first step focusses on identifying the course, activities and strategies related to RIS3 priorities in Slovakia.

The most important document is **National strategy: research and innovation strategy for smart specialisation of the Slovak Republic 2021-2027**

<https://www.mirri.gov.sk/wp-content/uploads/2018/10/Research-and-innovation-strategy-for-smart-specialisation-of-the-Slovak-Republic-2021-2027.pdf>

The priority of sustainable energy is not defined separately, but is present in the principles of all five priorities of the strategy.

Priority area 1-4: Increasing energy efficiency in the economy

Priority area 1-5: Efficient waste management

Priority Area 1-6: Energy Security of the Slovak Republic

Priority area 3-3: Intelligent energy systems

Priority area 5-4: Sustainable use of natural resources (soil, water, air, biodiversity, ecosystem)

Supportive strategic documents: Integrated National Energy and Climate Plan of Slovakia for 2021-2030

Regional innovation strategy of the Košice region (in Slovak): <https://ickk.sk/en/>

The strategy does not prioritise sectors.

Institutions: Cassovia New Industry Cluster is an association of legal entities from the public and private sector, the main goal is to **create a new, knowledge-based industry** in the region of Eastern Slovakia: <https://cnic.sk/en/>

It can be concluded that strategic documents and institutions offer a certain basis for the development of green building practices in Eastern Slovakia. However, a critical assessment shows that there is a lack of greater concreteness, necessary for effective cooperation to bring green building more to the forefront of the regional innovation agenda. The realisation of a more sustainable built environment in Eastern Slovakia requires a more consistent and coordinated approach and therefore key activity is needed to push green building into strategic plans and its financing.

STEP 2 The second step defines the study branches, training programs, and activities offered in Slovakia including specific sectors, secondary schools, universities or areas that are considered crucial for the green building sector.

Identification of the regional education and skill ecosystem

- *Secondary schools Košice, Slovakia*

In the context of green buildings with a focus on low energy consumption and climatic conditions within the Košice region, there are vet schools that have a focus on the implementation of high-voltage wiring in all types of buildings in their curriculum. In the Košice region this is the SOŠ Kukučínová 23, Košice and within the region the SOŠ Technical Spišská Nová Ves, Michalovce.

The Secondary School of Electrical Engineering in Košice does not currently provide education for high-current electrical installation in buildings. Their current focus is on automation, information systems and specialisation for the future VOLVO car factory.

However, in terms of construction implementation in the Košice region, SPŠ stavebná is the only school that provides education for the implementation of construction objects under the study focus 3650 M - Construction. In this specialization, there is room in the professional subjects for education for the provision of construction of new construction objects, or adaptation of existing buildings to green buildings not only the building envelope, but also the roofs. The focus on the implementation of green buildings needs to be embedded in the national curricula, according to which the school curricula will be adapted. Teaching staff in several schools can be redirected to focus on green building education. Presently, the schools of interest lack a specific specialization in clean energy and green construction. The School of Civil Engineering has been suggesting a Space Planning major for years and, as part of the project, we recommend adding a Building Construction and Implementation major (covering residential and industrial aspects).

- *Universities study branches (all Slovakia):*

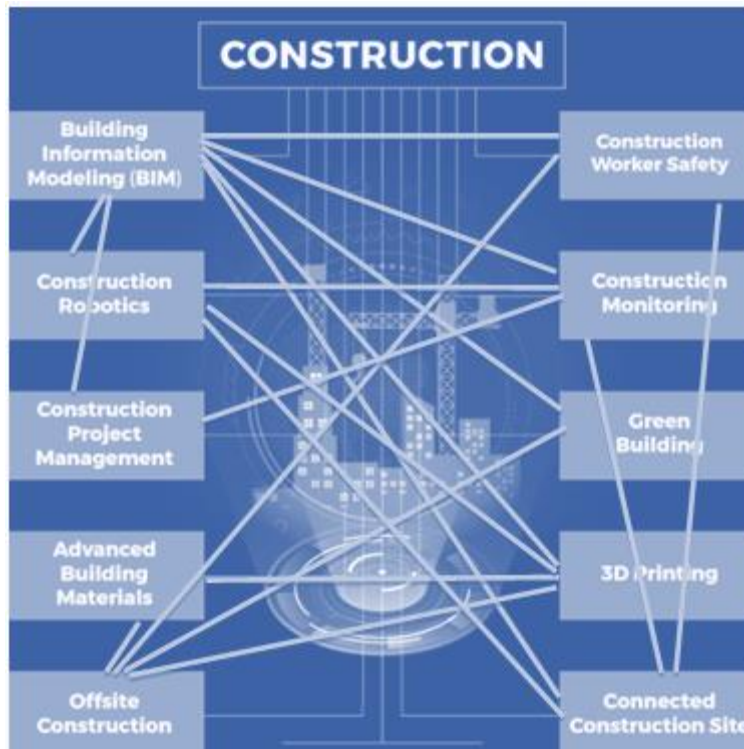
STU Bratislava has three relevant programmes related to RIS3 objectives: Technical equipment of buildings Energetic Machines and Equipment and Environmental protection technologies.

University of Žilina has study programme in Energy and Environmental Technology.

TUKE Košice is a key HEI in the region and has related content to RIS3 objectives at four different Faculties: Energy machinery and equipment (Faculty of Mechanical Engineering); Architectural Engineering - partial focus on Building services and HVAC (Faculty of Civil Engineering - SvF); Use of alternative energy sources (BERG faculty) and artificial intelligence, smart systems (Faculty of Electrical Engineering and Informatics).

Education is localized in several faculties, which indicates interdisciplinary approaches to the topic of green building. At the same time, it points to a low level of coordination, with the Faculty of Civil Engineering naturally taking a leading role.

Contribution of SvF TUKE to research and development of trends in innovations and digitization of the construction industry is defined in the following figure.



In addition to the University, educational courses are offered by other institutions.

Green Building Academy is an educational program intended for the professional public as well as experts outside the construction industry. The modules are a series of lectures dealing with various aspects of sustainability in the construction industry, basic definitions and principles of sustainability, as well as good examples from practice. The academy is organized under the auspices of The Slovak Green Building Council (SKGBC). (<https://www.skgbc.org/green-building-academy/>)

- **The Slovak Chamber of Civil Engineers (SKSI)** offers lifelong professional education in various forms primarily intended for members of the chamber who work in the construction industry. The most common forms include education for the needs of passing exams (authorization exams, professional competence exams for the performance of SV/SD and EHB). Various face-to-face forms of education are subsequently digitized and bring the basis of the online form, which is transformed into a platform educational portal called ERUDIO (<https://vzdelavanie.sksi.sk/erudio2020>). The Chamber covers the needs of several professions, including **technical services of buildings, technological equipment of buildings and electrotechnical equipment of buildings**;

At the same time, the Chamber tries to implement interdisciplinary education, which includes BIM education, lectures on the energy efficiency of buildings, construction safety, etc. Its

educational activities include general information for the performance of the profession, especially in the fields of law, economics, budgets, insurance, fees, contracts and ethics.

International companies operating in Slovakia implement education related to the products they offer, but this education does not belong to comprehensive education covering all aspects.

<https://dekpartner.sk/vzdelavacie-centrum>

https://www.xella.sk/sk_SK/skolenie

https://www.xella.sk/sk_SK/webinare

<https://www.wienerberger.sk/sluzby-a-podpora.html>

<https://www.isover.sk/izolacna-akademia-online-seminare>).

Similarly, education in the field of BIM design, which is a part of sustainable construction, is carried out. In Slovakia, courses are available for the public within specific software.

<https://www.academyx.eu/graphisoft-archicad-zaciatocnici-kurz-skolenie/>

<https://www.academyx.eu/autodesk-revit-pokrocili-kurz-training/>

<https://www.academyx.eu/nemetschek-allplankurz/>).

The courses are focused on using the software.

In Slovakia, several steps have been taken to develop a regional ecosystem of skills for green buildings, but not in a systematic way. There is room for improvement - expanding green building curricula, improving coordination between educational institutions - secondary and higher education institutions, external educational institutions and companies.

STEP 3 The third step involves a critical assessment of the learning and knowledge dissemination of the green building sector for the Eastern Slovakia region based on the findings from steps 1 and 2.

The following gaps and opportunities for improvement within the regional green building skills ecosystem are identified.

The evaluation of supply and demand points to a low alignment of education and training programmes in Slovakia, especially in the Košice region, with the country's research and innovation strategies, as well as with sustainability and green building practices. Although RIS3 does not have a separate priority for sustainable energy, the principles of sustainable energy are integrated into various priorities of the strategy, such as increasing energy efficiency, waste management and smart energy systems. This demonstrates the commitment to sustainability in the national strategy.

Education on **green building practices** is provided to secondary and tertiary schools in the country, related to green building practices and energy efficiency. Areas of employment for

graduates of these programmes are in the construction, energy and environmental sectors. So little of the European approaches have been translated into national priorities and into education. Slovakia reflects on the need for additional and lifelong education in the area of sustainability and current RIS3 trends only slowly or partially and not comprehensively.

To enhance the alignment of the educational system with the regional smart specialization strategies in Slovakia, it is necessary to develop and improve the system, update the curriculum, allocate resources effectively, and establish strategic partnerships. Regular reassessment of alignment and continuous improvement efforts will ensure that the VET/CoVE center remains responsive to the evolving needs of the labor market. Moreover, fostering collaboration between educational institutions, industry stakeholders, and research organizations can facilitate knowledge exchange and innovation. By leveraging emerging technologies and promoting entrepreneurship, the VET/CoVE center can contribute to the growth of high-value sectors and drive economic transformation.

Opportunities and ways of improvement:

1 Curriculum integration: Green building principles, including energy efficiency and sustainability, need to be integrated into the national curriculum for secondary schools and into the focus of universities. Changes in strategic priorities are needed to ensure that the curricula are aligned with the priorities outlined in RIS3.

2 Coordination and cooperation: the level of coordination between educational institutions is underdeveloped. Improved collaboration between high schools, universities, external education initiatives and companies is essential to create a coherent ecosystem of skills for green buildings.

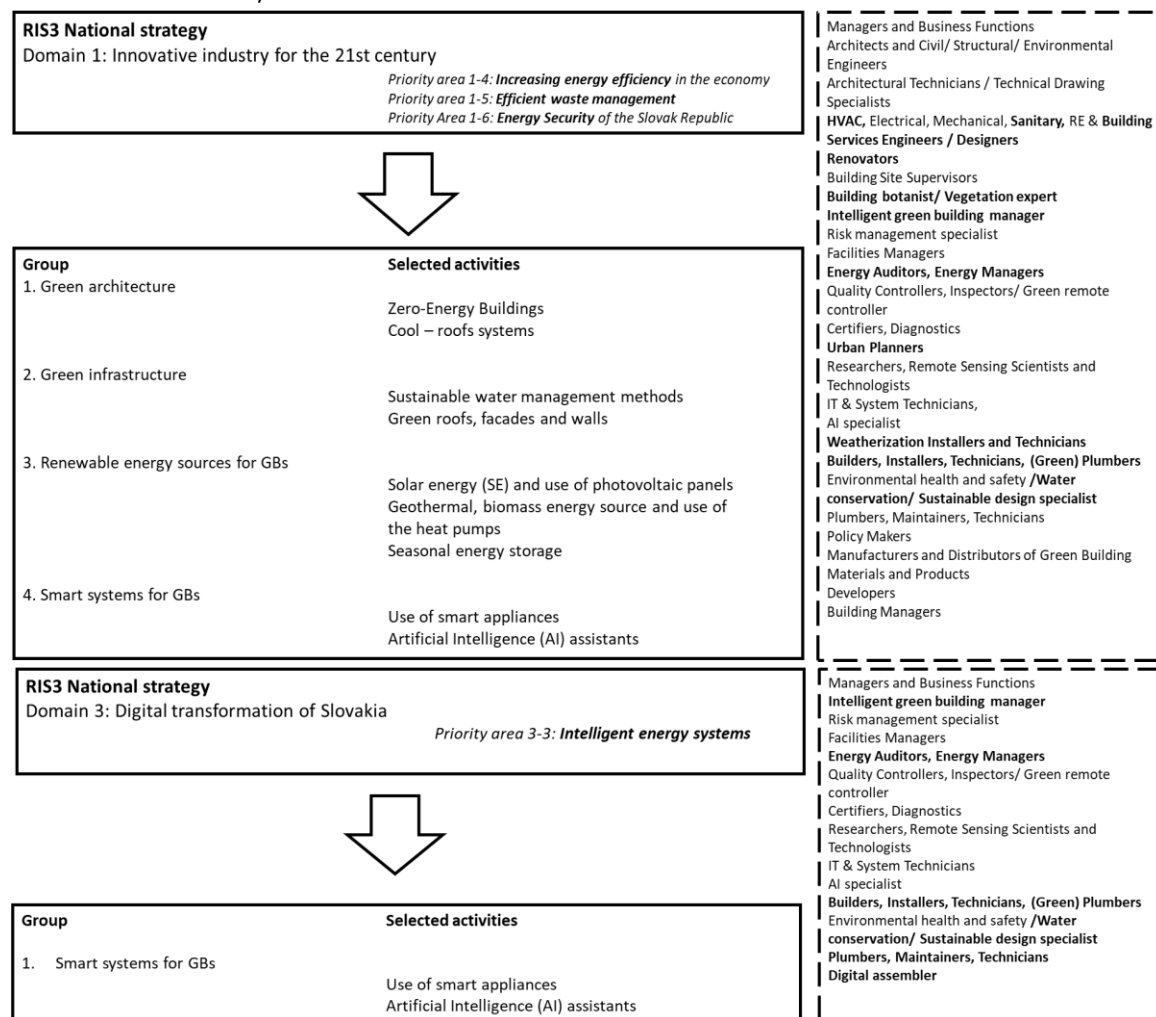
3 Specialisation of study programme in green building: there is currently a lack of specialisation in green building. To address this gap, the introduction of a specialisation in building construction and implementation, which would include both residential and industrial aspects and would be more attractive to female students, is under consideration.

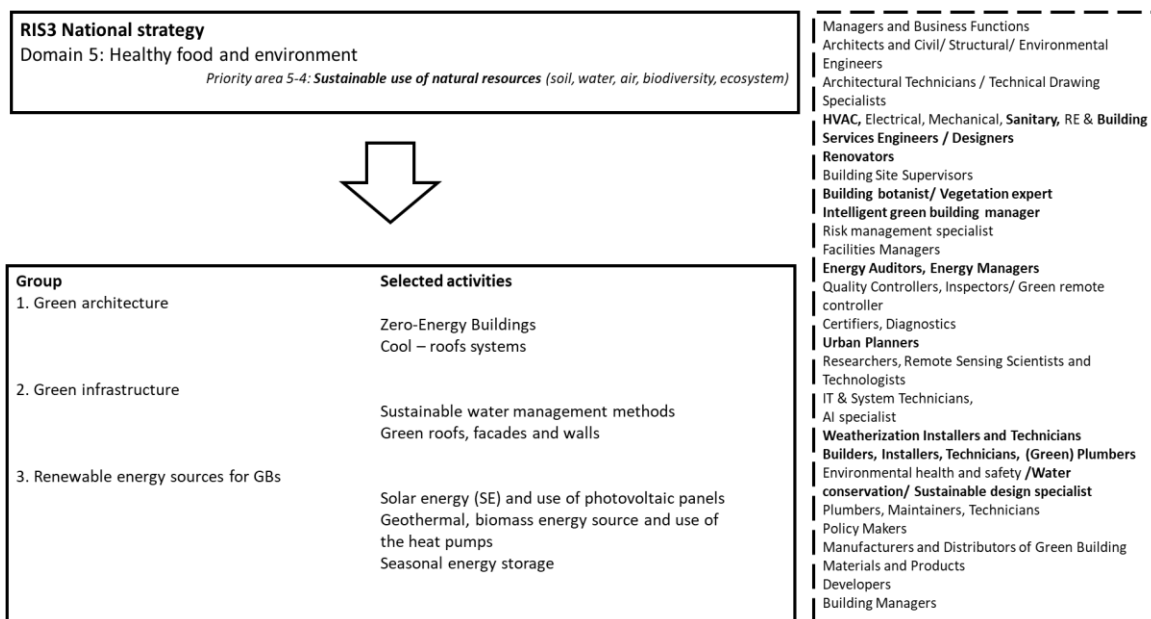
4 Comprehensive education: Lifelong professional education, especially in areas related to green building and sustainability, is offered by institutions such as the Slovak Chamber of Civil Engineers. International companies in Slovakia offer training related to their products, but these programmes may not provide comprehensive coverage of all aspects of green building. Coordination of student internships, coordination of such education would benefit future professionals in both the construction and energy industries. There is also opportunity to further integrate BIM education into the broader green building curriculum.

2.3 Future Trends and Alignment Analysis

Following tables show the comparison and analysis of the future technological trends in the green buildings and its groups and selected activities and RIS3 priorities in Slovakia.

Table 1 Future Trends/ RIS3





By understanding these trends in selected activities, we can assess the alignment between the technological advancements and the strategic goals of Slovakia in the field of green buildings. This analysis will help identify areas where Slovakia and specially eastern region can leverage emerging technologies and ensure that its sustainable building energy sector remains competitive and aligned with national objectives.

CoVE dimension can establish excellence in teaching and learning by training teachers on their technical competences by doing internships in companies or in joint research hubs; innovative learning methods (including MOOC's, simulators, virtual reality, Artificial Intelligence) can be developed in cooperation with partners.., teachers can update their pedagogical competences and in particular their digital skills including those necessary for online and distance learning., they also offer the opportunity for international (virtual or personal) mobilities of students and teachers.

Methodology of alignment (activities):

1. **Raise awareness and stakeholder engagement** of the forthcoming COVE, achieve the involvement of regional stakeholders active in the implementation of innovation strategies (IC KSK, CIKE, CNIC, ministries) in order to understand their views and to get their input on the alignment of VET courses with regional strategies.
2. **Advocate for strategic changes in innovation strategies** to increase the emphasis on green building within the themes of sustainability and energy efficiency
3. **Focus on future green building professions:** career panel discussions and presentations of experts on emerging professions to gain insights into the emerging and future professions related to green building and sustainability and align strategies and education,

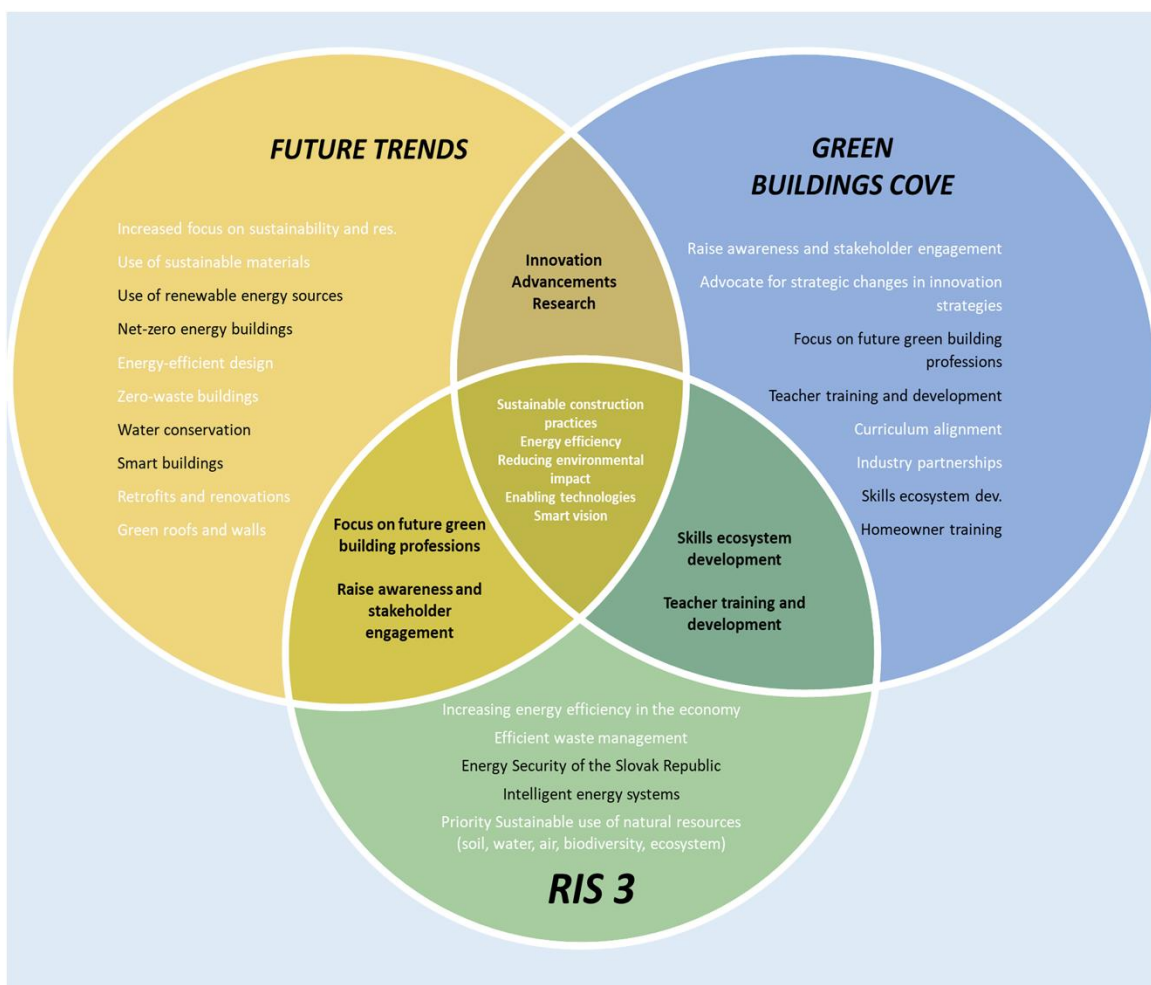
4. **Teacher training and development:** provide training and professional development opportunities for teachers, to develop green and digital skills and challenge based education.
5. **Curriculum alignment:** Raise awareness of innovation strategies and align, to the extent possible, the curricula and objectives of vocational education courses in secondary and higher education with the RIS3 strategy and the European strategy.
6. **Industry partnerships:** Promote partnerships with industry organisations and green building professionals to ensure that VET courses are aligned with industry standards and practices.
7. **Skills ecosystem development:** Map and create a regional skills ecosystem, to foster internationalization and knowledge transfer, promoting best practices.
8. **Homeowner training:** to develop training courses for home and building owners within the COVE to educate them about green building practices.

