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NETWORK OF EXCELLENCE FOR APPLIED RESEARCH IN VET

Network of excellence for applied research in VET

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Methodological Concept

The NEARVET concept of applied research in Vocational Education and Training (VET)

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RINOVA
innovar, crear & regenerar

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Contents

Acknowledgements and Disclaimer

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Dimitra Education and Consulting (Greece)
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2. Introduction and context – the NEARVET concept and applied research in VET (Vocational Education and Training)

2.1 Introduction to the Methodological Concept

The Methodological Concept Study provides the first pillar of NEARVET. It is based upon the results of a review of available literature and publicly available sources (desk research and literature review) to present the first part of situational analysis in relation to the NEARVET concept and its surrounding context of applied research in VET. As a Study, it specifies and elaborates further the NEARVET (Network of Excellence in Applied Research in VET) concept. This concept was set out in the application to the call for Partnerships for Innovation (Forward Looking Projects), Priority 4: (Structures and mechanisms for Applied research in VET) issued as part of the centralised Erasmus+ programme framework in by the European Education and Culture Executive Agency (EACEA) of the European Commission in November 2021.[1]

NB A note on VET-related terminology used in this Study

Where the terms 'teachers' 'trainers' and 'tutors' are used in their VET context, they are deemed to be interchangeable and synonymous, unless specifically stated otherwise.

Similarly, where the terms 'schools' 'colleges' and 'providers' are used in their VET context, they are deemed to be interchangeable and synonymous, unless specifically stated otherwise

2.2 Introduction to Applied Research

'Applied research' is a term that is widely used within the University community. Arguably, when looked at through an academic lens, it is typically posited by way of contrast to the tenets of *basic research* (sometimes referred to as '*pure*' or '*fundamental*' research). Aside from teaching students, *pure* research has traditionally comprised the core *raison d'être* for Universities. It is surrounded by a series of paradigmatic considerations concerning epistemology and ontology. *Applied research*, on the other hand, is a less widely practised discipline, although there is evidence that the situation is in some 'flux' (see below).

[1] This is explained further below, at section 2.4.

The boundaries between pure and applied research and the way that pure research and applied research have traditionally been distinguished from each other in the academic community are subject to some debate. Some scholars dispute the value of the distinctions that are often made between pure and applied research and challenge the notion as to whether it is useful, or even valid, to draw distinctions between the two – for instance, in areas such as the social sciences in general and in social research in particular. [2]

Within Universities, applied research is sometimes viewed in terms of 'how to apply the findings of University-generated research to real world situations.' However, as surrounding factors shift – factors such as changes in society, the economy, the financing of the University sector and the requirements of government – the traditional distinctions between 'pure' and 'applied' research are subject to ever-increasing attention and discussion. For instance, the definitions and context within which 'pure' and 'applied' research take place across Universities, including the way they should be viewed and defined, is changing.[3] Nonetheless, for others, the distinctions are clear. Below, two simple figures are provided that summarise this widely held perspective on the differences between applied research and pure research:

[2] Ritchie, J. et al (2014*, Qualitative Research Practice*, Sage.
[3] See for example: '*The relationship between basic and applied research in universities*,' Bentley, Gulbrandsen and Kyvik (2015), available at https://link.springer.com/article/10.1007/s10734-015-9861-2#:~:text=To%20this%20extent%2C%20fundamental%20research,and%206%20%25%20not%20at%20all.

(*Figure taken from* https://brainly.ph/question/18585927)

	Fundamental research	Applied research
Purpose	• Expand knowledge of phenomena • Results in universal principles relating to the process and its relationship to outcomes • Findings of significance and value to society/organizations in general	• Improve understanding of a particular problem • Results in solution to problem • New knowledge limited to problem • Findings of practical relevance and value to problem owner(s)
Context	• Undertaken by people based in universities and other research institutes • Choice of topic and objectives determined by the researcher • Flexible timescales	• Undertaken by people based in a variety of settings including organizations and universities • Objectives negotiated with originator • Tight timescales

Adapted from Saunders *et al.* (2012, p. 12).

2.3 Specific considerations in relation to Applied Research in VET

It is outside the scope of this Study to enter the debate more deeply about the definition of applied research, as it is conducted in academia. The concept of applied research is also considered in various ways, alongside and outside of the University sector.[4] Therefore, at this point the Study steps outside of this discussion, and instead of viewing the matter through an academic lens, for instance, it orientates itself to consider the concept of applied research in the specific context of VET.