CoVE represents an integrated part of skills ecosystems contributing to regional development, innovation, smart specialisation, clusters strategies, and social inclusion, as well as to specific value chains and industrial ecosystems.

2.4 Visualization of the alignment

The green building sector, future technological changes, and the Regional Strategy for Smart Specialization (RIS3) are interconnected and have implications for the environment, social sphere, and economy. The green building sector focuses on sustainable construction practices, energy efficiency, and reducing environmental impact. Future technological changes play a crucial role in driving innovation and advancements in the green building sector.

The RIS3 aims to promote regional development by identifying key areas of specialization and fostering collaboration between different stakeholders. In a Venn diagram, we can observe overlapping areas that identify the common ground between the green building sector, future technological changes, and RIS3 strategies. This visualization helps highlight the potential synergies and opportunities for promoting Vocational Education and Training (VET) offerings that align with the goals of sustainable development, innovation, and regional growth. RIS3 strategy does not specifically focus on the (green) building and construction industry but can still be applied to the field of green building from the point of view of energy efficiency and intelligent energy systems.



Green building trends

Increased focus on sustainability and resilience	Use of sustainable materials
Use of renewable energy sources	Net-zero energy buildings
Energy-efficient design	Zero-waste buildings
Water conservation	Smart buildings
Green roofs and walls	Retrofits and renovations

VET offerings

HVAC, Sanitary, RE & Building Services Engineers / Designers	(Green) Builders, Installers, Technicians, Plumbers
Renovators	Weatherization Installers and Technicians
Building botanist/ Vegetation expert	Water conservation/ Sustainable design specialist
Intelligent green building manager	Smart Urban Planners

Energy Auditors

Energy Managers

VET Offerings encompass vocational education and training programs that focus on cultivating skills and competencies in the sustainable energy sector. These programs feature a diverse range of roles and job titles that are aligned with emerging trends and RIS3 strategies. Notable positions include HVAC, Sanitary, RE & Building Services Engineers/Designers, (Green) Builders, Installers, Technicians, Plumbers, and more in the future. As the sustainable energy job market continues to expand, there is an increasing demand for proficient individuals who possess the necessary training, knowledge, and awareness to foster a secure and productive environment. Consequently, numerous governments, companies, and industry organizations are actively developing comprehensive educational and skills training initiatives to address the challenges associated with workforce transition. By creating VET in these trends, individuals can gain valuable insights that enable them to leverage their existing technical expertise in shaping sustainable energy policy, conducting research, and making informed investment decisions.

2.5 Proposed Changes in VET education and training

To effectively implement and modernize the **green building sector**, it is important to focus on training programs that provide hands-on experience with green technologies. This challenge (problem) based learning, apprenticeships, internships, and on-the-job training opportunities (OECD, 2020). To conclude, partnerships between industry leaders and educational institutions can help ensure that VET/ CoVE courses are up to date with the **latest trends and technologies in green building** construction and maintenance and will prepare well skilled professionals/ workers to fill **the gap** in the **green building sector**.

In addition to practical experience with green technologies, effective upgrading of the green building sector requires a range of educational approaches. Entrepreneurship education, problem-based and problem-solving learning, as well as interdisciplinary training covering construction, energy, digital technologies and the environment are important elements. These innovative educational methods foster a dynamic and adaptive workforce that is equipped to address the complex challenges of sustainable construction.

The focus on green buildings needs to be embedded in national curricula, suggesting that there is scope for improving the integration of sustainability and green building themes in the curricula of vocational secondary schools and universities, emphasising the need for future occupations.

There are currently various initiatives, including online seminars and educational portals, dealing with topics such as sustainability, BIM (Building Information Modelling) and energy efficiency.

International companies operating in Slovakia offer training related to their products and services,

but this training may not comprehensively cover all aspects. This points to the challenge of creating education specific to sustainable energy and green building. In doing so, it is important to note that the difficulty stems from the need for interdisciplinary education covering areas such as BIM design, green buildings, energy efficiency, building safety, digital devices, and many others, with a future-oriented focus on research, innovation and sustainability, with a particular emphasis on the Košice region. Current initiatives to integrate green building practices, energy efficiency and interdisciplinary education into the curriculum in collaboration with companies, associations, building owners are resulting in the need to create new courses and study programmes as for example: Blue green infrastructures in Smart cities , Green Buildings, Urban Planning and Smart Cities, Sustainable Energy, Innovation green management, project management and interdisciplinary problem-solving.

2.6 Best CoVE Practices in the country

Based on a telephone conversation with the National EQAVET reference point in Slovakia (Mr. Cuvalová), the State Institute of Vocational Education (ŠIOV) is a directly managed organization of the Ministry of Education, Science, Research and Sports of the Slovak Republic. During the conversation, it was revealed that they are not aware of any Centers of Vocational Excellence (CoVEs) mapped in Slovakia. Although they had heard about us once, they expressed interest and conducted a promotion. They will provide further information if they discover any additional details. According to the European Commission data, our proposed CoVE is currently the only CoVE in the Slovak Republic. As a result, we do not have access to established best practices within Slovakia.

Vocational Education and Training Centres (VET Centres) in Slovakia are already part of vocational secondary schools, practical training centres, school management or vocational practice centres. These COVs are active in the field of vocational education and training. If a school has a school-based practical training facility with a different location, this facility is referred to as a "VET Satellite Centre". The operation of a school as a COV or its possible school facility is a guarantee of the quality of VET, as it takes into account cooperation with organisations, material and technical provision, and the requirements of employers. There is therefore an opportunity to build on existing infrastructure and to create centres of excellence also by linking secondary and higher education institutions with other partners.

The Ministry of Education, Science, Research and Sport of the Slovak Republic has launched a call for proposals in 2021 to support excellence in VET education for the creation of centres of excellence in vocational education and training (VET) in 2021 and has selected 17, but this is funding to improve the quality of existing vocational education and training in secondary vocational schools. It is a call that is complementary to the larger COVE projects in the European Union.

In addition, there are strong courses on sustainable energy and green building at Slovak universities.

1. The Slovak University of Technology in Bratislava provides a Solar Energy Technician course covering photovoltaic and solar thermal systems, energy efficiency, and maintenance.
2. The Technical University of Košice offers a Sustainable Energy Engineering course on sustainable energy systems, energy management, and environmental engineering.
3. The University of Žilina has a Renewable Energy Sources course introducing solar, wind, hydro, biomass, and geothermal energy.
4. The Slovak Green Building Council offers a Green Building Professional course focusing on green building principles, energy efficiency, and certification systems.
5. The Academy of Fine Arts and Design in Bratislava provides a Sustainable Architecture and Design course covering sustainable design concepts and practical projects.
6. The Faculty of Civil Engineering at the Slovak University of Technology in Bratislava offers an Energy Efficient Buildings course covering insulation, ventilation, lighting, and energy performance.
7. The Faculty of Horticulture and Landscape Engineering at the Slovak University of Agriculture in Nitra provides a Green Roofs and Walls course on vegetated surfaces and biodiversity.

2.7 Conclusion

Vocational education and training programs prepare people for work and develop worker's skills to remain employable and respond to the needs of the green transition. VET programs offer accessible short-term training, certificates, and degrees that can benefit many workers by providing in-demand skills (EC, 2023).

By considering proposed changes and trends alongside vocational education and training programs, individuals can position themselves as key contributors to the sustainable energy transition while capitalizing on emerging opportunities.

In conclusion, integration into the regional innovation system is essential for COVE in the field of green building in Košice, Slovakia, which is in line with the strategic innovation objectives of the region and the country. The trend analysis allowed to assess and improve the alignment between technological advances and Slovakia's strategic objectives in the sector. The activities of the Centre of Vocational Excellence (CoVE) are expected to play a key role in improving teaching and vocational education. It offers opportunities to develop technical competences through internships and innovative learning methods such as MOOCs, simulators, virtual reality and artificial intelligence. In addition, it promotes the enhancement of pedagogical and digital skills for online and distance learning, thus encouraging international mobility of students and teachers. Building on existing infrastructure and strengthening partnerships between secondary and higher education institutions can further enhance the quality of vocational education and training in green building.

The proposed alignment methodology includes:

- raising awareness among regional stakeholders,
- promoting strategic changes in innovation strategies,
- focusing on future green building professions,
- ensuring teacher training and development,
- aligning curricula with innovation strategies,
- promoting industrial partnerships,
- creating a regional skills ecosystem.

Establish partnerships with firms, technology parks, and industry to provide students with opportunities for research and development internships, enabling them to contribute to RIS3-related projects will be represented in our first **CoVE in Slovakia in the green building sector** as:

- a reference point for everyone believing in **green innovation**,
- a meaningful and fair relation between **people, industry, and environment** is successfully restored,
- a place where innovation and cooperation constitute the foundation to create a dynamic **ecosystem of education and science**.

Several institutions in Slovakia already offer courses and programmes related to COVE core activities. These proposed COVE actions aim to strengthen the link between education and regional strategies. The visualisation of the coherence between the green building sector, future technological change and the Regional Intelligent Specialisation Strategy (RIS3) clearly highlights potential synergies and opportunities. Although RIS3 may not focus specifically on the (green) building and construction industry, it can still be applied to this area, with an emphasis on energy efficiency and smart energy systems.

The proposed changes in VET emphasise practical experience with green technologies, problem-based learning, internships and on-the-job training. Entrepreneurship education and interdisciplinary training are important elements in preparing a dynamic and adaptable workforce. In summary, aligning education with regional strategies and emerging trends in green building is essential to meet the demand for skilled professionals in the green building sector and to promote innovation and sustainability in Slovakia.

3. Lazio Region, Italy

3.1 Smart Specialisation Strategies

The Italian National S3 identifies the main market sectors, as well as the associated technical competences and services provided, to support research and innovation. Within these sectors, Construction and Assembly, Environment and Smart City are among the most important, as demonstrated by almost twenty ongoing programmes of European Digital Innovation Hubs (EDIH). The impact on sustainable energy is demonstrated by focuses and associated goals of National RIS3 and EDIH, where Building and Construction Industry (BaCI) play a crucial role, particularly we see in the European policy framework of Sustainable Energy and associated targets. This field is integral to the overarching green and digital transition, marked by a growing embrace of public investments and policy measures by economies to advance a more sustainable path for growth.

Moreover, the technical competences selected as more relevant for Italy are strongly related with innovation in BaCI: Cyber Physical Systems, Artificial Intelligence and Internet of Things. Buildings hold a pivotal position in the pursuit of climate change goals. Enhancing energy efficiency within the building sector necessitates the creation and deployment of cutting-edge, dependable technologies. Consequently, there exists a strong interconnection between the energy industry and the building and construction sector, aiming to drive advancements in performance-based digital design and sustainable construction practices.

Lazio Region is part of the Italian regions registered in the RIS3 strategies and one of the leading territories for the country development. The region focus on two S3 thematic platforms: Industrial modernisation in *Digitalisation and safety for Tourism partnership*, and Energy in *Sustainable Building partnership*. The latter is strongly correlated with trends on technological changes and their impacts on qualifications (see D.3.1 – Italy) as the main objectives is to “create an alliance between European regions to boost new markets and take advantage of regional opportunities for specialisation in eco-construction, integration of renewable energy and energy efficiency in buildings and cities”. S3 priorities demonstrates the importance of a VET specifically oriented to the BaCI local labour market. They focus on new technologies for the security of citizens and the safeguard of the territory and new technologies and solutions for energy saving and environmental sustainability. Sectors involved in these innovations are various and include New technologies and solutions for monitoring and preventing disasters; Disaster resilience; New technology applications and solutions for environmental sustainability in the construction; Energy; Smart buildings; Development of green companies; Environmental services; Smart grids.

Research and innovation capacity, SMEs support, stakeholder involvement, international network and sustainable development targets are all supported by the associated local digital innovation hubs.

The implementation of the RIS3 in the Lazio region entails a collaborative process involving key stakeholders, regional authorities, industry representatives, research organizations, and educational institutions. This collaborative approach ensures that vocational education and training (VET) programs are in sync with the region's strategic plan and emerging needs in the labour market and associated skills.

Furthermore, the execution of the RIS3 strategy encompasses a range of policies and investments aimed at fostering the development of priority areas. These policies and investments are consistent with the European Union's research and innovation agenda and emphasize investments in innovative initiatives. By giving precedence to investments in sectors with substantial growth potential and job creation prospects, the RIS3 approach contributes to aligning VET programs with the evolving needs of the labor market and the emerging industries across Lazio.

In Sardinia the Smart Specialization Strategy (S3) assume a role key in the next programming period (2021-2027) as well to create development and employment through research and innovation based on the resources and skills present in Sardinia.

As established by DGR No. 32/29 of 07/29/2021, in which it outlines the guidelines for the revision and updating of the Strategy of Sardinia's Intelligent Specialization Strategy, The Regional Center for Programming, responsible for governance, supported by Sardegna Ricerche, is currently engaged in the revision of the Strategy of Intelligent Specialization (S3) according to the new criteria and thematic objectives established by the EU in Programming 21-27.

The focus of the S3 revision is in removing the bottlenecks that prevent the broader production system, from benefit from innovations especially those made in previous programming, so that a smart, sustainable and lasting development of Sardinia.

The definition of the S3 is the condition behind the approval by the by the EU of the Operational Program OP ERDF 21-27 regarding R&I, digitalization of enterprises and competitiveness.

The Areas of Specialization are six: Biomedicine, ICT, Aerospace, Culture, tourism and environment, Agro-industry, Smart grids for efficient energy management.

The area of interest is Smart grids then it is examined this one.

Area of specialization: Smart grids for efficient energy management. Development of a new model for energy management

The energy sector boasts the widespread presence of know-how and research facilities, including: the Biofuels and Biomass Laboratory, the Energy Efficiency Laboratory, the Electrical Energy Laboratory, the Concentrating Solar Technologies Laboratory, and hydrogen from RES. Innovation in energy, with enabling technologies in distributed control and management systems and communication technologies between components and systems (internet of things) also offers strong potential for cross fertilization.

The main investments made include:

The creation of a Renewable Energy Platform articulated in laboratories, equipment and expertise. It carries out research and technology transfer, promotion, dissemination and training activities towards other public administrations and the territory. The Platform's laboratories are: electric energy; biofuels and biomass; concentrating solar power and hydrogen from renewable energy sources (RES)

the construction of two experimental RES plants based on small-scale solar thermodynamic technology for micro-grid experimentation in two municipalities Berchidda and Benetutti in which an innovative energy management model is also being tested: the two municipalities, the only case in Italy, are owners and operators of the grid.

The transformation of traditional electricity grids into smart grids opens the market to new players and stakeholders and is connected to other sectors, such as the green economy and sustainable energy efficiency construction.

The overall goal is the efficient management of different energy sources (renewable and fossil) and their integration.

Through this regional strategy, other objectives are also achieved:

- strengthening the regional system in terms of innovation and collaboration between companies and research facilities
- realization of less expensive and more effective systems of energy production and management, using renewable sources and reducing CO2 emissions
- improved ability to deal with emergencies
- solutions to connect energy generators with storage systems and public distribution networks
- ICT solutions to manage energy outages caused by the use of renewable sources, with the creation and implementation of forecasting and management models to ensure quality service
- enhancement of human capital skills
- improvement of the island's quality of life and attractiveness.

The Region of Sardinia has invested in the implementation of close interaction between universities, industry and public agencies to create the set of cross-cutting and vertical skills useful for developing the new energy management model [1].

[1] S3 Regione Sardegna: <https://s3.regione.sardegna.it/s3/programmazione-2021-2027>

3.2 Fitness Analysis

Programming 2021-2027

The European Regional Development Fund (ERDF) support 5 Operational Strategic Objectives (OPs) posed as challenges the EU is currently facing, such as supporting recovery from the covid-19 pandemic, green and digital transitions and supporting competitiveness growth.

- PO1 support growth-oriented research and innovation for economic development, digital connectivity and digitisation of society and the productive structure, and business competitiveness.
- PO2, among others, support the protection and preservation of nature, biodiversity, and green infrastructure (including in urban areas) and the reduction of all forms of pollution; it will also support sustainable urban mobility as part of the transition to a zero-emission economy.
- PO3 support a more connected Europe with strategic transport networks.
- PO4 support the promotion of socio-economic inclusion of marginalised communities, low-income households and disadvantaged people, and will also support the inclusion of migrants.
- PO5 through the integrated intervention of territorial development strategies, promote and provide support for social and environmental, integrated and inclusive economic development as well as cultural heritage, sustainable tourism and security in non-urban areas.

The ERDF 2021-2027 pursues POs by providing financial support to:

- investments in infrastructure;
- applied research and innovation, including industrial research and experimental development;
- investment in access to services;
- productive investments in Small and Medium Enterprises (SMEs) and investments aimed at creating new jobs and preserving existing ones;
- tangible, intangible and software investments;
- network services, cooperation and exchange of experience between innovative clusters, enterprises and between these and public and private research centres.

Assuming that the funding framework is not yet defined at the moment, it is possible to indicate a rough estimate according to which the **Sardinia Region** has twice as many resources as in the past programming period (2014-2020).

With DGR 38/2 of 21 December 2022, the Regional Council took note of the Sardinia ERDF Regional Programme 21-27, amounting to over 1.5 billion euro for the 2021-2027 programming period.

The Programme, approved by the European Commission with Decision C (2022)7877 of 26 October 2022, has a financial allocation almost doubled compared to the previous programming cycle - from 930.9 million in the 2014-20 ERDF ROP to 1.581 billion in the ERDF ROP 21-27 - 70% financed by EU resources and 30% by national resources - and is distributed over 6 main Priorities tracing the trajectories towards a sustainable transition, in accordance with the Regional Strategy for Sustainable Development and the objectives of Sardinia 2030: **smart competitiveness, digital transition, green transition, sustainable urban mobility, a more social and inclusive Sardinia, integrated urban and territorial development.**

Among the strategic choices identified by the Region, 'Green and Digital Transition' and 'Smart Competitiveness' are allocated the largest resources, about 1 billion in total, covering two-thirds of the Programme.

The UN 2030 Agenda for Sustainable Development, launched in 2015 by the UN General Assembly, endorsed by 193 UN member states and supported by other institutions such as the European Union (EU), constitutes the main strategic reference for policies aimed at significant 2030 targets.

The EU strategy, the European Green Deal, is also based on the UN 2030 Agenda and constitutes the natural framework within which the objectives of the Structural Funds for the 2021-27 programme cycle are defined.

The Region of Sardinia seized this opportunity by putting the 2030 Agenda at the basis of a sustainable development bringing widespread wellbeing, and in October 2021 (D.G.R. no. 39/56 of 08 October 2021) approved its own Regional Strategy for Sustainable Development (SRSvS), as the outcome of a pathway started in 2018 (D.G.R. no. 64/23 of 28 December 2018), with the involvement of regional and local institutions and civil society. The SRSvS of Sardinia, sets sustainable development objectives within the framework of its economic, social and environmental programming.

The process of constructing the Strategy has led to the Smart Specialisation Strategy being considered crucial for the approach to be taken to the declination of the Prosperity and Planet pillars in the SRSvS and to strengthen the competitiveness of our production system. Explicit references to S3 or its vision are found throughout the SRSvS and especially in the objectives of Sardinia + Smart, Sardinia + Green and Sardinia + Social.

The strategic objectives strongly connected with S3 are those of the "Smarter Sardinia" priority theme, aimed at: strengthening the competitiveness of enterprises by facilitating sustainable organisational and product innovation processes; supporting research and development; and fostering the connection between enterprises, research centres, universities and higher education institutions.

The Region has therefore adopted the European perspectives for the transformation of S3 into S4: Smart Specialisation Strategy for Sustainability.



Virtuous interaction between the Regional Sustainable Development Strategy 2030 of the Region of Sardinia, the regional S3 and the Regional Development Plan

1. Alignment assessment and gaps identification in education and training;

Training in the S3 specialisation areas in the 2014 - 2020 POR FSE programming of Sardinia

From 2014 to 2020, Sardinia's Smart Development Strategy (S3) was supported by the European Structural and Investment Funds (ESIF) through specific public notices. These initiatives aimed to foster research, innovation, and job creation across various sectors, creating opportunities for cross-sector collaboration. Two key public notices facilitated integrated training and entrepreneurship initiatives aligned with the S3 Areas of Specialisation (AdS). The first notice, under the ROP Sardinia ESF 2014-2020, focused on promoting job creation in sectors with growth potential, involving local development policies and vocational training. It aimed to enhance professional skills and establish or bolster enterprises in emerging sectors like Green & Blue Economy, ICT, Green Chemistry, and Tourism, among others.

Three distinct lines of action were outlined:

1. Strengthening professional skills and job placement (Line A1, A2, B).
2. Qualification and retraining for the long-term unemployed (Line B).
3. Supporting pathways for business startups and self-employment (Line C).

Each line targeted specific beneficiary groups, such as young people, women, and the long-term unemployed, allocating financial resources and projects accordingly. For instance, Line

A1 catered to young individuals up to 35 years old, with at least 45% being women, focusing on Smart Grids for intelligent energy management.

Additionally, a second public notice, POR FSE SARDEGNA 2014-2020, emphasized the integration between local participatory development and employment in the Green & Blue Economy. It comprised two main lines of intervention:

1. Promoting self-employment and entrepreneurship.
2. Realizing training courses for competence certification and awareness of funding opportunities.

These lines were further divided based on territorial areas: rural, coastal, and others, engaging Local Action Groups (LAGs), Fisheries Local Action Groups (FLAGs), and other territorial representatives. Each line had specific financial resources allocated and aimed to benefit different groups, including the unemployed, workers in crisis situations, and individuals above 45 or with low schooling. The focus was on skill upgrades, job placements, and fostering entrepreneurship aligned with the Green & Blue Economy sectors.

In summary, these initiatives sought to bridge skill gaps, empower various demographic groups, and foster entrepreneurship within the context of Sardinia's Smart Development Strategy, aligning with the European Union's goals for regional development and innovation.

By Resolution no. 33/9 of 30.06.2015, its annexes (Annex A and Annex B), and subsequent resolutions, the Regional Administration approved the structure of the Regional Directory of Professional Figures (RRFP), and at the same time approved the structure of the new Regional Directory of Qualification Profiles (RRPQ), identifying the latter as the sole reference in Sardinia for the recognition of learning however acquired and for the transparency of the qualifications issued, which are therefore valid throughout the country.

In Sardinia the ESF+ Regional Programme 2021-2027 pursues the objective of improving the employment situation, with a special focus on young people and women, enhancing the educational offer, combating school drop-out and enriching the offer of social services for the most fragile segments of the population.

The Programme has a total budget of EUR 744 million, divided into the following areas

Employment: 32.5%

Education, training and skills: 24.5%

Inclusion and the fight against poverty: 27%

Youth employment: 16%.

The Sardinia ESF+ 2021-2027 Regional Programme devotes an entire priority to youth employment, allocating 16% of total resources against a regulatory requirement of 12.5% of resources. **The issue of gender equality is addressed in a two-pronged approach:** measures dedicated exclusively to Sardinian women to promote the growth of female employment and strong support for care responsibilities to eliminate gender segregation. Also new are the territorial strategies in agreement with the other regional programmes, financed by the ERDF and the EAFRD, which will make the interventions even more effective.

The low level of education of the population, insufficient human capital in companies to face the new challenges of change, the phenomena of company crises also as a result of the pandemic with workers expelled from production contexts and the transitions between work-work and school-work call for the need to invest in continuous and lifelong learning.

In this context, it is also important to strengthen services for the validation and portability of skills acquired in formal contexts, skills acquired in formal and informal contexts by implementing the Ministry of Labour Decree of 5 January 2021 on the National Skills Certification System.

In the context of linkage and cooperation with the economic-productive world is the promotion of technical-vocational training and non-academic tertiary training.

In connection with the interventions financed by the ERDF Regional Programme in Policy Objective (PO) 1, A Smarter Europe intelligent Europe, opportunities for collaboration between universities, research institutes and the local production world to support the dissemination of scientific and technological (STEM) skills at all levels, addressed in particular to women in order to defeat the gender gap in this area of education training and facilitate the dissemination and transfer of innovation between enterprises and research centres.

The Regional Programme will activate integrations, synergies and complementarities with the ERDF on measures that require structural changes particularly on the modernisation of services. It also contributes through the development of skills for smart specialisation and key enabling technologies, the training of researchers and networking and partnership-building activities between higher education institutions, universities and vocational training with the business system; about "Greener Europe", through support for the creation of green jobs and the new skills needed for a full implementation of the Green Deal Europe

Also important are measures to strengthen school and training guidance, which is crucial especially in the transitions to higher levels of education, including university.

The objective of raising the educational level of the youth population by promoting access to university and tertiary education and enhancing specialisations aimed at responding to the development objectives of the territory is also a priority element in connection with the actions envisaged in some national project such as FUTURA programme of the PNRR (Piano Nazionale di Ripresa e Resilienza).

The programmed actions are also complementary with the ERDF (OP 4), particularly regarding support for 'new millennium' schools, including laboratories for technological improvement, as well as for the strengthening of ITS (Higher Technical Institute), again for the component concerning technological laboratories.

Actions concerning integrated vocational training, apprenticeships, traineeships and ITS are also envisaged in synergy with the measures envisaged in the programme, to meet the needs of the production system, especially in strategic sectors for the regional economy (S3, internationalisation innovation), as well as to accompany the Digital and Ecological Transitions.

Higher education and research policies are programmed from the areas of the Smart Specialisation Strategy ensuring the contribution of the ESF+ to OP1 "a smarter Europe" and thus integration with the ERDF Programme 2021-27.

The transition from the world of training to the world of work is facilitated by the direct involvement of the world of production already during the training for the achievement of the EQF level 3 professional qualification of Operator. The Region has started the experimentation of training courses leFP fourth-year training courses for the attainment of the professional technician qualification. The leFP offer is homogeneous throughout the regional territory, in order to meet needs of the regional production system, thanks to a unitary system of training provision ensured by the vocational training agencies and professional institutes, agencies and professional institutes.

The actions selected to ensure the achievement of the objectives by way of example but not limited to, are:

- Measures aimed at countering gender stereotypes and stimulating the acquisition of knowledge in STEM subjects, starting from pre-school up to University;
 - Doctoral scholarships in connection with the business system in favour of the participation of women researchers in particular in the Green and Blue Economy and ICT;
 - PhD scholarships for projects strongly linked to the needs of enterprises, in strategic sectors for the regional economy (S3, internationalisation innovation, climate and energy transition and environmental, social and governance sustainability);
- Integrated vocational training interventions (three-year and four-year leFP and IFTS pathways) and support services to support participation (e.g: purchase or rental of digital devices and tools - PCs - tablets - and subscriptions for web connection etc.).

The target groups for measures under Specific Objective will be young people under 18 and young people aged between 18 and 35.

Among them, the main target groups will be:

- Women
- Inactive
- Holders of a secondary education diploma or a post-secondary education diploma
- Holders of a tertiary education diploma
- Disadvantaged persons [2]

[2] https://www.sardegnaprogrammazione.it/documenti/35_146_20220901092352.pdf

There are currently twelve profiles in the Construction Sector of the RRPQ (Regional Directory of Qualification Profiles) of Sardinia.

Two of them are specifically related to the energy and sustainability sector: "Tecnico dell'efficientamento energetico di edifici e impianti esistenti" (Technician for the energy efficiency of existing buildings and systems) and "Tecnico in Sistemi edilizi biocompatibili" (Technician in biocompatible building systems).

Since the chosen field of the Italian COVE is the energy efficiency of buildings, it is strategic to include all the qualification profiles present that, in different fields, contribute to the common goal of greater efficiency and sustainability of buildings. In fact, in these cases, although references to energy and sustainability are not made explicit in the standards in terms of knowledge, skills

and abilities, the training paths could include specific contents within the curriculum such as green building and energy saving of buildings.

In the RRPQ of Sardinia, these twelve profiles make up 55 ADAs (activity areas) of which at least 6 are already perfectly in theme with the focus of the Italian CoVE.

The RRPQ represents the regional reference standard for all Sardinian job market operators, i.e. the "dictionary" through which competences and qualification profiles can be made explicit for different purposes.

The repertory defines, in fact, the professional reference standards of the Sardinian territory against which the planning of the regional training offer takes place; it also represents a valid support for businesses, in the formulation of job offers and in the clarification of training and professional requirements, and for citizens, in the self-guidance phase and in the compilation of their CVs.

They are as follows and refer to the two abovementioned profiles, to which a third profile could be added, that of "Tecnico esperto nella progettazione e gestione di interventi strutturali" (Technician expert in the design and management of structural interventions), which has an interesting managerial and executive coordination focus.

Activities areas (ADA)

A9999246 Representation of building system energy situation
Recognise the technological and environmental components of the existing building envelope and plant system, understand the technical documentation and supply contracts, adopt the appropriate techniques and instruments for measuring the building plant system and produce a report of the analysis carried out
9999247 Energy performance improvement measures
Examining the energy situation of the building-plant system, examining the client's requirements, drawing up possible intervention scenarios on the building envelope and/or plant
9999248 Configuring technical solutions for improving energy performance
Analysing the interventions to be carried out, verifying the resources and primary energy sources available, identifying the main technologies/systems on the renewable energy market, elaborating hypotheses and technological solutions of the most suitable energy systems to be implemented.
9999249 Formulation of energy performance improvement plan
Identify and examine the different financing sources and incentive systems in force, formulate the plan of works.
9999425 Identifying the building's energy requirements and environmental impact
Acquire and analyse all information relating to the building intervention in order to identify the building's energy requirements and environmental impact
9999426 Drawing up a sustainable, energy-efficient building project
Carrying out the technical-economic feasibility study in order to elaborate the design of the executive work.

Recently the Autonomous Region of Sardinia published a Notice intended for VET providers for the planning of future courses *"PR SARDEGNA FSE+ 2021-2027 AL SERVIZIO DELLA DIGNITÀ. Decisione di esecuzione della Commissione C (2022) 6166 25.8.2022 Programma "PR Sardegna FSE+ 2021-2027" per il sostegno a titolo del Fondo sociale europeo Plus nell'ambito dell'obiettivo "Investimenti a favore dell'occupazione e della crescita" per la regione Sardegna in Italia. CCI 2021IT05SFPR013 Priorità 1 – "Occupazione" Obiettivo specifico ESO 4.1 a) Settore di intervento 134. Misure volte a migliorare l'accesso al mercato del lavoro.*

It is expressly stated in the Notice that its purpose is to finance training courses aimed at the certification of qualification profiles included in the Regional Repertoire of Qualification Profiles (RRPQ) responding to the skills needs expressed by employers in the regional context. The Qualification Profiles (PQ) certifiable in Sardinia, which "best respond to the needs of the regional production system, which may be the subject of applications for inclusion in the List referred to in art. 13 of the Public Notice", for a total of 78 FPs of the Appendix 2, comprehends also, in Building (Edilizia) sector:

PQ code 122 Construction worker ("bricklayer") [*Operatore edile ("muratore")*] EQF 3; PQ code 56270 BIM technician [*Tecnico BIM*] EQF 5; PQ code 120 Building design technician [*Tecnico del disegno edile*] EQF 5; PQ code 56134 Energy efficiency technician for existing buildings and installations [*Tecnico dell'efficientamento energetico di edifici e impianti esistenti*] EQF 5; PQ code 121 Construction site coordination technician ("site manager") [*Tecnico di coordinamento di cantiere edile ("capocantiere")*] EQF 5; PQ code 56278 Technician expert in the design and management of structural interventions [*Tecnico esperto nella progettazione e gestione di interventi strutturali*] EQF 7; PQ code 56227 Technician in biocompatible building systems [*Tecnico in sistemi edilizi biocompatibili*] EQF 6; PQ code 119 Technician responsible for building interventions [*Tecnico responsabile di interventi edili*] EQF 5.

Currently, the Regional Council, at the proposal of the Employment Assessor, Ada Lai, allocated ten million euro for employment policy and vocational training measures, of which eight million for the Sardinian Employment Fund Annuality 2022 and two million for the LavoRAS Integrated Multi-Fund Employment Programme Annuality 2023, for the publication of a notice for the launch of short training courses aimed at skills certification.

The resolution, moreover, provides another million for the scrolling of the ranking list of the public open call for the granting of aid to accredited training agencies (Annuity 2022-23 - 2024, Regional Law No. 22)

The response of the Department of labour, vocational training, cooperation and social security of the region of Sardinia (*Assessorato del lavoro, formazione professionale, cooperazione e sicurezza sociale della Regione Sardegna*) to the growing demand for professional figures in the green building sector seems adequate and updated to current market needs.

it is conceivable that in the next two years there will be even better alignment between the VET/CoVE center and the RIS3 strategies in the regional and supra-regional sphere.

The construction industry is quickly changing with digital technologies, although they are often not used effectively and widely. This makes it challenging for different professionals in the construction sector to handle the integration of the many new technological changes with traditional roles and processes.

The skills needed to be digitally competent change as digital innovations evolve and develop over time. Now, digitisation leads the innovations in the construction sector, yet a lack of digital literacy among employed workers can often be detected.

Increasing the development of a broader culture of existing digital technologies is a key goal for the new generation of professionals and construction enterprises related to energy sustainability in the building and construction sector.

2. Italian COVE activity (based on main goal and specific objectives);

3.3 Future Trends and Alignment Analysis

CIOFS FP has conducted in Sardinia some structured interviews in May and June 2023 on demand needs at regional and national level and the opportunities for specialized profiles in the future scenario, interviewing some experts holding key roles in the sustainable energy sector at regional level.

The aim was to identify current trends and regional strategies, identify regional or national good practices to produce a set of recommendations for VET centres to align their courses according to smart specialization strategies.

The results shows that development possibilities of the sector in Sardinia are very significant. Job placement rate -one year after graduation- in the local industry is high, next to 75 percent. Moreover, according to data, out of 100 jobs in such enterprises, training system provides only 40 percent at the moment. There is a shortage of more than 50 percent of manpower.

There is an aging building stock with poor energy performance that is a key business prospect for the entire sector. The ambitious and challenging European Directive, approved in March 2023, goes in that exact direction: "Reduce the energy consumption of buildings".

There are about 370,000 properties in Sardinia, only 19% of the properties have been upgraded in some way and to varying degrees (almost 3 out of 4 housing units were built before 1991, a year that marked an important breakpoint because the first national law L.10/91 regulating energy efficiency and energy production from renewable sources came into force). In addition, there are three regional specificities: first given Sardinia's location in a critical area, in the Mediterranean, there is the need to push even more on energy efficiency; given the scenarios and forecasts of rising temperatures there is the need to boost summer cooling; so it is crucial thermal insulation of buildings. Secondly in Sardinia the efficiency of photovoltaic systems is significantly higher.

Third point there are regional traditional knowledge to be considered, related to the circular economy; some supply chains, such as rammed earth (*ladiri* in Sardinian language), which

has great thermal insulation capabilities and products with recycled materials such as cork, hemp et al.

From the needs analysis there is a shortage of skilled labour and there is a shortage of training, the figures most in demand are "coaters" for thermal insulation, panel installers, solar thermal installers etc.

There is as well an increasing importance of developers and users of software and monitoring and control and building automation systems, such as domotics etc.

Consequently the digital transition, in addition to the ecological transition, represents an opportunity for the sector but knowledges and skills of the courses must be constantly adapted. Vocational education and training programs offer accessible, short-term training, perfect for training an up-to-date workforce.

The modernization of Vocational Education and Training requires the active involvement of all stakeholders, including policy makers.

In Sardinia as well as in Lazio the most notable and promising areas for further research and development in the sector includes:

Internet of things and smart building technologies

Sensory systems

Simulation, modelling and digital twins for energy efficient building design

Renewable energy integration with energy storage solutions

Virtual, augmented and extended reality

Location-based technologies

Interaction technologies

Artificial intelligence and cloud computing

Grid integration and energy management: demand response programs, vehicle-to-grid (V2G) systems, and microgrids

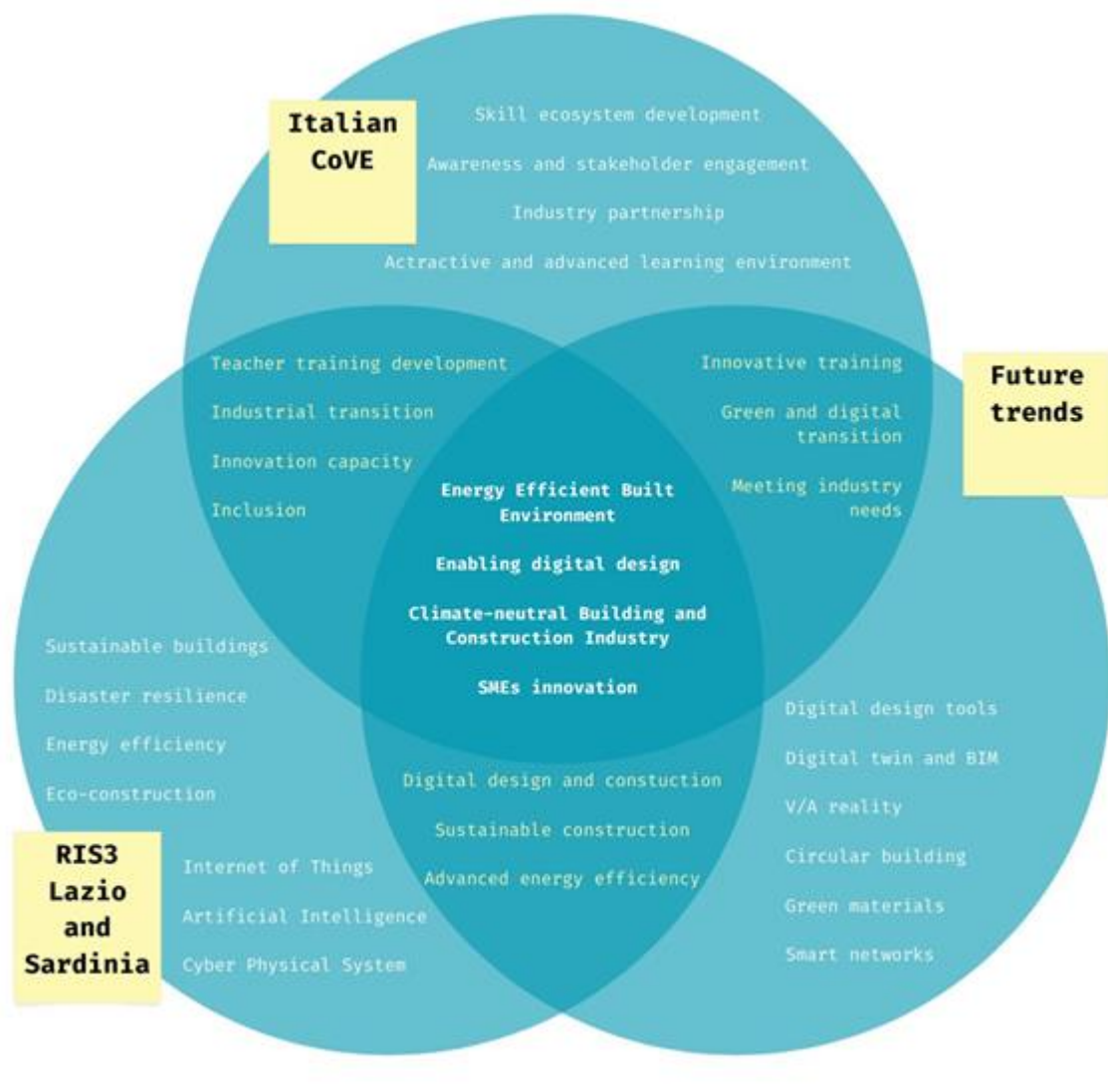
Circular building construction process and recycled or bio-based materials: together with advanced LCA methodologies and energy modelling tools.

Given these thoughts and notes, the recommendations are:

- Constantly, adequately and timely align the curricula with the RIS3 strategy and the European strategy.
- Develop curricula that respond to current and future labour market needs, based on regularly identified professional and training needs in the field of sustainable energy and energy efficiency in buildings.
- Update curricula promptly and regularly to ensure that they are adequate, up-to-date and responsive to evolving market needs and technological innovations, involving companies and industry experts.
- Promote partnerships with business organisations and professionals to ensure that VET courses are aligned with industry standards and practices.

- Accompany the curricula with the vocational and training standards of reference for the VET system and the labour market in Italy (Job Atlas and Regional Qualification Profile Directories).
- Structuring and proposing refresher training interventions for workers and qualification interventions for labour forces to be included in the labour market, using public and private funding channels.
- Promoting the continuous professional development of trainers.
- With reference to training delivery: structuring a supportive and inclusive learning environment that considers the diverse needs of learners and fosters active participation and collaboration; using innovative teaching methodologies to foster learning, such as the workshop approach, gamification, application of the experiential model (Kolb cycle); using active, participative and personalised teaching methodologies to enhance the learning experience and engagement.

3.4 Visualization of the alignment



3.5 Proposed Changes in VET education and training

The proposed changes in VET education and training within the Building and Construction industry in Italy, with a particular focus on **the Sardinia and Lazio regions**, are closely related to the importance of collaboration, technological requirements, and other key considerations.

1. Collaboration within the Industry and Stakeholder Engagement

Collaboration is a fundamental element in improving VET education and training. In Italy, partnerships between educational institutions, employers, industry associations, construction companies, and government bodies have been instrumental in shaping VET programs. To further strengthen this collaboration, there is a need for a structured framework that fosters dialogue and cooperation among these stakeholders.

In Lazio, local chambers of commerce, vocational schools, and regional government agencies should work together to create a collaborative ecosystem that supports VET programs. This can include the establishment of advisory boards comprising representatives from various sectors to provide input and guidance on curriculum development and program evaluation.

- a. Apprenticeship Programs: Encouraging construction companies to actively participate in apprenticeship programs can provide students with real-world experience while helping companies identify and groom potential talent.
- b. Industry-Guided Curriculum: VET institutions can collaborate with industry experts to ensure that their curriculum aligns with current industry trends and requirements. This ensures that students are well-prepared for the workforce.
- c. Research and Development Partnerships: Collaboration can also extend to research and development initiatives, which can drive innovation and efficiency within the sector.

2. Technological Requirements and Digitalization

The Building and Construction industry has been undergoing significant technological transformations in recent years. These changes necessitate adjustments in VET programs to ensure graduates are equipped to work with the latest tools and methodologies.

- a. E-Learning Platforms: The use of e-learning platforms can make VET more flexible and accessible, allowing learners to access course materials and resources remotely. Italy's experience with initiatives like the "Fondo per il Potenziamento Tecnologico" (FPT) to upgrade VET institutions' technological infrastructure is noteworthy (CISCO, 2019).
- b. Sustainable Practices: Italy is committed to sustainable construction practices. VET programs should include training on energy-efficient building methods, materials, and renewable energy integration.
- c. Digital Skills Training: Digitalization has revolutionized the industry. VET programs should incorporate training in Building Information Modeling (BIM), Virtual Reality (VR) and Augmented Reality (AR), digital project management tools, and other relevant software. Collaborative projects between VET institutions and technology providers can facilitate the integration of these tools into the curriculum.