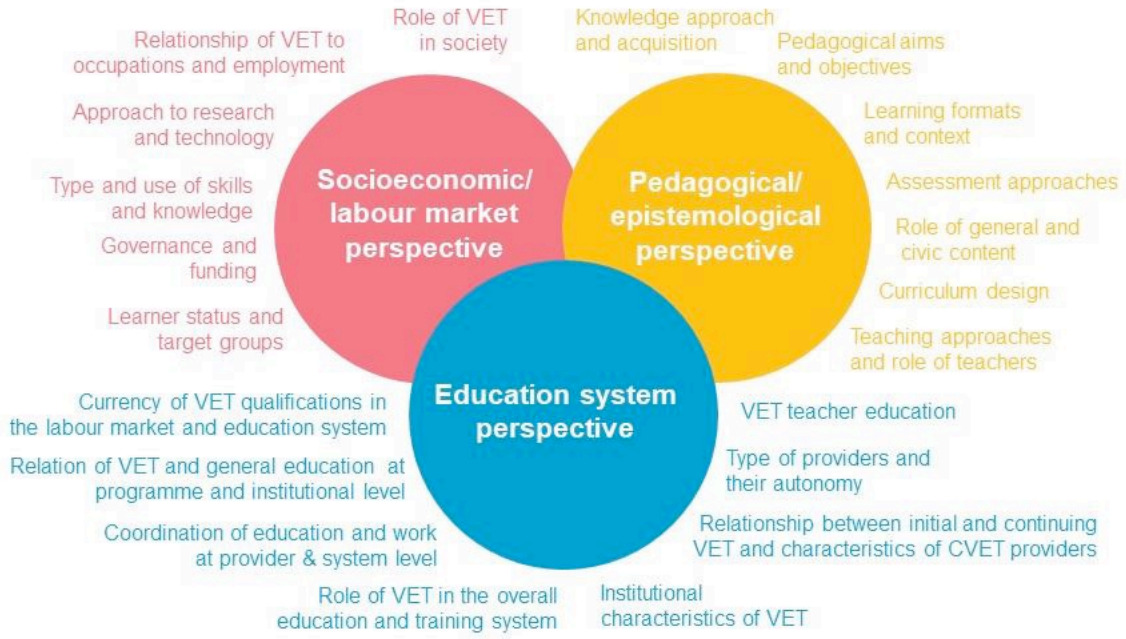
In one respect, the notion of applied research specifically in VET is not a new one. As long ago as 2010, CEDEFOP addressed the question in an article surrounding the publication of its report *The modernisation of vocational education and training*. However, the way it referred to applied research in VET at that time was somewhat different to that of the present day. At that time, CEDEFOP was concerned with the fact that change in VET was driven by the need to respond to socioeconomic challenges, but that VET itself can be a factor for change: it supports economic development, encourages innovation and productivity in companies, and helps provide the skills that employers and employees need. However, CEDEFOP noted that it was doing so with relatively little input from research, carrying the risk that the efforts to modernise VET would not achieve the desired results. It therefore called for research that, rather than being focused on reviewing policies and practices, "should identify which measures work, under which conditions and for whose benefit." [5]

At its simplest, the conceptualisation of VET is, principally, circumscribed to developing the capabilities, competencies and skills of the present and future workforce through vocational education and training for both young people and adults. However, whilst this understanding of VET is necessary and key to making progress, it only represents a partial conception as regards the potential that the VET system holds.

For instance, in 2023, in its most recent comparative study of VET, CEDEFOP has developed a framework that is aimed at understanding the different conceptions and approaches to VET that exist within and across European countries.[6] This framework identifies '50 dimensions' of VET, pointing to how having an appreciation of the widespread variety of goals that are set for VET in different contexts can also point to potential conflicts, for example between social, economic and educational goals. These dimensions are drawn together by its 'Three

[4] See for instance https://www.questionpro.com/blog/applied-research/ Applied Research: Definition, Types & Examples; or https://www.voxco.com/blog/applied-research/ What is applied research?
[5] https://www.cedefop.europa.eu/en/news/why-applied-research-should-underpin-training-policy
[6] The future of vocational education and training in Europe: 50 dimensions of vocational education and training: Cedefop's analytical framework for comparing VET (2023), CEDEFOP.