3. Flexible and Adaptive Curriculum

The world of work is evolving rapidly, with emerging technologies and changing industry demands. To remain relevant, VET programs in Italy must adopt a flexible and adaptive curriculum.

- a. Competency-Based Education: A shift towards competency-based education allows learners to progress at their own pace and receive recognition for skills acquired, not just time spent in the classroom.
- b. Lifelong Learning: VET institutions should embrace the concept of lifelong learning, offering opportunities for upskilling and reskilling throughout

individuals' careers. Initiatives like the "Progetto Crescere in Digitale" demonstrate Italy's commitment to continuous learning (MiSE, 2020).

c. Industry needs: Developing and updating curriculum to meet industry needs can be time-consuming. Collaboration with industry experts can streamline this process.

4. Quality Assurance and Monitoring

Ensuring the quality of VET programs is paramount to their success. Italy, including Lazio, should establish rigorous quality assurance mechanisms to evaluate and continually improve these programs.

a. Evaluation and Assessment: Regular evaluation of VET programs should be conducted to assess their effectiveness in meeting the needs of learners and employers. Transparent assessment criteria, such as those outlined in the European Quality Assurance Reference Framework (EQAVET), can be adopted (EQAVET, 2016).

b. Certification and Recognition: To enhance the value of VET qualifications, Italy should align its certification and recognition processes with European and international standards. The European Qualifications Framework (EQF) provides a valuable framework for this purpose (Cedefop, 2017).

5. Financial Support and Incentives

Funding is a crucial factor in the success of VET initiatives. Adequate financial support from both public and private sectors is required to implement the proposed changes effectively.

a. Public Funding: Italy's government should allocate sufficient funds to support the development and enhancement of VET programs. Initiatives like the "Programma Operativo Nazionale - FSE" have been instrumental in financing VET projects (Fondo Sociale Europeo, 2021).

b. Private Sector Engagement: Encouraging private sector participation through incentives, such as tax credits or subsidized training programs, can strengthen the partnership between VET institutions and employers.

c. Public-private partnerships: grants, and industry sponsorships can help bridge the financial gap.

Lazio-Specific Considerations

Lazio, the central region of Italy, holds unique characteristics that require special attention in the context of VET changes within the Building and Construction industry, especially focused on the historical preservation and multicultural environment.

Lazio, **Sardinia** and Italy in general, boasts a rich cultural heritage, with numerous historical buildings and sites. VET programs should include training on the preservation and restoration of historical structures, combining traditional craftsmanship with modern techniques. Finally, given the cosmopolitan nature of Lazio, VET programs should prepare students to work in a multicultural environment. Language skills and intercultural competence are increasingly important in this context.

Proposed changes in Vocational Education and Training (VET) within Italy's Building and Construction industry, with a focus on **Lazio and Sardinia**, are vital to ensure that the workforce is well-prepared to meet the industry's evolving needs. Collaboration, technological requirements, flexibility, quality assurance, and financial support are key elements in this transformation. By working together, VET institutions, construction companies, and government bodies can create a robust and dynamic educational ecosystem that benefits individuals, the industry, and the entire region of Lazio. These changes will not only contribute to the growth of the Building and Construction sector but also enhance Italy's VET system and contribute to the competitiveness of its workforce on a global scale in sustainable and innovative construction practices.

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3.6 Best CoVE Practices in the region

At national level there are several interesting initiatives. The following overview is intended to highlight features, local context, collaborations and actors, tools and methods of successful CoVE in order to identify essential factors for the creation of the Italian **CoVE in the Sardinia and Lazio regions**.

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The **Excellence in Green and Digital Manufacturing** project is dedicated to establishing a European COVE network, comprising six centers across five countries: Italy, Spain, Finland, Czech Republic, and Greece. The primary objective is to foster innovation and sustainable competitiveness within the Advanced Manufacturing (AM) sector. As a critical pillar of the European economy, the AM sector faces substantial challenges brought about by the twin transitions, which have ushered in disruptive changes and a pressing need for industry decarbonization. To tackle these transformative shifts and emerging challenges, it is imperative for citizens and the current and future workforce to acquire new competencies that can be applied both in their personal lives and professional endeavors. In this context, Vocational Education and

Training (VET) providers are poised to play a pivotal role. They will prepare the workforce and society for the future, ensuring that no one is left behind. VET providers will enhance their responsiveness and operate in close collaboration with policy levels.

EXCEED, as an initiative, embraces the synergistic application of digital and green principles, adhering to the "digital eco-innovation" paradigm and facilitating the transition to a circular digital economy. These principles serve as powerful drivers for accelerating innovation within the AM sector. The project is a collaborative effort involving a public-private platform consisting of 39 partners, including 18 full partners and 21 associates. EXCEED is designed to function as an integrated skills ecosystem, focusing on the following key areas:

1. **Upskilling and Reskilling:** EXCEED will provide a joint, internationalized, flexible, and individualized Life Long Learning training program aimed at low-skilled adults and workers at risk of marginalization.
2. **Higher VET Enhancement:** The project will design new curricula and update existing ones to strengthen Higher VET (EQF 4 and 5).
3. **Talent Management:** A central aspect of the project is the establishment of an International Talent Factory. Recognizing the pivotal role of talented and skilled individuals in a country's future prosperity, EXCEED will develop joint strategies for Talent Management.
4. **Professional Development:** EXCEED will focus on upskilling and empowering VET professionals, who are instrumental in translating innovation into educational contexts.

Over the course of four years, the project aims to engage at least 600 learners and benefit an estimated 26,000 individuals through a comprehensive multichannel communication strategy. This initiative holds the promise of driving positive change and innovation in the field of Advanced Manufacturing while ensuring that the workforce is well-prepared for the challenges of the future.

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The Centres of Vocational Excellence in **Smart Farming and Sustainable Food Systems** project is dedicated to meeting the evolving needs of the "agriculture of the future." Its primary focus lies in equipping the agriculture sector with the essential skills and knowledge required for its transformation, with a strong emphasis on digitalization, decarbonization, and sustainability. These Centers of Vocational Excellence will unite key players in European Vocational Education and Training, academia, research, and business, particularly in regions with a rich tradition in the agri-food sector.

AgriFood4Future is committed to developing vocational training skills and educational programs tailored to the demands of the "agriculture of the future." This mission is structured around three core objectives: i) **Transformation Towards Sustainability:** AgriFood4Future will actively contribute to the shift of the agri-food sector towards digitalization, decarbonization, and sustainability. ii) **Promoting Innovative Practices:** The project will actively support the widespread adoption of emerging agricultural practices such as climate-smart agriculture, precision agriculture, and regenerative and organic approaches. iii) **Skills and Mindset Cultivation:** AgriFood4Future will provide the necessary soft and technical skills, raise awareness, and nurture

an entrepreneurial mindset among young individuals and workers in the agri-food sector, thus preparing them for the "agriculture of the future."

These objectives will be realized through a series of well-defined project stages. Initially, the project will undertake an assessment of skills requirements and engage in preparatory work. Subsequently, it will foster cooperation and networking among partners with the intention of forging enduring collaborations. These partnerships will serve as the foundation for the development of innovative education and training programs in the realm of intelligent agriculture and sustainable food systems. As the project progresses, the partners will formulate an action plan aimed at ensuring the long-term sustainability and impact of their endeavors. AgriFood4Future is poised to make significant contributions to the transformation of agriculture, aligning it with the imperatives of the digital age, environmental sustainability, and the cultivation of a skilled, forward-thinking workforce.

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The European Open Design School for Sustainable Regional Development, known as DeuS, is a collaborative project spanning nine countries. It is spearheaded by regional Vocational Education and Training (VET) providers and representatives from the cultural and creative industries. These stakeholders have various connections to research and technological centers and public entities, including four European Capitals of Culture, encompassing both past, current, and future designated cities.

European Open Design School for Sustainable Regional Development - DeuS builds upon the foundation of the Open Design School pilot initiative, which was initiated during the European Capital of Culture event in Matera in 2019. This pilot program is seen as a crucial, open laboratory essential for the successful execution of the European Capital of Culture program.

The central objective of this project is to establish a robust network designed to challenge the conventional notions of urban sustainable development that underpin the Open Design School. This network is the result of in-depth discussions, testing, and improvement processes, drawing upon the collective knowledge, expertise, best practices, and lessons gleaned from similar experiences among project partners and stakeholders.

DeuS strives to create environments in European regional settings, both physical (Creative Open Spaces) and virtual (a comprehensive Creative Knowledge Platform). These settings are intended to facilitate the engagement of VET systems, professionals, researchers, policy-makers, and local communities in iterative processes of innovation and problem-solving. The ultimate goal is to generate solutions to local challenges, in line with the Regional Innovation Strategies for Smart Specialization (RIS3), and make these solutions available to SMEs, entrepreneurs, public bodies, and anyone in need. This approach opens up educational opportunities in the realms of design and innovation, critical thinking, and entrepreneurship. It encourages the development of creative and cost-effective methods for connecting within and across regional territories. Cooperation and education create pathways to access skills, competencies, and research infrastructures, thereby promoting the involvement of all parties in feedback loops that enhance their responsiveness and appeal. This iterative process enables creative innovators to learn, adapt, and share with others, contributing to ongoing innovation. Moreover, participants are encouraged

to assess social needs at the local level and continually evaluate and enhance their solutions through a trial-and-error approach. This approach fosters the sharing of lessons learned and best practices among the diverse stakeholders involved in DeuS, ultimately promoting sustainable regional development.

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GIVE - Global Initiative for Vocational Excellence primarily focuses on enhancing the social dimension of Vocational Education and Training (VET). The central goal of this project is to conceive and develop a European Platform of Centers of Excellence dedicated to the transformation of the VET sector. This transformation aims to promote social inclusion, particularly for individuals from disadvantaged backgrounds. The platform's core mission is to create an educational environment that empowers these target groups to acquire essential soft skills and facilitates their transition into the labor market. By achieving these objectives, the Platform of Inclusive Excellence will serve as a strong focal point for promoting inclusive governance and excellence in VET training practices.

Key Objectives: 1) Inclusive Governance Models: The project will implement and promote inclusive governance models for the management and growth of VET centers and agencies. These models will emphasize inclusivity in decision-making processes and policies. 2) Innovative Educational Approaches: At an international level, the project will implement and promote educational approaches and tools specifically designed to enhance the social inclusion of disadvantaged learners. These approaches will address the unique needs of these individuals. 3) Effective Training-Work Transition: GIVE will introduce and advocate for models that facilitate the design and implementation of effective training-to-work transition activities, ensuring that disadvantaged individuals can successfully enter the labor market.

Key Deliverables: 1) Inclusive Vocational Excellence Center: The project will establish a dedicated Center on Inclusive Vocational Excellence, which will serve as a hub for the development and dissemination of best practices in inclusive VET. 2) Reference Framework: A comprehensive reference framework will be drafted and put into practice to enable and promote innovative and inclusive pedagogies. This framework will also encompass anticipatory, entrepreneurial, and agile governance strategies, ensuring the evolution of VET practices. 3) Didactic Methods and Tools**: GIVE will develop didactic methods and tools specifically tailored to foster the social inclusion of disadvantaged individuals. These resources will enable personalized and effective learning experiences. 4) Learner-Centered Techniques: The project will provide a range of training and teaching techniques that prioritize the learner. These techniques will be adaptive, grounded in real-world scenarios, and employ a practical-theoretical approach, enhancing the overall learning experience. In summary, GIVE is committed to reshaping the VET landscape, with a strong focus on social inclusion and excellence. The project's deliverables and objectives aim to create a more inclusive, accessible, and effective VET sector that empowers individuals from disadvantaged backgrounds to thrive in the labor market.

At regional level, in Lazio the most relevant best practices are:

DIHCUBE is on a mission to establish the **Italian Digital Hub for Construction and the Built Environment**. This initiative is of paramount importance, given the construction industry's central role in the Italian economy, accounting for a significant 22% of the GDP and impacting the lives of all citizens. However, this sector faces considerable challenges, including technological lag, low competitiveness exacerbated by recent economic crises, and difficulties in harnessing innovation. These hurdles also impede the sector's transition towards sustainability, making it imperative to address these issues head-on.

Recognizing the critical importance of the construction sector's sustainable transformation, the Commission has identified it as one of the 14 priority ecosystems facing the most substantial challenges in achieving sustainability goals and embracing digital transformation. DIHCUBE is poised to tackle these challenges by uniting the most advanced research centers with the entire construction industry value chain, including SMEs, professionals, material and technology suppliers, and the public sector.

The project's partners have been carefully chosen to promote a systematic technological shift. They encompass research and innovation experts, representatives from the public sector, and specialists in business innovation. Notably, two of these partners are among the most representative organizations in the construction sector, one of which will lead and utilize its nationwide network to systematically engage with DIHCUBE stakeholders.

Given the current low level of digitalization in the construction sector and the immense potential for digital transformation, DIHCUBE's services will span the entire spectrum, ranging from fundamental digital literacy to advanced pilot coaching for the utilization of artificial intelligence. The hub will also provide highly specialized consultancy for niche applications. Importantly, DIHCUBE's assistance will be accessible across Italy and will encompass a comprehensive set of services. Furthermore, the Hub will serve as a central access point to the EDIHs (European Digital Innovation Hubs) network and has already established agreements with six construction EDIH-candidates. As Italy grapples with the impact of the recent crisis and implements its National Recovery Plan, the construction sector, central to this plan, will only thrive through a profound transformation characterized by both sustainability and digitalization. DIHCUBE is poised to play a pivotal role in ushering in this much-needed transformation.

Center of Vocational Excellence for the Green Economy, known as **3LoE**, places a strong emphasis on providing comprehensive green skills. A primary focus of 3LoE is to address the challenges related to energy, climate, and environmental protection. To this end, 3LoE has established Centers of Vocational Excellence dedicated to the green economy and has initiated a broad spectrum of vocational education, training, and higher education initiatives encompassing green economy, digitalization, and entrepreneurship.

Key Objectives: 1) **Skill Enhancement:** One of the central objectives of 3LoE is to sustainably enhance skills. This involves meeting the demand for young professionals, managers, and entrepreneurs in the green economy sector. Additionally, it aims to bolster the competitiveness of small and medium-sized enterprises (SMEs) operating in the green economy. 2) **Energy Efficiency and Climate Protection:** 3LoE is committed to realizing energy savings, promoting the use of renewable energies, and advancing environmental and climate protection. This will be

achieved through the development of qualified and innovative SMEs that actively contribute to these goals.

Key Deliverables: 1)Dual Vocational Training: 3LoE is actively engaged in the implementation of dual vocational training within the realms of education, training, and higher education. This entails the fostering of an intensive partnership between the various places of learning, particularly companies and centers, to provide learners with a comprehensive education in green economy-related fields. 2)Sustainable Partnerships: The project seeks to establish sustainable partnerships between the Centers of Excellence and SMEs. These partnerships are organized and secured on a permanent basis through the involvement of chambers. Such partnerships are vital for the long-term success of the green economy initiatives. 3)Professional Skills Enhancement: 3LoE is dedicated to improving the skills of professionals and managers within SMEs that are actively engaged in green economy activities. This upskilling effort is vital for enhancing the overall effectiveness and competitiveness of these businesses. 4) Entrepreneurship Promotion: The project places a strong emphasis on promoting entrepreneurship within the green economy sector. It seeks to secure business transfers and stimulate startups. This involves increasing both the quantity and quality of young entrepreneurs' activities, fostering innovation and growth.

In summary, 3LoE is committed to equipping individuals with the skills needed to thrive in the green economy sector. It is actively engaged in a range of educational and training initiatives aimed at fostering sustainability, promoting energy efficiency, and enhancing the competitiveness of SMEs. The project's objectives and deliverables are designed to drive progress and innovation in the field of the green economy.

Moreover, some important digital innovation hubs have been implemented in Lazio and support the development of innovative research actions and practices. Among them it worth mentioning the following cases.

The **R.O.M.E. Digital Hub**, also known as R.O.M.E., has the primary mission to expedite the digital transformation of Small and Medium-sized Enterprises (SMEs) and Public Sector Organizations (PSOs). It achieves this by providing innovative and cost-effective services that span across a vast geographical area, encompassing Northern and Central Italy with a particular emphasis on the Lazio Region. The R.O.M.E. network of partners comprises a diverse range of organizations, including SMEs, Technology Parks, Universities, Research and Development Centers, Entrepreneurial Associations, and a Digital Innovation Hub (DIH). These partners collectively possess the requisite knowledge and experience to accomplish the stated objective. The strength of R.O.M.E. primarily derives from the existing synergy among its partners. Furthermore, the project benefits from the extensive management capacity and deep expertise of the Coordinator, which hosts numerous companies in its technology park. This collective experience positions R.O.M.E. as exceptionally well-suited to overcome the barriers hindering the digital transformation, particularly among SMEs, which face unique challenges. R.O.M.E.'s services catalog encompasses critical technologies, including High-Performance Computing, Cybersecurity,

and Artificial Intelligence, with a primary focus on the latter. It also includes offerings related to Advanced Digital Skills such as the Internet of Things (IoT), Blockchain, and Computer Vision.

For SMEs, the expected outcomes of R.O.M.E. are significant. The project aims to facilitate the creation of networks that enhance their investment capacity, streamline shared investment processes, and promote the industrialization of Research and Development (R&D) projects. These efforts are geared towards stimulating future mergers and collaborations among similar entities, ultimately strengthening their competitiveness within specific sectors. In the context of PSOs, R.O.M.E. seeks to enhance their understanding of community needs, positively impact citizens, elevate the quality of services, and foster a modern and innovative approach to addressing the challenges of digitalization.

In essence, R.O.M.E. serves as a catalyst for the digital transformation of both SMEs and PSOs, leveraging the expertise and collaborative efforts of its diverse partner network to usher in positive change and innovation in Italy's digital landscape.

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The **CURE - Creativity for Urban Rebirth** lays the groundwork for the establishment of a multifaceted service hub that seamlessly integrates science, the arts, public engagement, and business, all with the shared goal of propelling innovation and addressing the intricate challenges posed by the Sustainable Development Goals (SDGs). As we confront the intricacies of global issues, creativity emerges as one of the most potent tools for reshaping our societies and patterns of interaction. Creative thought processes have the capacity to stimulate new, innovative visions, such as the concept of '15-minute cities,' offering a fresh perspective on how our society can adapt and manage new challenges in a sustainable and harmonious manner.

From this vantage point, it becomes increasingly vital to foster a rekindled dialogue between the realms of science and the arts, which are the two preeminent creative forces in our society. Historically, their roles have encompassed understanding our world and projecting us into the future. The fusion of scientific rigor with creative disciplines offers a formidable catalyst for the convergence of technological innovation and creative freedom, all while emphasizing inclusion and social sustainability.

The specific challenges addressed by CURE primarily revolve around the future of cities, especially within a post-pandemic context. Contemporary cities are at the epicenter of a spirited debate regarding their evolution, with the COVID-19 pandemic accentuating the existing complexities. It has made abundantly clear the pressing need for a profound reevaluation of our lifestyles. This encompasses the reconfiguration of our societies and urban spaces, the recalibration of the relationship between urban and rural areas, the reformation of our production systems, and the imperative to stay within ecological boundaries. In this dynamic context, the proposed hub is positioned as a bridge that connects the realms of science, technology, and the arts on one end, and Small and Medium-sized Enterprises (SMEs) and public administration on the other. CURE is envisioned as a fertile environment where innovative mindsets can flourish, fostering the conception and collaborative creation of novel approaches, solutions, and business models. Moreover, CURE is committed to nurturing a sustained dialogue among all stakeholders

in the inevitable urban renaissance, contributing to the ongoing discourse and transformative process.

Finally, it worth mentioning the following CoVEs promoted by regional/national agencies and bodies located in Lazio:

The **ITS Academy of Regione Lazio**, also known as Institutes of Higher Technological Education, are specialized institutes of excellence established to meet the demand for new and advanced technical and technological skills from businesses and to enhance employment. They constitute one of the primary segments of non-university tertiary education. They represent a new educational strategy that combines education with the world of work, offering highly dynamic and qualified training that meets the job market's demand for suitable competency levels. They promote employment, particularly among the youth, and strengthen the conditions for the development of a knowledge-intensive and competitive economy. They offer non-academic post-high school technical specialization programs, designed for technology areas considered a priority for economic development and the country's competitiveness.

Objectives: To provide agile, effective training closely connected to the world of work to ensure qualified professional prospects in line with European parameters in the production system. ITS Academies primarily aim to enhance and expand the professional training of senior technicians with high technological and technical-professional competencies systematically contributing to support measures for economic development and the competitiveness of the production system. They support the dissemination of scientific and technological culture, continuous career orientation for young people toward technical professions, informing their families, updating and in-service training for teachers of scientific, technological, and technical-professional disciplines in schools and vocational training, active labor policies, particularly concerning the transition of young people into the world of work.

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LAZIO INNOVA, an in-house company of the Lazio Region, with a minority shareholding by the Chamber of Commerce of Rome, is the result of the restructuring process of the Lazio Region's companies dedicated to innovation, credit, and economic development, as provided by regional law no. 10/2013. It operates in favor of businesses and local public administration by providing incentives using regional, national, and/or European resources. It supports credit and provides guarantees, intervenes in risk capital, offers services for internationalization, promotes business networks and regional excellence, assists in business establishment and development, and participates in social inclusion measures.

It performs specialized technical assistance functions for the Lazio Region, particularly regarding the implementation of European and national programming. It supports the Steering Committee for the implementation of regional and European policies in defining and implementing the regional unified plan for regional and European policies. It also coordinates the programming,

management, operation, monitoring, and control of regional programs co-financed by European Funds (ERDF, ESF, EMFF, and EAFRD), the Development and Cohesion Fund (DCF), and other European and national resources allocated to Lazio.

On behalf of the Region, it is responsible for the implementation of specific development and internationalization projects. It is tasked with overseeing European innovation programs through analysis, project cooperation planning, and the implementation of services and activities to benefit the Lazio innovation system. Lazio Innova manages the 'Fare Lazio Fund,' established by the Lazio Region as part of the 2014-2020 European programming for managing financial instruments to support businesses. The fund is divided into two sections:

- Fare Credito, which includes various instruments to support SMEs' access to flexible and scalable credit. Its initial endowment of 62 million euros has increased over time to over 455 million euros.
- Fare Venture, which intervenes with 68.5 million euros in venture capital and is further divided into two parts:
 - Lazio Venture
 - Innova Venture

The endowment of Fare Lazio is currently being expanded for a total amount of 165 million euros from the 2021-27 Programming resources, with 110 million euros dedicated to the instruments in the Fare Credito section.

Within its functions of technical assistance to the Region and management of the Active Space Network, Lazio Innova informs citizens, businesses, local authorities, and associations about European policies and regional funding programs to raise awareness in the region about the main European priorities and promote active citizenship at the local and regional levels, in close coordination with the Region's Europe Desks. Finally, through its participation in the ENTERPRISE EUROPE NETWORK (EEN), Lazio Innova offers an integrated system of services to help companies identify new commercial, production, and technological partners abroad and support innovation, technology transfer, and the participation of SMEs in European tenders.

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Porta Futuro Lazio is a project of the Lazio Region, publicly funded and free, developed in collaboration with universities, offering everyone the opportunity to grow professionally through orientation and training services, positioning themselves effectively in the job market. Currently, there are 10 open offices located throughout the regional territory, making it easier for all citizens and businesses to utilize the innovative and entirely free services to enhance employability provided in the 'PFL' model.

The first facility was established in 2011 by the Province of Rome in the Testaccio district. Given its success, acknowledged by the European Union, which recognized the model as a best European practice, the Lazio Region launched the PFL project to make empowerment services available to all regional residents, gradually establishing offices offering orientation, training, and matching services between available professional opportunities and citizens possessing the required skills. For citizens accessing PFL offices, all available services are explained, with an initial

needs analysis, motivation assessment, and professional objectives exploration. Users are then guided towards personalized use of orientation and training services, including the issuance of credentials for using the Porta Futuro Lazio software, through which individuals can create their CV and send it, accompanied by a cover letter, to companies seeking personnel listed in the database. For companies, PFL offers guided creation of their virtual profiles for posting job or training opportunities and identifying the professional skills that best match their needs. Additionally, at the offices, companies can benefit from direct meetings with job seekers through the organization of Recruitment Days, Career Days, and Employer Branding events.

Enea Formazione E-learn is a working group dedicated to promoting the spread of technical-scientific culture through the ENEA online training platform To everyone at any stage of life. Objectives: Promote the dissemination of technical-scientific culture as a key tool for understanding the world around us: its complexity, open questions, and ongoing changes in the energy, environmental, and sustainable development sectors. Encourage free technical-scientific professional development as a necessary prerequisite for the economic growth of society and the personal social development.

In Sardinia among the regional good practices at the present there are courses provided by the ITS (Higher Technical Institute) in Macomer (NU) 'Fondazione ITS Efficienza Energetica Sardegna'; each course has a maximum of 20 enrolled students.

The calls for tenders for training 2022/2024 concern 5 professional figures.

1. SUSTAINABILITY MANAGER 4.0

Higher technician of energy systems in the circular economy - environment 4.0.

2. IMP-ENERGY 4.0 Higher technician for energy supply and plant construction - address energy storage and maintenance of large plants 4.0

3. HIDROGEN Energy Plant Manager 4.0. Higher technician for energy supply and plant construction 4.0 (Energy Plant Manager 4.0) address production and distribution of energy from hydrogen in collaboration with CarboSulcis

4. WORK IN GREEN BUILDING Higher technician for energy saving in sustainable building 4.0

5. DOMOTICS 4.0 Higher technician for energy efficiency: management, maintenance and control of plants and distribution networks - Domotics 4.0

These courses can be accessed with an upper secondary school diploma or a vocational training diploma plus one year of a supplementary annual leFP course and passing an entrance test.

At the end of the course a Higher Technical Diploma is awarded with EQF level V competences for two-year courses and level VI for three-year courses.

In the last two years (2021-2022) ITS Macomer has an average of 14 graduates in *Management and maintenance of energy plants* and *Technicians for the sustainable construction sector*.

The placements in the world of work are varied: some are hired by the companies themselves where they have done the practical internship activity envisaged in the curricular project, others choose the path of entrepreneurship. Fundamentally and with specific reference

to the last two years, after Pandemic period, the graduates remain to work in Sardinia, however in the past they have also had recruitments abroad, specifically in Malta, where all the trainees were absorbed with permanent contracts, after the experience made benefiting from the Erasmus Plus Charter of which the institute is a holder.

In the field of sustainable energy and in particular the energy efficiency of buildings, CIOFS FP Sardegna will have an active role in the identification and analysis of training needs, in dialogue with key stakeholders in the sector, in the request for the activation of courses consistent with market needs identified, and it will participate in the tenders promoted by the regional Department of Labour, professional training, cooperation and social security.

In addition, CIOFS FP will take a proactive role in proposing additions, revisions or updates to the regional repertoire with regard to profiles and competences (ADA) and possibly also with regard to the National Atlas of Work and Qualifications (INAPP) (https://atlantelavoro.inapp.org/atlante_repertori.php)

3.7 Conclusion

The alignment of VET courses with Smart Specialisation Strategies **in Italy, Sardinia and the Lazio region**, particularly within the Building and Construction industry, is a critical undertaking for the sustainable development and competitiveness of the region and we can outline a set of recommendations to ensure the effective integration of the SECOVE.

First and foremost, the alignment of VET courses with RIS3 Strategies is essential for the targeted development of the Building and Construction industry in the Lazio region. This requires a thorough analysis of the specific needs and growth areas within the industry, including sustainable construction practices, digitalization, and innovative building materials. VET programs should be designed and updated to address these specific requirements, fostering a skilled workforce that can contribute to the region's competitive advantage.

Furthermore, the alignment of SECOVE with RIS3 Strategies is crucial to create a dynamic ecosystem for knowledge transfer and innovation. Collaboration between VET institutions, research centers, and industry stakeholders is paramount. This collaboration can ensure that VET courses are not only in line with current needs but also adaptable to future developments, making the region more resilient and forward-thinking.

To support the alignment of VET programs with Smart Specialisation Strategies, it is vital to compare the technological trends in the sustainable energy sector and subsectors with the VET offerings and RIS3 priorities. This comparative analysis can reveal gaps and overlaps, helping policymakers and educators fine-tune VET courses to meet the specific demands of the industry. This also requires close monitoring of emerging technologies and trends to remain at the forefront of innovation.

In the context of the Building and Construction industry, the promotion of sustainable construction practices and renewable energy integration is a pressing concern. VET programs should include modules related to energy-efficient building design, green building materials, and

sustainable construction techniques. Moreover, specific emphasis should be placed on digitalization and the use of Building Information Modeling (BIM), as these technologies are becoming integral to the industry.

The proposed changes in VET education and training should be iterative and adaptive, closely following industry developments and technological advancements. This means a commitment to lifelong learning, upskilling, and reskilling, allowing the workforce to stay competitive and embrace new technologies as they emerge. It is also essential to provide incentives for both individuals and companies to invest in ongoing education and training.

To ensure the effectiveness of these recommendations, a multi-stakeholder approach is crucial. Collaboration between educational institutions, employers, industry associations, construction companies, and government bodies is necessary for developing a coherent and coordinated strategy. Regular dialogue and feedback mechanisms should be established to assess the impact of VET programs and adjust them as needed.

In conclusion, for **Italy, Sardinia and the Lazio region** to align VET courses with Smart Specialisation Strategies and the SECOVE project, especially in the Building and Construction industry, a comprehensive approach that addresses industry needs, tech trends, and ongoing VET development is crucial. Implementing these recommendations can enhance the position of the region in sustainable construction and energy-efficient building methods, boosting economic growth and enhancing long-term sustainability and resilience.

4. Basque Country, Spain

4.1 Smart Specialisation Strategies

The Basque Country has implemented a smart specialization strategy known as the RIS3 (Research and Innovation Strategy for Smart Specialization¹). This strategy aims to foster sustainable economic growth and competitiveness fostered by innovation, by focusing on key areas of specialization where the region has a comparative advantage.

The region has identified Energy and Advanced Manufacturing as strategic areas. The diagnostic report drawn up by the EU agrees with the one made recently by the Basque Government, stating that the Basque Country enjoys high values, an important Basque Science and Technology Network which is a European benchmark and an exemplary track record in conviction of commitment to R&D&I.

Key aspects of these strategies in the Basque Country include:

- **Priority Areas:** as mentioned above, the RIS3 identified several priority areas for smart specialization where the Basque Country has significant potential for innovation and economic development. These areas include advanced manufacturing, energy, biosciences, health, digital technologies, and sustainable mobility.
- **Stakeholder Involvement:** the development of the RIS3 in the Basque Country involved collaboration and consultation with a wide range of stakeholders, including academia, industry, public authorities, and civil society. This transversal, participatory approach ensured that the strategy aligned with the region's strengths and needs.
- **Collaboration and cooperation:** the region has a strong tradition of industrial clusters, which are collaborative networks of companies, research institutions, and other stakeholders in specific sectors. The RIS3 strategy builds on this foundation by promoting cluster-based collaboration and fostering synergies among different actors in the priority areas.
- **Research and innovation:** The RIS3 emphasizes the importance of research and innovation as drivers of economic growth. It promotes the integration of research institutions, universities, and technology centers with the business sector to facilitate knowledge transfer and commercialization of innovative ideas.
- **SMEs:** The strategy recognizes the crucial role of small and medium-sized enterprises (SMEs) as well as entrepreneurship in driving innovation and economic development. It supports the creation of startups and startup incubators, facilitating the growth innovative startups and provides funding aid, training, and other resources to help SMEs engage in research and development activities.
- **Internationalization:** the Basque Country aims to strengthen its international presence and collaboration through the RIS3 strategy. It encourages partnerships with international

¹ <https://www.spri.eus/en/ris3-euskadi/>

research institutions, companies, and organizations to foster knowledge exchange, attract foreign investment, and enhance the global competitiveness of Basque firms.

- Sustainable Development: the RIS3 in the Basque Country advocates for a sustainable and responsible approach to economic growth. It promotes the development of environmentally friendly technologies and solutions, as well as social innovation to address societal challenges.

The regional strategy is the result of a participatory process in which various stakeholders take part: government, private businesses, research institutions and civil society. The Basque region can already demonstrate a track record of developing policies to support competitiveness, specialisation and diversification that comply with RIS3 requirements. It ultimately aims at targeting the region's necessities by coordinating efforts with a multilevel governance: sub-regional, national and supranational levels.

4.2 Fitness Analysis

In the process of identifying vertical priorities, the basic document was the Science, Technology and Innovation Plan, PCTI-2030², which establishes an explicit strategy of diversifying the Basque economy, based on three essential enabling technologies: biosciences, nanosciences and advanced manufacturing; and five priority markets: transport and mobility, digital world, science industry, ageing and health, and energy.

Consequently, three essential technology-enabling priorities have been defined in the Basque Country that affect different sectors in which the Basque Country has strong specialisation and skills, with the focus on a key area in the Basque Country, all combined with a commitment to diversify the business fabric towards a high technology level and high growth potential sector. These are: advanced manufacturing, energy and bio-health convergence.

SECOVE's, as a transnational project engineered to foster sustainable energy in VET, the Basque CoVE's main objectives are:

- Foster talent, the incorporation of women in the most masculinized sectors, where fewer women work.
- Focus on a specific orientation towards industrial and scientific VET and also training in strategic sectors (SE), encouraging and emphasizing occupations in the industrial sector or other emerging sectors.
- Encourage inclusive Vocational Education and Training in line with sustainable development goals.

² https://www.euskadi.eus/contenidos/informacion/despliegue_pcti_euskadi/es_def/adjuntos/PCTI-EUSKADI-2030.pdf

- Foster innovation and excellence in VET in Spain; as well as updating technical VET curricula.
- Encourage partnerships and cooperation between VET centers, universities, companies and other stakeholders including collaborative engagement with governance.
- Help SMEs innovate and transform their operations by bringing them to smaller projects.
- Build a CoVE network across the region.
- Become a regional reference and advisor institution for both companies and VET schools.
- Set up of a summer academy (as stated in the application but sustainable throughout the years).
- Promote internationalization and the mobility of students, teachers, and trainers.

SECOVE is a long-term project that is expected to have a significant impact on the quality of VET, specifically in the fields of Cybersecurity, Artificial Intelligence and IT in the Basque Country and contribute to the industrial fabric and overall economic development of the region. To sum up, the vision for the regional CoVE aims to encompass the Centre's aspirations towards excellence, inclusivity, collaboration, continuous learning, cultural respect, and sustainability. It sets a strong future-oriented direction for the CoVE's growth and strategy.

4.3 Future Trends and Alignment Analysis

The Basque region's energy sector forms a crucial cornerstone of its industry. There are roughly 350 businesses connected to this sector within the region, generating a global turnover of 47 billion euros, 15 billion of which are rooted in the Basque Country itself. These companies create 63,000 jobs worldwide, with 21,000 of these situated in the Basque Country³. Ambitious long-term objectives include eradicating oil consumption for energy by 2050, achieving net zero fossil fuel consumption and net zero GHG emissions by the end of the century, and reducing GHG emissions by 30% and 80% by 2030 and 2050, respectively, when compared to 2005 levels, as outlined in the Basque Country Energy Strategy 2030⁴.

On the other hand, the Basque government's policies are also in line with the 2030 Agenda, which, through conferences, events, activities and projects, aims to raise awareness and implement the sustainable development goals in Basque society as a whole. This is of interest for this project given that it is about respecting and working considering, at least, the goals:

- SDG4 - Quality education.

³ <https://www.bizkaiatalent.eus/pais-vasco-energias-renovables/>

⁴ <https://www.euskadi.eus/informacion/estrategia-energetica-de-euskadi-2030/web01-a2ingkli/es/>

- SDG5 - Gender Equality
- SDG7 - Affordable and non-contaminating energy
- SDG9 - Industry, Innovation and Infrastructure
- SDG13 - Climate Action
- SDG17 - Partnerships to achieve the goals

This section delves into the interconnections between Cybersecurity, Artificial Intelligence (AI), and Information Technology (IT) in relation to the Sustainable Energy (SE) sector. Given their pivotal role in securing essential infrastructure, refining energy consumption, and creating renewable energy systems, an exploration of these technologies is of significant importance. The relevance of this topic to the sustainable energy goals of the region aligns with the regional innovation strategies, RIS3 Euskadi, included in the Science, Technology, and Innovation Plan 2030 (PCTI). The plan identifies Energy as one of the top three priorities, keeping in mind the European Green Pact's goal of zero greenhouse gas emissions by 2050.

Cybersecurity involves safeguarding networks, devices, and data from unauthorized access or malicious use, which is vital for protecting energy infrastructures from cyber threats that could cause disruptions or compromise the integrity of energy systems⁵. A report by the Spanish Centre for Industrial Cybersecurity (CCI) and the Naturgy Foundation⁶ highlights the significant impact of power cuts due to cyberattacks on all sectors, and not just end users. With the digitization of grids, integration of renewable generation, and implementation of smart meters and advanced metering systems, cybersecurity faces novel challenges. Therefore, PCTI 2030 recognizes cybersecurity as an essential technology in its digital-tech transition, illustrated by the establishment of CYBASQUE⁷, an association representing the Basque Country's Cybersecurity Industries.

The European Commission's High-Level Expert Group on Artificial Intelligence (HLEG)⁸ defines AI as systems displaying intelligent behavior by analyzing their surroundings and independently taking actions to meet specific goals. AI's increasing usage in the energy sector, particularly for grid management, makes it instrumental for boosting efficiency and supporting decision-making, thus aiding energy companies in managing the grid, meeting demand, and avoiding waste. AI is also deemed a core technology in the Basque PCTI 2030's digital-tech transition.

Information Technology (IT) incorporates digital technology in industrial settings to enhance manufacturing processes, manage supply chains, and improve overall operational efficiency. The IT industry is key to a more sustainable energy sector by providing essential tools, technologies, and expertise. The Basque Country is host to several IT companies developing

⁵ <https://www.eib.org/attachments/lucalli/20220206-european-cybersecurity-investment-platform-en.pdf>

⁶ <https://www.cci-es.org/wp-content/uploads/La-nueva-distribucion-electrica-ciberseguridad-transformacion-digital.pdf>

⁷ https://www.cybasque.eus/en_US/home-cybasque

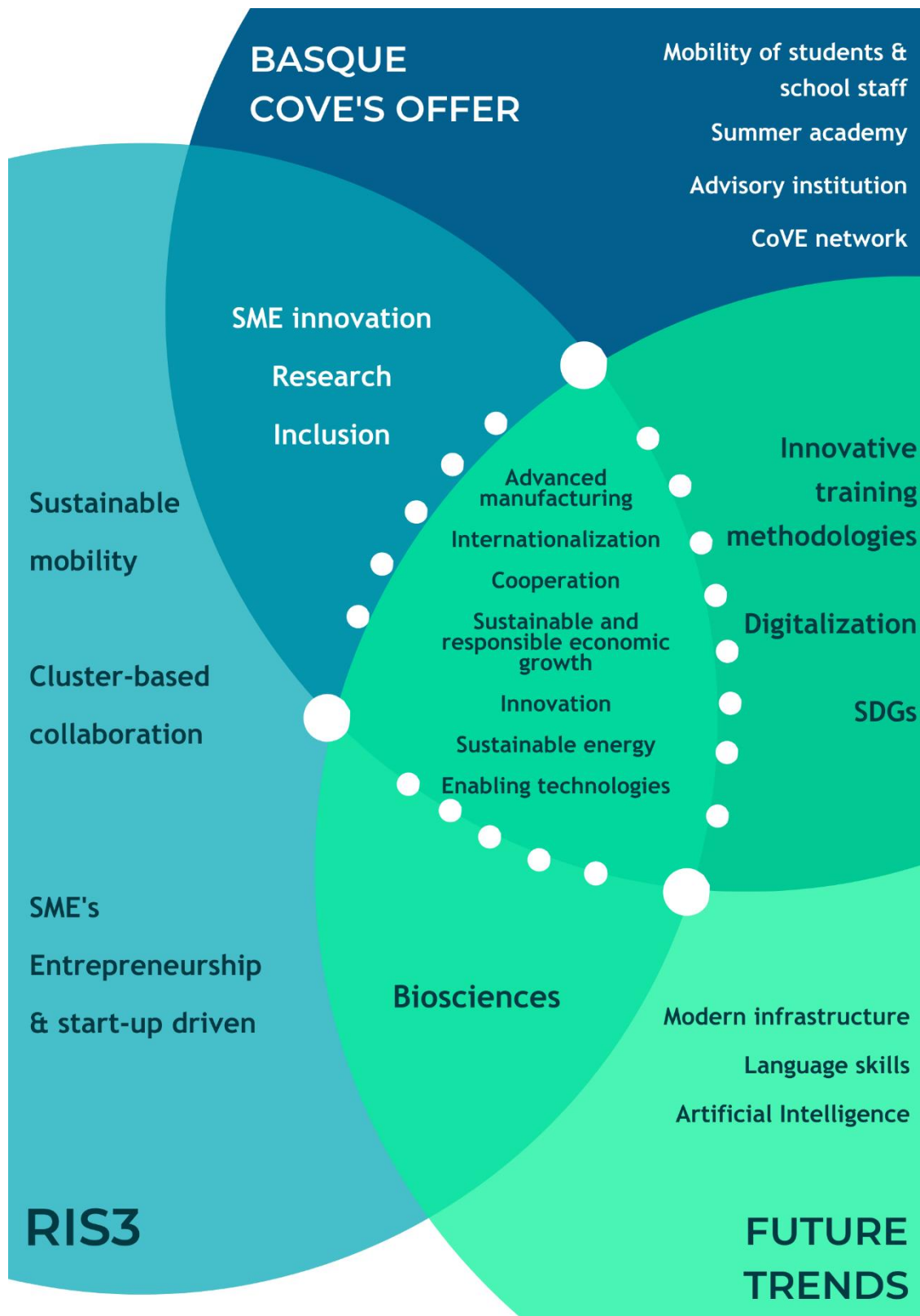
⁸ <https://digital-strategy.ec.europa.eu/en/policies/expert-group-ai>

innovative solutions for the energy sector, thereby making a significant contribution to the local economy.

The escalating pace of technological advancements has significantly transformed labor market needs. Therefore, it is crucial to prepare the workforce for future market demands by modernizing vocational education and training (VET) programs. As the Sustainable Energy sector increasingly adopts technology and digitalization, professionals skilled in Cybersecurity, AI, and IT are becoming more critical to the sector's advancement. These professionals are essential for digitalizing the energy industry, ensuring the protection of energy infrastructure, improving decision-making, and enabling energy efficiency. Given the need to train the workforce for these professions, the following recommendations are made:

- Develop a curriculum that meets the current and future labor market needs based on the analysis of the necessary skills and qualifications in the cybersecurity, AI, and IT professions.
- Give access to state-of-the-art infrastructure, equipment, and software tools for practical training and hands-on experience.
- Collaborate with industry leaders and experts to provide real-world training opportunities, like internships, apprenticeships, and job shadowing.
- Encourage ongoing professional development of trainers and instructors to equip them with the latest skills and knowledge.
- Establish a supportive and inclusive learning environment that accommodates the diverse needs of learners and fosters active participation and collaboration.
- Use innovative teaching methods and tools, such as gamification and digital learning platforms, to enhance the learning experience and engagement.
- Regularly review and update the curriculum to ensure it stays relevant and responds to the evolving market demands and technological advancements.

4.4 Visualization of the alignment



4.5 Proposed Changes in VET education and training

In the current Basque context, VET plays a key role in promoting employability, social inclusion and economic development. Based on the challenges and objectives identified in the current context of VET in Spain, the Basque regional CoVE is an initiative that aims to boost the economic development, employability and competitiveness of the northern region of Spain, providing professionals with the necessary skills to meet the needs of labor market demands. This CoVE aims to cover innovative industrial sectors, promote people's qualifications and offer opportunities for professional growth and success.

Among the reasons for selecting this CoVE, is the Basque Smart specialization strategy, which is energy-centered, foreseeing 68.000 jobs according to the Sustainable Bond 2019. Additionally, the Basque VET Plan states that it is a core priority to face the challenges of Industry and transforming VET centers into High Performance Centers.

SECOVE will promote technological knowledge transfer among different stakeholders concerning advanced technologies (IoT, AI, Cybersecurity), digitization, connectivity, virtual environments, sustainable development and 'smart' 4.0 values among others. As established by the European Commission, European industry must take a strong leadership role in greening the economy. Common environmental goals can only be achieved by incorporating new technologies and rethinking the production processes in respect to the environmental impacts. Industry must lead by example in the green transition⁹.

At regional level, the strategic scope of the Basque VET Plan 2029-2021 establishes the goal of boosting integrated VET centers (can be seen as a version of CoVE), deepening relations with business and dual training, and providing support for applied technological innovation and entrepreneurship in VET centers. With the establishment of a CoVE in Bilbao, SECOVE will promote excellence in VET as demanded by the regional directions.

The Centre of Vocational Excellence in the Basque Country will offer a range of activities and services aimed at promoting excellence in vocational education and training in the region during the SECOVE project. More specifically, these activities and services include:

Establishing strategic partnerships with industry. These partnerships will ensure that the education provided is relevant for the needs of the labor market and will provide current students (future workers) with the opportunity to acquire learning outcomes in a professional environment.

- Foster partnerships between educational institutions and industries to bridge the gap between vocational education and the job market. Involve industry professionals in curriculum development, offer internships and apprenticeships, and ensure that the training provided aligns with industry needs and standards.

⁹ European Commission (2021). Industry 5.0 towards a sustainable, human-centric and resilient European Industry. doi: 10.2777/308407

Developing and implementing training programs. The Basque CoVE intends to work with other VET centers across Spain to develop and implement high-quality training programs in the field of sustainable energy, specifically in cybersecurity, AI and IoT. These programs aim to support innovation and the development of new technologies to meet the needs of both trainees and industry needs.

- Program development:
 - Analyze the state of the art of VET education and the labor market in relation to cybersecurity, AI and IoT.
 - Identify qualification needs (knowledge and skills) in relation to labor market requirements in the field.
 - Planning and sketching the solution to be implemented.
- Implementation of programs:
 - Development of a national strategy to implement the contents according to the characteristics of the place and available VET centers.
 - Ensure the official accreditation of the study plan for VET.
 - Provide training in specialized VET degrees and in a dual format.

Providing training for teachers and trainers. The Basque CoVE will also provide training and support for educators to ensure that they have the skills and knowledge necessary to deliver up-to-date, high-quality training programs. This includes training on the use of new technologies, pedagogical methods, and industry-specific skills:

- Upskilling/reskilling professionals.

Offering mobility and exchange programs. The Basque CoVE will promote even further internationalization and mobility practices by offering European exchange programs for students, teachers, and trainers. These programs provide opportunities to learn about different cultures, languages, and educational systems:

- Creation of a list of European partner VET Centers and their field of expertise;
- Involvement in specific programs and projects for both trainers and trainees.

Promoting research and innovation. During the SECOVE project, the Basque CoVE will push research and innovation in VET by supporting the development of new teaching and learning methods, technologies, and curricula. This helps to ensure that VET in the Basque Country stays at the forefront in the latest industry trends and best practices:

- Ongoing research on emerging teaching and industrial technologies;
- Establish close connections with relevant stakeholders in the sector to obtain information about the latest trends and anticipate future needs of the labor market;
- Organization of workshops, seminars and conferences regarding cybersecurity, AI and IoT to share the latest knowledge.

- Encourage experimentation and pilot projects of new teaching and learning methods, technologies in VET centers. This allows testing and refining new approaches in a controlled environment before they are implemented more widely.

Providing guidance and counseling services. The Basque CoVE will offer guidance and counseling services to not only to help learners make informed decisions about their education and career paths but more prominently as a new attribute, this includes services to SMEs and other industry stakeholders in the cybersecurity, AI and IoT fields.

- Career counseling and job placement services for students.
- Consulting services for relevant stakeholders in the field.
- Establishment of a meeting place for cooperation between partners and a binding network of partners to support the development of CoVE and its activities and within the international CoVE platform.
- Enhance career guidance programs to provide information about vocational education and technical professions to students, parents, and educators. Highlight the diverse range of career options available and emphasize the benefits and opportunities associated with technical fields.

Ensuring accessibility for all and encourage women into technical professions. Encouraging women to pursue technical professions require a multifaceted approach that addresses various barriers and promotes inclusivity in VET centers.

- Ensure that all individuals, regardless of their gender or background, have equal access to vocational education and training programs. Implement policies that eliminate discrimination and promote diversity in enrollment. Offer scholarships, grants, and financial assistance programs to support underrepresented groups, including women.
- Challenge societal stereotypes and biases by promoting the idea that women can excel in any field, including technical and vocational fields. Encourage girls from a young age to explore their interests in these areas.
- Flexible learning options such as online courses or part-time programs can aid accommodate individuals with diverse needs and responsibilities. This can be especially beneficial for women who may have caregiving responsibilities or face other barriers to full-time education.
- Create inclusive and supportive learning environments that encourage women's participation in vocational education and training. Establish safe spaces, address biases, and provide mentorship and support services to help women succeed.
- Raise awareness through campaigns to showcase successful women in these fields and encourage women's participation in technical professions.

This list of activities and services provided by the Basque CoVE are designed to promote excellence in VET in the Basque Country and to ensure that learners and teachers have the skills and knowledge necessary to succeed in the changing workforce. These will also aid the CoVE to

become a national reference on the field of cybersecurity, artificial intelligence and internet of things. Lastly, the Basque partnership will maintain and continue working on the aforementioned activities to ensure the sustainability of SECOVE after the end of the project.

4.6 Best CoVE Practices in the region

The next few lines provide an overview of both Basque and Spanish good CoVE practices:

- We find Spanish partners in: SEED – Sustainable Energy Education”. The project recognizes the need of preventing global climate change by providing quality and cutting-edge vocational training on how to make the world an energy-free continent. According to SEED, vocational education is a key engine of innovation and growth and must be flexible in its labor market adaptation. Spanish partners taking part: Public University of Valencia; DG Formación Profesional y Enseñanza and AVAESSEN.
- TourX-CoVES for the Tourism industry is another one which is relevant for Spanish partners. The goal of TourX is to create a bottom-up approach to excellence in the tourism industry, where the partner educational providers (VET and HEIs) are improving their capacity to quickly adapt the delivery of skills to changing social and economic needs. Through the creation of a sustainable Platform for Excellence in Tourism, TourX promotes a bottom-up strategy that involves the creation of regional knowledge-triangles. Spanish partners taking part: Asociación Mundus – Un Mundo a tus Pies, Ayuntamiento La Oliva, Asociación de Empresarios Turísticos de Fuerteventura, Escuela de Hostelería Europea S.L., University of Aveiro, Sun Dreams Global S.L.
- We also find Spanish partners in AgriNEXT. The AgriNext project’s main objective is to develop a learning environment that meets the demand for skills in the labor market in the area of multifunctional agriculture. Spanish partners taking part: On Projects Advising S.L., I.E.S. Virgen de la Cabeza; Union De Agricultores Y Ganaderos-Jóvenes Agricultores de Jaén; I.E.S. Galileo Galilei.
- EULEP- The European Learning Experience Platform (EULEP) brings 20 organizations from 8 countries together to collaborate on innovation-focused topics (artificial intelligence, virtual reality, and social innovation). These organizations are mostly Chambers of Commerce and Industry and VET providers. They connect with people on many levels, from local to European, in collaboration with European Digital Innovation Hubs (EDIH). The partnership will be able to create replicable, scalable approaches that work in various contexts thanks to cross-fertilization. Spanish partners taking part: Cambra Oficial De Comerç I Indústria De Terrassa; Fundació Per A La Universitat Oberta De Catalunya, Ajuntament De Terrassa.
- EUVECA – European platform for VET excellence in health. The European Platform for Vocational Excellence in Health Care (EUVECA) project is intended to assist the healthcare sector in meeting its needs. By ensuring the sector has access to talents for the future, innovation and development may be ensured. In 7 areas of Europe, the initiative establishes regional hubs for excellence in the health care workforce that work together on a European platform. The purpose is to encourage European (blended) mobility and cross-regional learning and collaboration among health care professionals and students from the participating areas. To ensure coordination, adaptation, innovation, and upward

convergence within regional health education eco systems. Spanish partners taking part: Universitat de València (Poblienestar), Universitat Politècnica de València (ITACA).

- Fashion earth alliance – vocational excellence and enterprise united for training, policy reform and sustainability in the fashion, textiles and apparel industries (FEA-VEE). FEA-VEE brings together a diverse set of partners to facilitate interactions and exchanges between VET providers of all levels and fashion industry leaders. Two major pillars support the flow of collaboration among these disparate actors: a) a shared understanding and agreement on future collaborative activities tactics and activities, and b) encouraged actions led by an online networking platform to initiate and sustain collaborations and learners’ mobility. Spanish partners taking part: Barcelona Chamber of Commerce and Industry; Universitat Politecnica de Catalunya.
- LCAMP – Learner Centric Advanced Manufacturing Platform for CoVES. VET must develop learning ways for people who plan, manage, oversee, or operate technology in order to prepare for the fifth industrial revolution. LCAMP will address this issue by establishing a European Learner Centric Platform of CoVES for Advanced Manufacturing with a consortium of 21 partners and 60 associated partners from around the world, including VET and HVET institutions, companies, regional governments, R&D centers, business associations, and clusters. Basque partners taking part: TKNIKA, AFM – Asociación Española de Fabricantes de Máquina Herramienta, sus accesorios, componentes, herramientas de corte y deformación, otros sistemas y tecnologías de fabricación, INVEMA – Fundación de Investigación de la Máquina- Herramienta.
- Lastly, the SECOVE project. Seeking to mainstream a European culture of innovation, inclusivity, and excellence in the field of sustainable and renewable energies, SECOVE seeks to develop a platform of Centers of Vocational Excellence throughout five different European countries. To achieve the greatest level of involvement and osmosis between the VET sector and the industry, the platform will be built on a strong transnational communication between locally established VET centers, commercial groups, public actors, and other important stakeholders. Basque partners taking part: Politeknika Ikastegia Txorierri, ONDOAN, GAIA.

4.7 Conclusion

The previous few pages have showcased a thorough analysis of the Basque CoVE’s objectives, the RIS3 strategies in the region and the future trends that will determine the labor market, as well as the alignment between the three.

SECOVE, as a transnational project, has been implemented to enhance sustainable energy in Vocational Education and Training (VET). It promotes talent, inclusive VET, innovation, partnerships, helps SMEs to innovate, fosters internationalization and mobility, and aims to build a regional CoVE network.

Simultaneously, the Basque Country is implementing the Research and Innovation Strategy for Smart Specialization (RIS3) to stimulate sustainable economic growth and competitiveness via innovation, focusing on sectors such as Energy, Advanced Manufacturing, biosciences, health, digital technologies, and sustainable mobility. In the region a participatory approach has been adopted for the implementation of the RIS3 strategy involving government, private businesses, research institutions, and civil society.

The Basque Country has identified technology-enabling priorities like advanced manufacturing, energy, and bio-health convergence through its Science, Technology, and Innovation Plan (PCTI-2030). The region has also succeeded in formulating policies that align with the RIS3 requirements, fostering competitiveness, specialization, and diversification.

The region aims to coordinate efforts across different governance levels to cater to its specific needs. Taking into account its strength in the energy sector, ambitious goals have been set to eradicate oil consumption by 2050 and achieve net-zero fossil fuel consumption and greenhouse gas emissions by the end of the century.

The roles of cybersecurity, AI, and IT are crucial in the sustainable energy sector for securing infrastructure, refining energy consumption, and creating renewable energy systems. The labor market also requires professionals skilled in these areas due to technological advancements. The Basque regional CoVE aims to enhance economic development, employability, competitiveness, and address labor market needs by supporting the Basque smart specialization strategy and prioritizing Industry 4.0 values.

The CoVE will offer a range of activities and services aimed at promoting excellence in vocational education and training, such as establishing strategic partnerships, developing training programs, providing training for both teachers and students, as well as promoting research and innovation. Moreover, it aims to build a CoVE network across different regional and national Centers of Excellence in different sectors (including sustainable energy, tourism, agriculture, healthcare, fashion, and advanced manufacturing). The CoVE's activities are designed to turn it into a national reference in cybersecurity, AI, and IoT. It also aims to ensure SECOVE's sustainability and continuity after completion.

In summary, the Basque Country's RIS3 strategy and the implementation of projects like SECOVE are enhancing the region's economic development, innovation, and competitiveness while also addressing the evolving labor market needs.

5. Porto Metropolitan Area, Portugal

5.1 Smart Specialisation Strategies

In Portugal, Smart Specialisation Strategies (S3) are implemented at the regional level through Regional Smart Specialisation Strategies (RIS3). These strategies aim to promote regional competitiveness by identifying and supporting the development of key areas of specialization in each region.

There are 7 regions in Portugal, and each region has developed its own RIS3. These strategies are based on the region's unique strengths, assets, and potential for innovation. The following are examples of the priority areas identified in each region's RIS3:

- 1.1 Norte Region: The priority areas in the Norte Region include agri-food, tourism, renewable energy, and textiles.
- 1.2 Centro Region: The priority areas in the Centro Region include agri-food, biotechnology, forest-based industries, and tourism.
- 1.3 Lisbon Region: The priority areas in the Lisbon Region include information and communication technologies, creative industries, tourism, and biotechnology.
- 1.4 Alentejo Region: The priority areas in the Alentejo Region include agri-food, renewable energy, tourism, and health.
- 1.5 Algarve Region: The priority areas in the Algarve Region include tourism, renewable energy, and marine resources.
- 1.6 Azores Region: The priority areas in the Azores Region include marine resources, agri-food, renewable energy, and tourism.
- 1.7 Madeira Region: The priority areas in the Madeira Region include tourism, biotechnology, and renewable energy.

The implementation of the RIS3 in each region involves a collaborative process among key stakeholders, including regional authorities, industry, research organizations, and educational institutions. This collaborative process ensures that VET courses align with the region's strategic plan and the needs of the labor market.

In addition, the implementation of the RIS3 involves a range of policies and investments to support the development of the priority areas. These policies and investments are aligned with the European Union's research and innovation agenda and prioritize investments in innovation.

The implementation of the RIS3 in Portugal is an effective way to ensure that VET courses align with RIS-3. By prioritizing investments in areas with high potential for growth and job creation, the RIS3 approach can help to ensure that VET courses are aligned with the needs of the labor market and the demands of emerging industries in each region of Portugal.

5.2 Fitness Analysis

Introduction: The fitness analysis aims to evaluate the alignment between the VET/COVE (Vocational Education and Training/Centre of Vocational Excellence) centre in Portugal and the strategies outlined in the Regional Strategy for Smart Specialization (RIS3). The analysis will assess how well the centre's offerings align with the priorities and objectives of the RIS3 for Portugal and identify areas for improvement or further alignment.

Methodology:

1. **Identify RIS3 Strategies for Portugal:** Begin by reviewing the RIS3 documentation specific to Portugal and identify the key strategies, priorities, and objectives outlined in the regional plan. These may include specific sectors, industries, or areas of focus that are considered crucial for the country's economic development and competitiveness.
2. **Review VET/COVE Centre Offerings:** Evaluate the courses, training programs, and activities offered by the VET/COVE centre in Portugal. Consider the curriculum, learning outcomes, and target audience for each offering.
3. **Establish Alignment Criteria:** Define the criteria or indicators that will be used to assess the alignment between the VET/COVE centre and the RIS3 strategies for Portugal. These criteria can be based on the objectives, priorities, and specific requirements outlined in the Portuguese RIS3.
4. **Assess Alignment:** Apply the established criteria to analyze the alignment between each offering of the VET/COVE centre and the RIS3 strategies for Portugal. This assessment can be done by reviewing the content, objectives, and target skills of each offering and comparing them with the priorities and objectives of the Portuguese RIS3.
5. **Determine Degree of Alignment:** Assign a rating or score to each offering based on the level of alignment with the RIS3 strategies for Portugal. This rating can be subjective or based on predefined criteria. For example, a scale of 1-5 can be used to indicate the degree of alignment, with 1 being no alignment and 5 being strong alignment.
6. **Identify Gaps and Opportunities:** Analyze the results of the fitness analysis to identify areas of strength where the VET/COVE centre's offerings align well with the RIS3 strategies for Portugal. Additionally, identify any gaps or areas where further alignment is needed. These gaps can serve as opportunities for curriculum development, partnership collaborations, or targeted training initiatives to enhance alignment.
7. **Develop Action Plan:** Based on the identified gaps and opportunities, create an action plan to enhance the alignment of the VET/COVE centre with the RIS3 strategies for Portugal. The action plan may include steps such as curriculum revisions, introducing new courses

or programs, establishing partnerships with relevant stakeholders, or seeking funding for targeted initiatives that align with the Portuguese RIS3.

Conclusion: The fitness analysis provides a comprehensive assessment of the alignment between the VET/COVE centre in Portugal and the RIS3 strategies for the country. By identifying areas of alignment and gaps, the analysis enables the centre to make informed decisions on curriculum development, resource allocation, and strategic partnerships to enhance its alignment with the regional smart specialization strategies. Regular reassessment of alignment and continuous improvement efforts will ensure that the VET/COVE centre remains responsive to the evolving needs of the Portuguese economy and labor market.

5.3 Future Trends and Alignment Analysis

Introduction: This analysis aims to compare and analyze the future technological trends in the sustainable energy sector and its subsectors for Portugal. By understanding these trends, we can assess the alignment between the technological advancements and the strategic goals of Portugal in the field of sustainable energy. This analysis will help identify areas where Portugal can leverage emerging technologies and ensure that its sustainable energy sector remains competitive and aligned with national objectives.

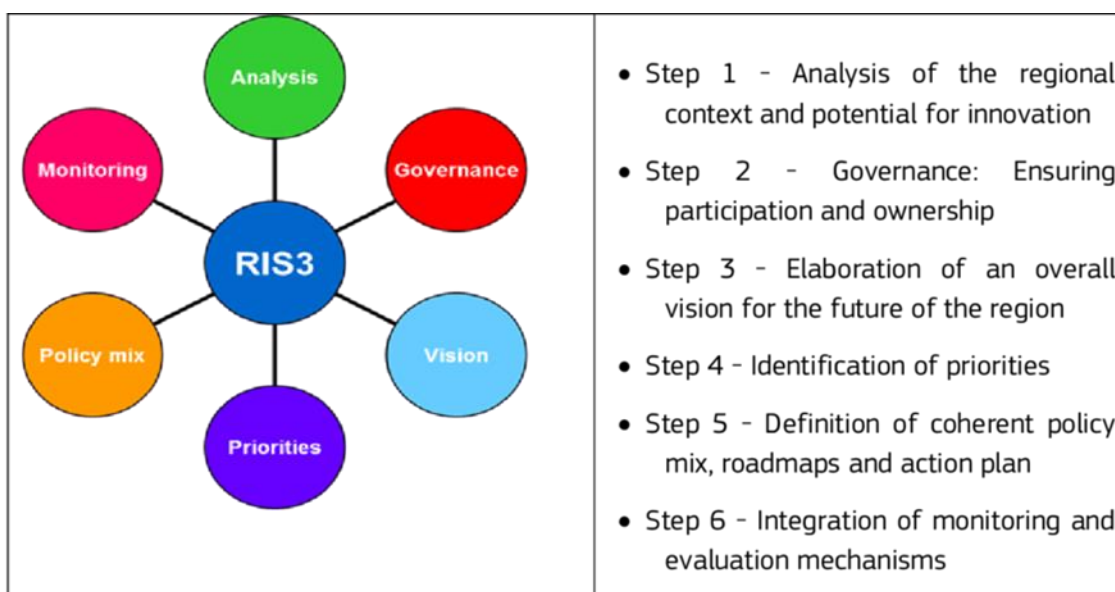
Methodology:

1. **Identify Sustainable Energy Subsectors:** Begin by identifying the key subsectors within the sustainable energy domain in Portugal. These may include renewable energy generation (such as solar, wind, hydro, and biomass), energy storage, energy efficiency, smart grid technologies, electric vehicles, and other relevant areas.
2. **Research Technological Trends:** Conduct a comprehensive review of the current and emerging technological trends within each subsector. This research can involve studying industry reports, scientific publications, market analyses, and consulting with experts in the field. Focus on understanding the latest advancements, innovations, and breakthroughs that have the potential to transform the sustainable energy landscape.
3. **Analyze Relevance to Portugal:** Evaluate the identified technological trends in the context of Portugal's energy goals and policies. Assess the extent to which each trend aligns with the country's strategic priorities, renewable energy targets, energy security objectives, and environmental sustainability commitments. Consider the potential impact of these technologies on Portugal's energy sector, economy, and society.
4. **Determine Alignment:** Based on the analysis of relevance and impact, determine the degree of alignment between each technological trend and Portugal's sustainable energy objectives. Assign a rating or score to indicate the level of alignment, considering factors such as scalability, feasibility, economic viability, and regulatory support.

5. **Identify Opportunities and Challenges:** Identify the opportunities presented by the aligned technological trends, such as potential for job creation, export markets, cost reduction, and improved energy efficiency. Additionally, identify the challenges and barriers that may hinder the adoption and implementation of these technologies in Portugal. These could include factors like infrastructure requirements, regulatory constraints, financing limitations, or skill gaps.
6. **Develop Strategic Recommendations:** Based on the analysis of alignment, opportunities, and challenges, develop strategic recommendations for Portugal's sustainable energy sector. These recommendations can include policy measures, investment priorities, research and development initiatives, capacity building programs, and collaborative partnerships to leverage the aligned technological trends and overcome the identified challenges.

Conclusion: The future trends and alignment analysis provides valuable insights into the technological advancements shaping the sustainable energy sector and subsectors in Portugal. By understanding the alignment between these trends and national objectives, Portugal can proactively harness emerging technologies to drive innovation, competitiveness, and sustainability in its energy sector. Strategic actions based on this analysis will enable Portugal to capitalize on opportunities, address challenges, and establish itself as a leader in the transition towards a clean and sustainable energy future. Continuous monitoring and reassessment of technological trends will ensure that Portugal remains at the forefront of the rapidly evolving sustainable energy landscape.

5.4 Visualization of the alignment



The six steps of a RIS3 process as outlined by the RIS3 guide

Future Trends	
Renewable Energy	Energy Storage
RIS3 Strategies	
Increase Renewable Energy Capacity	
Promote Energy Efficiency	
Foster Innovation in Clean Technologies	
Enhance Energy Infrastructure	
Develop Sustainable Transport Solutions	
Support Circular Economy	
Promote Research and Development	
Strengthen International Cooperation	
Ensure Energy Security and Resilience	
Enhance Skills and Human Capital	
VET Offerings	
Renewable Energy Technician	Energy Storage Specialist
Energy Efficiency Consultant	Sustainable Transport Expert
Clean Technology Innovator	Circular Economy Specialist
Research and Development Associate	Energy Infrastructure Technician
International Cooperation Manager	Energy Security Analyst
Skills and Human Capital Development Coordinator	Renewable Energy Project Manager

In this visualization, each rectangle represents a different aspect: Future Trends, RIS3 Strategies, and VET Offerings.

The "Future Trends" rectangle includes specific subsectors of sustainable energy that are expected to see growth and development in Portugal. This includes renewable energy technologies (such as solar, wind, hydro, and bioenergy) and energy storage solutions.

The "RIS3 Strategies" rectangle lists the strategic priorities outlined in Portugal's RIS3 document related to sustainable energy. These strategies aim to increase renewable energy capacity, promote energy efficiency, foster innovation in clean technologies, enhance energy infrastructure, develop sustainable transport solutions, support the circular economy, promote research and development, strengthen international cooperation, ensure energy security and resilience, and enhance skills and human capital.

The "VET Offerings" rectangle represents the vocational education and training programs available in Portugal to support the development of skills and competencies in the sustainable energy sector. It includes specific roles and job titles aligned with the future trends and RIS3 strategies, such as renewable energy technicians, energy storage specialists, energy efficiency consultants, sustainable transport experts, clean technology innovators, circular economy

specialists, research and development associates, energy infrastructure technicians, international cooperation managers, skills and human capital development coordinators, and renewable energy project managers.

5.5 Proposed Changes in VET education and training

1. **Enhanced Collaboration:** Foster stronger collaboration between VET institutions, industry stakeholders, research organizations, and government agencies. Encourage the establishment of partnerships and networks to facilitate knowledge sharing, curriculum development, and work-integrated learning opportunities. This collaboration will ensure that VET programs align with industry needs and technological advancements.
2. **Integration of Technological Requirements:** Update VET curricula to integrate emerging technologies and digital skills relevant to the sustainable energy sector. This includes incorporating training on renewable energy systems, energy storage technologies, smart grids, data analytics, Internet of Things (IoT), and digital monitoring systems. Emphasize practical, hands-on training using state-of-the-art equipment and simulation tools.
3. **Focus on Energy Efficiency and Energy Management:** Strengthen the emphasis on energy efficiency and energy management in VET programs. Provide specialized training on energy auditing, energy conservation measures, energy management systems, and sustainable building practices. Equip students with the skills to identify energy-saving opportunities and implement energy-efficient solutions.
4. **Green Skills Development:** Introduce new VET programs and courses that specifically focus on developing green skills in areas such as renewable energy installation and maintenance, energy-efficient construction practices, sustainable transport technologies, circular economy principles, and waste management. These programs should align with the RIS3 strategies and address the growing demand for skilled professionals in the green economy.
5. **Entrepreneurship and Innovation:** Foster an entrepreneurial mindset among VET students by incorporating modules on entrepreneurship, innovation, and business development. Encourage students to identify and develop sustainable energy-related business ideas, provide support for start-ups, and connect them with relevant incubators, accelerators, and funding opportunities.
6. **Continuous Professional Development:** Establish mechanisms for continuous professional development for VET teachers and trainers. Provide training programs, workshops, and seminars to update their knowledge and skills in line with technological advancements and industry trends. Encourage participation in conferences, industry events, and international collaborations to enhance their expertise and facilitate knowledge exchange.

7. **Internationalization and Mobility:** Promote internationalization of VET education and training by facilitating student and teacher mobility programs, exchange opportunities, and partnerships with international institutions. This will allow students and teachers to gain exposure to best practices, diverse perspectives, and international experiences in the sustainable energy sector.
8. **Recognition of Prior Learning:** Develop mechanisms to recognize prior learning and skills acquired through work experience or informal training. Provide pathways for individuals with relevant industry experience to obtain formal qualifications and certifications, thus promoting lifelong learning and professional development.
9. **Industry-Driven Curriculum Development:** Involve industry stakeholders in the development of VET curricula to ensure that the skills and competencies taught are aligned with industry needs. Regularly review and update the curricula to keep pace with evolving technologies, industry trends, and regulatory requirements.
10. **Supportive Infrastructure:** Invest in state-of-the-art training facilities, laboratories, and equipment to enhance practical training opportunities. Ensure access to modern technologies, software tools, and simulation platforms that replicate real-world scenarios. Create an enabling environment for innovation, experimentation, and hands-on learning.

These proposed changes aim to strengthen VET education and training in Portugal, ensuring its alignment with the evolving needs of the sustainable energy sector. By incorporating collaboration, technological requirements, green skills, entrepreneurship, and continuous professional development, Portugal can prepare a skilled workforce capable of driving the transition to a sustainable energy future.

5.6 Best CoVE Practices in the region

1. **Strong Industry Collaboration:** Successful CoVEs in Portugal prioritize strong collaboration with industry stakeholders. They actively engage companies, industry associations, and research organizations in the development of their training programs and curricula. This ensures that the CoVEs are aligned with industry needs, current technological advancements, and market demands.
2. **Work-Integrated Learning:** CoVEs in Portugal emphasize practical, hands-on learning experiences for students. They provide opportunities for work-integrated learning, such as internships, apprenticeships, and industry placements. This allows students to apply their knowledge in real-world settings, gain practical skills, and develop a deeper understanding of the industry.
3. **State-of-the-Art Facilities and Equipment:** The best CoVEs in Portugal invest in state-of-the-art facilities, laboratories, and equipment. They provide students with access to

modern technologies, simulation tools, and industry-standard equipment. This creates an immersive learning environment and enables students to gain practical experience using the latest tools and techniques.

4. **Collaboration with Research Institutions:** CoVEs in Portugal foster collaboration with research institutions and universities. This collaboration allows for the integration of cutting-edge research and innovation into the training programs. It also facilitates knowledge exchange, promotes access to research findings, and encourages joint projects that address industry challenges.
5. **Continuous Professional Development for Teachers:** The best CoVEs prioritize the professional development of their teaching staff. They provide opportunities for teachers to enhance their knowledge and skills through training programs, workshops, and seminars. This ensures that teachers stay up-to-date with industry trends, pedagogical approaches, and technological advancements.
6. **Entrepreneurship and Innovation Support:** CoVEs in Portugal promote an entrepreneurial mindset among students. They provide support and resources for students interested in starting their own businesses or pursuing innovative projects. This includes access to entrepreneurship training, incubation programs, mentorship, and networking opportunities.
7. **Internationalization and Mobility:** Leading CoVEs in Portugal encourage internationalization and mobility among students and staff. They facilitate student exchange programs, international internships, and partnerships with foreign institutions. This exposure to different cultures, practices, and perspectives enriches the learning experience and prepares students for global career opportunities.
8. **Recognition of Prior Learning:** Successful CoVEs in Portugal have mechanisms in place to recognize prior learning and skills acquired through work experience or informal training. This allows individuals with relevant industry experience to obtain formal qualifications and certifications, promoting lifelong learning and career progression.
9. **Industry-Driven Research and Development:** The best CoVEs actively engage in industry-driven research and development activities. They collaborate with industry partners to identify research needs, conduct applied research projects, and develop innovative solutions to industry challenges. This strengthens the link between education, research, and industry, fostering innovation and competitiveness.
10. **Monitoring and Evaluation:** Leading CoVEs in Portugal have robust monitoring and evaluation systems in place to assess the effectiveness of their programs. They regularly collect feedback from students, industry partners, and graduates to continuously improve the quality of their offerings. They also track the employability and career outcomes of their graduates to ensure their programs are meeting the needs of the labor market.

By implementing these best CoVE practices, Portugal can further enhance the effectiveness and impact of its vocational education and training system, fostering the development of a skilled workforce and promoting industry growth and innovation.

5.7 Conclusion

In conclusion, the analysis of vocational education and training (VET) in Portugal highlights several key findings.

Firstly, there is a strong alignment between the VET/CoVE centers and the RIS3 strategies in Portugal. The VET offerings and activities are well-matched with the priority areas identified in the RIS3, particularly in the sustainable energy sector and its subsectors. This alignment ensures that VET programs are designed to meet the current and future needs of the industry, promoting economic growth and innovation.

Secondly, the future trends in the sustainable energy sector in Portugal indicate significant opportunities for growth and technological advancements. Renewable energy, energy efficiency, and smart grid technologies are expected to play a vital role in the country's energy transition. VET programs need to align with these trends and equip students with the necessary skills and knowledge to contribute to the sector's development.

Thirdly, there is a need for proposed changes in VET education and training in Portugal. Collaboration between VET institutions, industry stakeholders, and research institutions should be strengthened to ensure that the training programs are responsive to industry needs and incorporate the latest technological requirements. Additionally, the integration of emerging technologies and digitalization into VET curricula is crucial to prepare students for the evolving demands of the sustainable energy sector.

Furthermore, the review of best CoVE practices in Portugal provides valuable insights into successful approaches that can be adopted. These include strong industry collaboration, work-integrated learning, state-of-the-art facilities, collaboration with research institutions, continuous professional development for teachers, entrepreneurship and innovation support, internationalization, recognition of prior learning, industry-driven research and development, and effective monitoring and evaluation.

By implementing these findings and recommendations, Portugal can further enhance its VET system, ensuring that it produces a skilled workforce that meets the demands of the sustainable energy sector. This will contribute to the country's economic growth, environmental sustainability, and competitiveness in the global market. It is essential for stakeholders, including VET institutions, industry, and policymakers, to work together to drive these changes and foster a thriving and innovative sustainable energy sector in Portugal.

6. Attica Region, Greece

6.1 Smart Specialisation Strategies

For the period 2021 – 2027, the General Secretariat for Research and Development has developed the national strategy for smart specialisation, based on eight innovation platforms that relate to the priority sectors of the strategy: agrofood, digital technologies, biosciences / health / medicines, tourism / culture and creative industry, sustainable energy, environment and circular economy, material / construction and industry, transport and logistics. The National Smart Specialisation Strategy 2021-2027 details as well the subsectors of each priority sector and calls the Regions to further define their strategy, following the national one.

Herebelow, we present the sectors identified in the National S3 that are relevant to the Greek CoVE:

- Energy
 - Energy efficiency and energy savings (in buildings, in industry, RES installations etc)
 - Renewable sources for energy production, heating, cooling, off shore installations
 - Energy storage
 - Hydrogen energy technologies
 - Smart grids
 - Reducing impact of fossil fuels
 - Energy communities
 - Energy in transportation
 - Energy in agriculture
- Materials / construction and industry
 - Reduction of CO2 footprint with RES
 - Materials and processes for production, transportation and storage of energy
 - Construction materials for energy efficient buildings
- Transport and logistics
 - Green transports, sustainability in transports
 - Energy efficiency in transports including ports
 - Electromobility and hubrid mobility systems for cars, ships, airplanes and other transportation means.
 - Information systems and big data analysis in transports
 - Technologies for energy efficiency
 - Blockchain technologies for the improvement of energy consumption

We can see that, generally in Greece, special attention is given to the sustainable energy sector, reflecting a global shift towards green and renewable energy sources. Furthermore, sustainable energy related sectors are present also in other priority sectors, notably in construction and transport sectors, including for example construction materials for energy efficient buildings, green transport, electromobility and hybrid systems, technologies and in particular blockchain for energy efficiency.

These subsectors are strategically aligned with the overarching goal of achieving energy sustainability and reducing the carbon footprint. Such a focus not only ensures environmental responsibility but also positions Greece in a global context of sustainable energy leadership.

Linkage with Local, Regional, and National Strategies:

The relationship between the national Smart Specialisation Strategy and local, regional, and national strategies is pivotal for coordinated development efforts. Nevertheless, as per October 2023, the Regional S3 has not been presented yet and the only RIS3 strategy for Attiki is the one for 2014-2019, which is obsolete.

Business Discovery and Collaboration:

A notable aspect of Greece's smart specialisation strategy is the "business discovery" concept. This approach fosters active collaboration between researchers, businesses, civil society, and public sector entities. Through systematic communication and cooperation, informed and actionable policies are formulated, particularly in areas where local communities possess comparative advantages. This collaborative model transforms public administration into a more business-friendly entity, systematically planning development policies. It encourages targeted investments that promote diversification rather than perpetuating existing production models. This collaboration principle is also noted in the National Strategy for Vocational Education and Training and Lifelong learning, as introduced with the law 4763/2020. Since 2021, the country is in the process of reforming the VET and LLL system, introducing national and regional bodies that permit the collaboration between the worlds of education, business, scientific community, public and regional authorities. Specifically, the law 4763/2020 introduced the institutions of SSPAE – Councils for the connection of production and labour market with vocational education and training. These Councils operate at regional level and consists of representatives from regional authorities, businesses and VET institutions and they have as task to analyse the needs of the labour market, propose new VET programmes, facilitate the cooperation between stakeholders at regional level, adapt the training offer at the needs of the labour market and the society in general.

6.2 Fitness Analysis

Research and Innovation Strategies for Smart Specialization (RIS3) must be coordinated with national policies. If a region has designed an effective Research and Innovation Strategy based on a participatory effort that will leave room for the positions of the productive and academic sectors, then it will not be difficult to draw up an infrastructure development strategy financed by the European Regional Development Fund. - ERDF. The aim of this strategy will be to support small and medium-sized enterprises with the prospect of opening to new, improved markets, to support start-ups originating from the development of universities and research centres (financed by the European Regional Development Fund - ERDF, European Social Fund - ESF or even from the Horizon 2020 Program or from Regional Programs). The basic idea is that once the objectives and priorities of the Research and Innovation Strategy (RIS3) are clear, there should be an open dialogue with the Member State, the European Commission and local stakeholders to design a 'roadmap' where the policy mix may be used to finance complementary objectives. At the same time, overlapping efforts should be avoided.

At this point of time and after checking Greek education in the field of circular economy professions, the secondary education of EPAL (vocational high schools) or General high schools (the Greek Secondary education) does not provide any matching education as far as the requested alignment with the strategy is concerned smart specialization , nor is anything planned in the future.

Relevant specialities in EPAL that could benefit from an updating to include competences related to circular economy, sustainability and sustainable energy are:

Sector	Specialisation
Mechanical engineering	Technician of mechanical installations and constructions
	Technician of thermal, plumping installations and gas
	Technical of heating, air condition and cooling installations
	Automotive technician
Electrocal and electronic automation	Technician of electrical systems and networks
Public works, environment and urban planning	Technician of public works and geoinformatics

In addition, new specialities can be introduced to the level of secondary education and training, to cover the demand for skilled technicians in several specialisations that are listed in 6.3.

At the level of postgraduate initial vocational education and training, the institutes of Vocational Training (IEK), a new specialisation for Technician for Renewable Energy has been developed by SAEK Egaleo and has been introduced. Apart from that, there is a need for update of other specialisations that are related to sustainable energy, such as:

Sector	Specialisation
Mechanical and electrical engineering	Automation Technician
	Technician of thermal installations and gas
	Cooling technician
	Automotive technician
Public works	Designer of public works and geoinformatics

Regarding continuing vocational education and training the Agency of the Public Employment Service, through European NSRF programs, makes an effort of smart specialization in targeted skills of the circular economy, through specific business programs implemented by Vocational Training Centers through vouchers for the unemployed mainly, but they lack special knowledge, material and cannot be evaluated as good training practice.

At the level of higher education, the two main providers in the region of Attica are the National Technical University of Athens (NTUA) and the Polytechnic School of the University of Attica (UNIWA). Both HEIs have integrated learning units in their updated curricula, with a basic focus on the circular economy and energy saving as well as production through Renewable Energy Sources. Furthermore, they have developed postgraduate study programmes, such as MSc in Production and Management of Energy (NTUA) and Management and optimisation of energy systems, Circular economy and sustainable strategies, Energy and environmental works, Energy systems (UNIWA).

The success of a real transformation of the current economic model requires a change in individual behaviors and in the collective/cultural adoption of the principles of the Circular Economy, however. In these changes emerges the need for the essential contribution of the educational system to educate citizens with higher education as the leading agent in order to serve the new visions for society and the economy respecting the principles of sustainable development, this is possible through the programs of the Public Vocational Training Institutes, where they offer new thematic units updated through the concept of energy saving, but also in the creation of new thematic specializations with a main focus on the circular economy as mentioned. Undoubtedly, it is very important to have an effective monitoring system to prevent deviation from the goals

agreed between the politicians and the productive forces of each region. Effective mutual recognition between academia and industry is required based on previous collaborative programs and projects, as well as the existence of research and development laboratories within companies as well as highly qualified human resources. Otherwise, a communication gap will be created and there will be serious difficulties in the process of knowledge absorption by companies.

So, just to mention, Greek authorities, led by the General Secretariat of Industry and the General Secretariat of Public Investments, form national public-private partnerships and sometimes together with innovative programs from educational institutions.

6.3 Future Trends and Alignment Analysis

We acknowledge the significant insights provided by the study D3.1: Future Trends. This comprehensive study has shed light on the evolving educational needs that our vocational programs must address. It serves as a valuable resource in shaping our educational landscape to effectively respond to emerging trends in the sustainable energy sector.

The study focused on green construction and concluded on a list of recommendations for specific professions/specialisations that are summarised below:

Profession / specialisation	Structural needs for CoVE
Managers and business functions	Training or reskilling managers for sustainable building design, green technologies and solution, smart design and digitalization.
Architects and Civil/ Structural/ Environmental Engineers	Training or reskilling building professionals, architects for sustainable building design, green technologies and solution, smart design and digitalization.
Architectural Technicians / Technical Drawing Specialists	Training or reskilling Architectural Technicians / Technical Drawing Specialists for sustainable building design, green technologies and solution, smart design and digitalization 3D. BIM, CAD systems training courses
HVAC, Electrical, Mechanical, Sanitary, RE & Building Services Engineers / Designers	Specialized masters and other forms of continuing training in energy efficiency, building codes and energy certification
Renovators	Specialized masters and other forms of continuing training in reconstruction with an orientation towards green buildings

Building Site Supervisors	Specialized masters and other forms of continuing training in energy efficiency, building codes and sustainable building design.
Building botanist/ Vegetation expert	Training or reskilling Building botanist/ Vegetation expert for sustainable building design, green systems, smart design.
Intelligent green building manager	Adaptation of technical and vocational education and training courses/ new courses
Risk management specialist	Adaptation of technical and vocational education and training courses/ new courses
Facilities Managers	Adaptation of technical and vocational education and training courses/ new courses
Energy Auditors, Energy Managers	Specialized masters and other forms of continuing training in energy efficiency, building codes and sustainable building design. Technical education complemented by certified working experience. Training and examination related to certification
Quality Controllers, Inspectors/ Green remote controller	Technical education complemented by certified working experience. Training and examination related to certification
Certifiers, Diagnostics	Technical education complemented by certified working experience. Training and examination related to certification.
Urban Planners	Training or reskilling for sustainable building design, green technologies and solution, smart design and digitalization.
Researchers, Remote Sensing Scientists and Technologists	Training for teachers, researchers..etc.
IT & System Technicians, AI specialist	Training or reskilling IT & System Technicians, AI specialist for sustainable building design, green technologies and solution, smart design and digitalization for GBs.
Weatherization Installers and Technicians	Technical courses in related to Weatherization Installers and Technicians needs as maintenance / Green techniques and technologies and their connections on other parts of building design.
Builders, Installers, Technicians, (Green) Plumbers	Technical courses in related Builders, Installers, Technicians, (Green) Plumbers needs as installation / green techniques and technologies and their connections on other parts of building design.
Environmental health and safety /Water conservation/ Sustainable design specialist	Training or reskilling Environmental health and safety /Water conservation/Sustainable design specialist for sustainable building

	design, green technologies and solution, smart design and digitalization, water conservation methods.
Plumbers, Maintainers, Technicians	Adaptation of technical and vocational education and training courses/ new courses
Policy Makers	Training for policy makers and finance professional. Development of green building standards and certification systems, the use of green building techniques, and environmental education.
Manufacturers and Distributors of Green Building Materials and Products	Technical education complemented by certified working experience. Training and examination related to certification
Developers Building Managers	Courses in green procurement. Promoting green design.

To effectively address the imperatives of the Smart Specialization Strategy (RIS3) and serve the nation's developmental goals, several general specifications must be met:

1. **Adaptability:** Our curricula must remain flexible, enabling us to align with sector-specific and regional needs while preserving the core components of education.
2. **Technological Advancements:** Collaboration with businesses to foster innovation and specialised knowledge development is essential, particularly in the face of evolving technological trends.
3. **Commitment to Sustainability:** We acknowledge the growing emphasis on environmental sustainability and are dedicated to promoting sustainable practices across various sectors. This commitment encompasses supplier impact, waste management, energy conservation, and responsible resource consumption.
4. **Digital Experience and IoT:** As knowledge sharing and technological advancements are paramount, we recognize the need to equip our students with digital proficiency and insights into the Internet of Things (IoT).

SECOVE Program and Emerging Professions

The SECOVE program encourages exploration of sustainable energy, energy management systems, and the circular economy. Our educational models prioritizes the development of curricula that align with these dynamic sectors. We also focus on emerging professions and specialties that can evolve from existing roles or emerge in response to evolving consumer demands and technological advancements.

Filling the Skills Gap

Globally, there is a pressing need for trained technicians who can drive sustainability efforts. We believe that by bridging the skills gap through specialised training, we can help businesses and societies adapt to future opportunities and challenges. This transformation will foster a change in philosophy within businesses, communities, and citizens, ushering in a new era of sustainability.

Four Pillars of New Study Guides

Our new study guides are structured around four core pillars:

- Sustainable Energy
- Circular Economy
- Specialization in Renewable Energy Sources & Sustainable Energy
- Collaboration with Industry Partners

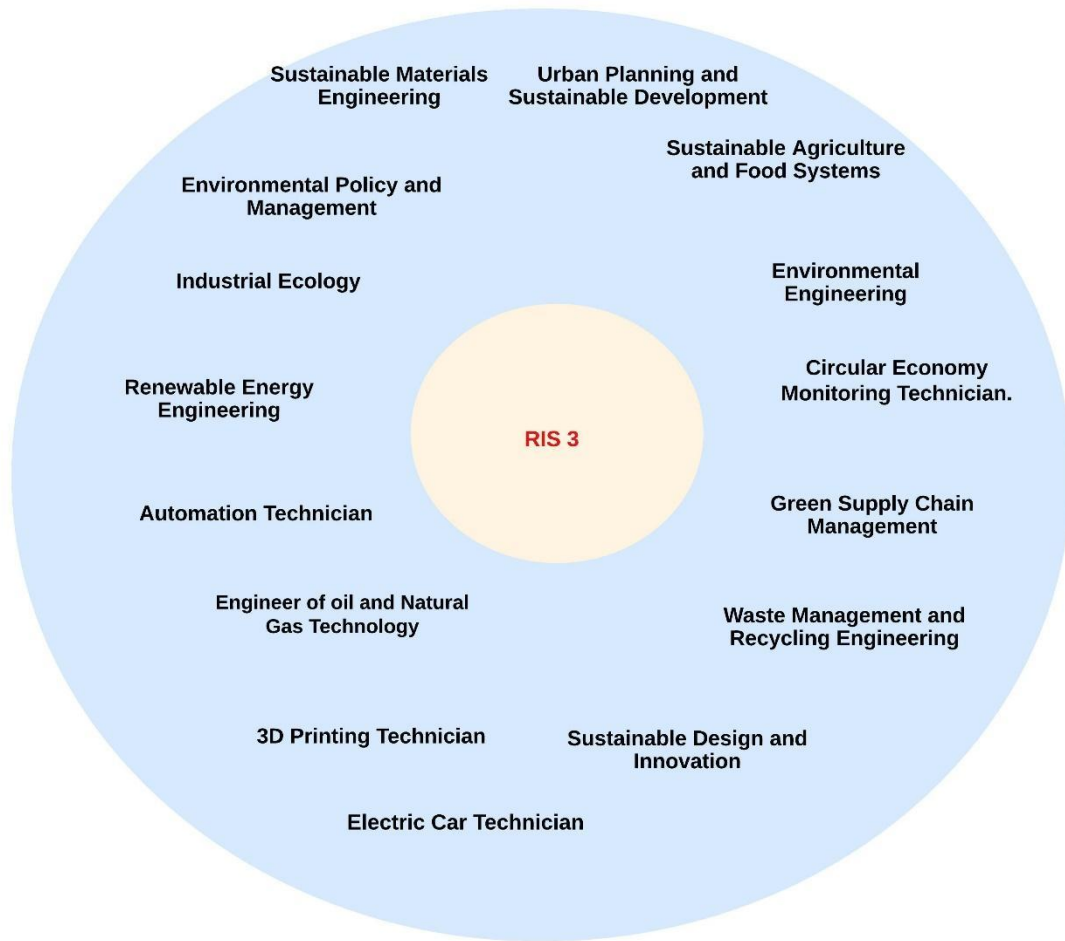
These pillars underpin our commitment to empowering individuals with the knowledge and skills needed to thrive in an ever-evolving landscape of sustainability and innovation

The implementation of the above priorities will be transferred to new thematic specializations or new updated existing specializations. Such specialties as:

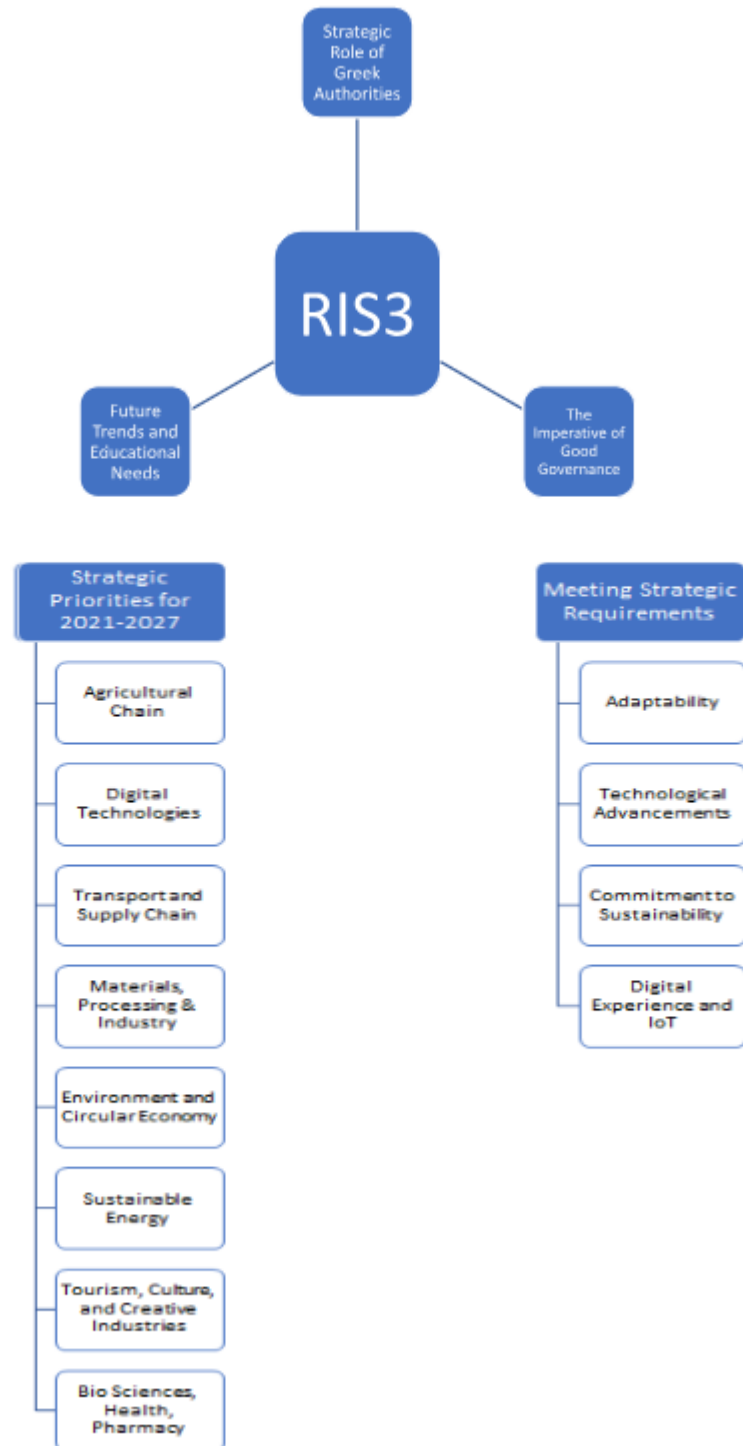
- Sustainable Materials Engineering: This program focuses on developing eco-friendly materials and processes to reduce waste and promote recycling and reuse.
- Industrial Ecology: Study how industries can minimize their environmental impact and optimize resource use through systems thinking and sustainability principles.
- Renewable Energy Engineering: Explore technologies for harnessing renewable energy sources to reduce dependency on finite resources.
- Automation Technician : Exploring skills in deploying automation and control systems that support sustainable and resource-efficient processes. They work to minimize waste, extend product lifecycles, and enhance resource management within automated systems, aligning their work with the principles of the circular economy. This approach seeks to reduce environmental impact while improving efficiency.
- 3D Printing Technician: Technician using technology to reduce waste, optimize resource use, and promote sustainable product design. They may work on projects that emphasize recycling and reusing materials, producing durable and repairable items, and minimizing the environmental impact of 3D printing processes.
- Engineer of oil and Natural Gas Technology: strives to develop and implement sustainable practices within the energy sector. They work to minimize resource consumption, reduce waste, and incorporate recycling and reuse techniques in oil and gas processes. Their goal is to align the energy industry with circular economy principles to mitigate environmental impact and promote resource efficiency.

- Sustainable Design and Innovation: Learn how to create products and systems with a focus on durability, repairability, and end-of-life considerations.
- Waste Management and Recycling Engineering: Dive into the science and engineering behind waste management, recycling, and waste-to-energy technologies.
- Green Supply Chain Management: Understand how to design and manage supply chains that minimize waste, reduce emissions, and improve sustainability.
- Circular Economy Monitoring Technician: Responsible for assessing, tracking, and optimizing the various elements of a circular economy system. They monitor the flows of resources, materials, and products, ensuring that waste is minimized, and resource efficiency is maximized. These technicians play a crucial role in evaluating the sustainability and environmental impact of circular economy practices and processes.
- Environmental Engineering: Focus on designing solutions to mitigate environmental pollution and address resource depletion.
- Sustainable Agriculture and Food Systems: Study sustainable farming practices and food production methods to reduce food waste and improve resource efficiency.
- Urban Planning and Sustainable Development: Explore how to design cities and communities with a circular economy in mind, reducing resource consumption and promoting sustainable living.
- Environmental Policy and Management: Understand the regulatory and policy frameworks that support and drive the circular economy.
- Electric Car Technician

These programs can help participants to gain the knowledge and skills needed to contribute to a more sustainable and resource-efficient future.



6.4 Visualization of the alignment



Future Trends	
Renewable Energy	Circular Economy
RIS 3 Strategies	
Adaptability	
Technological Advancements	
Commitment to sustainability	
Digital Experience and IoT	
VET Specialities	
VET Offering	VET Future
Renewable Energy Technician	Sustainable Materials Engineering
Automation Technician	Industrial Ecology
Engineer of oil and Natural Gas Technology	Sustainable Design and Innovation
3D Printing Technician	Waste Management and Recycling Engineering
	Green Supply Chain Management
	<u>Circular Economy Monitoring Technician (*)</u>
	Sustainable Agriculture and Food Systems
	Environmental Engineering
	Urban Planning and Sustainable Development
	Environmental Policy and Management

(*) : This specialty is already being planned by the DTHIEK Egaleo and will be ready with the new academic year.

6.5 Proposed Changes in VET education and training

- Enhanced Collaboration:

Promote and facilitate stronger collaboration among VET institutions, industry stakeholders, research organisations, and government bodies. Encourage the establishment of partnerships and networks to facilitate knowledge sharing, curriculum development, and the creation of work-embedded learning opportunities. This collaborative approach ensures that VET programs are closely aligned with the evolving needs of industries and technological advancements.

Direct Integration of the Labor Market with Educational Institutions:

Foster cooperation between educational institutions and private companies to develop training programs that directly address the real-time demands of various industries, the commercial sector, and the tertiary sector. These innovative training programs should be designed in close collaboration with educational institutions, ensuring the development of a highly skilled workforce that meets industry-specific requirements.

- Integration of Green Skills in Curricula:

Place a strong emphasis on the integration of green skills into the curricula of educational and training institutions. This involves incorporating green skills into the foundational technical specialties, creating a framework for future professionals who are well-versed in green innovation through specialised training.

- Strengthening Skills for Energy Efficiency:

Enhance the awareness and practical application of energy-saving strategies within the educational system. This initiative extends beyond energy management and incorporates best practices advocated by the European Union. It encourages citizens to develop strategies for energy efficiency, whether in the public or private sector. Promoting the development, installation, and use of energy from Renewable Energy Sources is one facet, along with innovative policies for proper waste management and the promotion of green construction practices.

- Circular Economy and IoT Integration:

Recognize the growing need to transition from a linear industrial approach to a circular economy model. This shift is driven by concerns about resource scarcity and the impact of traditional linear processes. Circular economy practices, such as reusing various products and mechanical components with the help of new design standards, are fundamentally different from traditional recycling methods. They prioritize minimizing the use of natural resources through the principles of "Reduce, Reuse and Recycle."

Experts anticipate that digital technologies, including the Internet of Things (IoT) and the Industrial Internet of Things (IIoT), will play a pivotal role in enabling this economic transformation. IoT, for instance, involves a digital ecosystem comprising sensor-equipped components, machines, and devices that communicate via the internet. This connectivity, often facilitated by cloud computing, allows for real-time data analysis and the optimization of various processes.

Today, forward-thinking companies are embracing innovative IoT solutions to enhance their operations, improve maintenance services, enhance safety measures, and promote sustainability by reducing CO₂ emissions. The synergy between circular economy principles and IoT technologies is a powerful driver of change, making it crucial to align these strategies with the Regional Innovation Strategies for Smart Specialization (RIS3) for sustainable and forward-looking business solutions.

As a result of the best practices that must be followed as mentioned above, the grid through which the new thematic specializations will be developed must be further analyzed in order to serve the need for technicians in circular economy matters. As needed VET can provide best educational practices for training cycle economy technicians and renewable energy technicians to follow the open market needs and co-operate with industries and public organizations.

These recommendations will help students develop the necessary skills and knowledge to excel in the fields of cycle economy and renewable energy while fostering a strong commitment to sustainability and ethical responsibility.

These proposed changes aim to enhance VET education and training in the Attica Region, aligning it with evolving industry needs, sustainability goals, and technological advancements. They emphasise collaboration, green skills integration, energy efficiency, and the adoption of circular economy principles with the support of digital technologies like IoT.

6.6 Best CoVE Practices in the region

Our exploration of best practices within Centers of Vocational Excellence (CoVEs) is a collaborative effort, with each partner contributing insights from their respective regions and countries. This comprehensive review sheds light on the following six main areas crucial for the development of CoVEs in Greece:

Alignment with Industry: A primary focus is establishing direct connections between secondary domains and CoVEs. This entails the harmonisation of industrial demands for executives and technicians with the educational processes, ensuring that curricula remain adaptable to industry needs and constraints.

Modernization of Laboratories: CoVEs recognize the importance of modernising laboratory equipment to mirror real-world working conditions and production parameters. Collaboration with industries and companies is encouraged to facilitate the acquisition of cutting-edge equipment.

Innovative Educational Programs: Embracing innovation and flexibility is key. CoVEs strive to introduce new technologies and foster collaborations between industries and educational institutions to develop programs that remain at the forefront of technological advancements.

Promoting a Culture of Innovation and Research: CoVEs emphasise the cultivation of a culture that promotes innovation and research. Educational institutions play a pivotal role in nurturing this culture through innovative curricula and teaching methods.

Knowledge Sharing and Exchange: The establishment of robust knowledge and learning collection and exchange systems is crucial. CoVEs aim to create platforms where information and insights can be shared among educators, students, and industry professionals.

Teacher Training and Professional Development: CoVEs recognize the importance of restructuring teacher training. While Greece has made limited progress in this area, the emphasis is on continuous learning and practical applications. Both state-led initiatives and industry-driven training for teachers are being explored to enhance their professional knowledge, skills, and

personal qualities. This ongoing process aims to shape teachers' professional identity, encompassing self-image, motivations for the profession, and their immediate and long-term roles.

Creating new specialities in VET such as Waste Management and Recycling Engineering, Circular Economy Monitoring Technician.

Update of specializations active in vocational training institutes such as Renewable Energy Technician and Mechatronics Technician to keep pace with the development of Renewable Energy Sources, energy conservation and the circular economy. Changes that will go hand in hand in the first specialty with the introduction of cutting-edge courses and updating of learning modules in new technologies, knowledge and skills on renewable energy sources and in the second specialty in the preparation of a new program with an emphasis on the Electric Car and the development of new skills and attitudes in the education of the students of this specialty.

In summary, CoVEs in Greece are committed to meeting internationally recognized quality criteria. They aspire to produce individuals capable of creatively addressing the demands of modern life and actively shaping their individual and collective futures. While there may be variations in priorities and emphases, the common ground lies in the shared commitment of institutions and bodies, both at the national and transnational levels, to advance vocational education and excellence.

Finally, it would be useful to mention CoVE programs led by Greek organizations or organizations of other member states of the European Union with the participation of Greek partners that have been or are being carried out, such as :

- Tour-X Center of Professional Excellence (CEP) for Tourism
- FEA-VEE Vocational Excellence and Enterprise united for training, policy reform and sustainability in the fashion, textiles and apparel industries
- SEED Sustainable Energy Education CoVE

6.7 Conclusion

In conclusion, our assessment has shed light on the specific needs and recommendations in each region. We summarise the key take aways from our findings:

- Empowering Through VET: Vocational education and training (VET) plays a pivotal role in empowering students by equipping them with essential skills. These skills not only bolster personal development but also enhance employability and foster active societal participation.
- Catalysing Business Performance: VET programs have a significant impact on business performance, fostering competitiveness, research, and innovation. This transformative

effect is achieved through the implementation of updated curricula that reflect current industry demands.

- **Adapting to the Modern Landscape:** Modern training systems aim to offer specialised programs that align closely with the age when students enter the job market. These programs are designed to be brief in duration, ensuring that the knowledge imparted remains relevant in the rapidly evolving job landscape. Flexibility, both in terms of content and operational methods, is essential for the success of these programs.
- **Complex Implementation Challenges:** Implementing such programs on an international scale presents a multitude of challenges. These challenges encompass technological advancements, evolving methods, and the rapid transformation of subject matter in technical professions. Overcoming these challenges requires careful planning, continuous curriculum redesign, and ongoing instructor retraining.
- **Systematic Revision in Greece:** Greece has undertaken a systematic revision of technical study programs in various technical specialties of VET. Additionally, training manuals have been developed to provide trainers with a standardised reference point for knowledge and skill development in trainees.
- **Key Educational Programs:** Certain educational programs are poised to play a dominant role in the educational and labour landscape. Fields such as energy and energy conservation, Renewable Energy Technicians, Automation Technicians, and specialisations in smart grid technologies are expected to contribute significantly to the country's evolving transition.
- **Enhancing Collaboration:** Cooperation between industries and VET educational institutions remains an area with untapped potential. Strengthening these collaborative efforts is crucial for facilitating the development process and addressing the challenges posed by evolving technical professions.
- **Promoting Research Through VET:** Leveraging VET to bolster research initiatives can foster collaborations with industries and boost the promotion of technical education. These efforts can enhance the country's competitiveness on a global scale.
- **Cross-National Cooperation:** Addressing common challenges in vocational training at a European level is best achieved through the exchange of ideas and the broadening of dialogues. By involving multiple Member States, identifying shared objectives, and collectively developing action plans, common challenges in vocational education can be more effectively addressed.

In summary, vocational education and training are pivotal drivers of personal and economic development. As the landscape continues to evolve, the adaptability and collaborative efforts of educational institutions, industries, and policymakers will be instrumental in ensuring the effectiveness of VET programs in meeting the needs of both students and the job market.

7. Conclusions

The recommendations for aligning Vocational Education and Training (VET) courses with Smart Specialization Strategies (RIS3) in the Kosice, Spanish Basque Country, Porto Metropolitan area in Portugal, Lazio region in Italy, and Attica region in Greece emphasize strategic alignment with regional objectives, collaboration and partnership, technological trends and innovation, sustainable practices and digitalization, lifelong learning and flexibility, internationalization and cross-national cooperation, empowering through VET, and catalyzing business performance.

Strategic alignment is crucial for sustainable development, competitiveness, and economic growth. Collaboration between VET institutions, research centers, industry stakeholders, and government bodies ensures that VET courses are adaptable to future developments and foster a resilient workforce. Technological trends in key sectors should be compared with VET offerings and RIS3 priorities to identify gaps and overlaps, allowing policymakers and educators to fine-tune VET courses to meet industry demands while staying at the forefront of innovation.

Sustainable practices and digitalization should be integrated into VET programs, including modules on energy-efficient building design, green construction materials, digital technologies, and Building Information Modeling (BIM). Lifelong learning and flexibility are essential for the success of VET programs in the rapidly evolving job landscape.

International collaboration is essential for addressing challenges and exchanging ideas in vocational education, enhancing research initiatives, promoting technical education, and contributing to global workforce competitiveness. VET programs play a pivotal role in personal and economic development by equipping students with essential skills.

In conclusion, the integration of VET courses with RIS3 strategies is viewed as a strategic imperative for sustainable development, competitiveness, innovation, and addressing evolving industries' needs.

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