Perspective Model of VET that it uses to analyse epistemological and pedagogical, education system and a socioeconomic or labour market perspective. This are considered alongside the different educational, economic and social purposes that VET usually pursues:



In this complex and multi-dimensional context, the European Commission has identified applied research in VET as a priority area for intention. One of the particular drivers towards highlighting the importance of applied research from the European Commission's perspective was the revelation in its Innovation Survey that just 4% of 'innovations' are based on academic research, whereas 96% of innovations are sourced by customer contacts, company networks and similar interactions, typically evolving from a practical need, and developed in a context far removed from environments in which scientific innovations are produced.[7]

The European Commission, in its calls for proposals quotes (but does not reference) a paper from Australia in the field of applied VET [8], stating that "*A distinguishing characteristic of applied research in VET is the sector's potential to bring together research and innovation, with the dual aims of understanding industry's problems and bringing about change in the workplace. The skills required to create and diffuse knowledge overlap both call for inquiry, reflective practice, communication and collaboration*."

[7] As highlighted by Vesa Harmaakorpi, Professor of Innovation Systems at Lappeenranta University of Technology, Lahti Area, Finland

[8] Simon, L and Beddie, F.M. (2017), *Explaining the VET applied research developmental framework*, NCVER

VET institutions are logical partners to assist with this challenge. As the only truly industry facing education sector, Vocational Education and Training is the obvious vehicle to actively engage SMEs in Applied Research. As well as providing training and encouraging learning, VET can become a catalyst for innovation in small businesses and microenterprises. Advanced VET requires direct contact between business and education/training to generate awareness about new trends, technologies and techniques and so deploy them rapidly and efficiently. The long history of the working relationship between VET and SMEs sets a strong foundation for practice-based innovation and applied research. The public foundation of VET provides a high-integrity, deliberate platform for the progression of government policy priorities. A new approach for vocational education targeted to productivity, technology adoption and applied research can be a new form of stimulus for enhancing economic growth, creating and diffusing an innovation culture across more areas of the European economy.

2.4 The context for NEARVET

It is in this context that the Call for Proposals from the EACEA was issued, and where NEARVET is located. [9] This call goes on to state that "*Another feature of VET applied research is the close link between research and efforts to improve VET pedagogy. These endeavours can lead to innovative thinking, new teaching practices and training products, and ultimately more creative graduates*" It adds "*In many countries applied research has led to stimulate innovation in companies, in particular in micro and small and medium enterprises (SMEs), as well as the continuous improvement and innovation in VET teaching and training practices. By being actively engaged in applied research with local companies, VET providers become co-creators of local innovation eco-systems. They do so by contributing to the generation of new and improved products, services and processes, but also through the supply of skilled, innovative and entrepreneurial VET graduates*."

NEARVET has been designed in a fast-moving and comprehensive cross-cutting policy context at the European Union level. A non-exhaustive list of this surrounding policy field that has direct relevance to VET in Europe and in which NEARVET has been initiated includes:

- The Council Recommendation on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience, calls for the establishment of Centres of Vocational Excellence.

[9] ERASMUS-EDU-2022-PI-FORWARD-LOT2 (25th November 2021)

- The Osnabrück Declaration on vocational education and training as an enabler of recovery and just transitions to digital and green economies, calling for support at EU level to "*Develop and strengthen centres of vocational excellence as innovative incubators and skills ecosystems encompassing learning, training and research activities.*"
- The European Pillar of Social Rights Action Plan; The European Commission's Green Deal, the UN's Sustainable Development Goals and the Paris Declaration on Climate Change
- The European Skills Agenda (notably action 1 on the Pact for Skills, action 6 on Skills to support the twin transitions, and action 8 on Skills for life.
- The Council Recommendation on Upskilling Pathways: New Opportunities for Adults.
- Digital Transformation in our education and training systems, as well as in youth, as encompassed in the European Commission's Digital Education Action Plan 2021-2027.

Furthermore, the European Commission highlights the importance of improving the skills of teachers and trainers in this field to meet the challenges of the future. It emphasises that VET teachers have a responsibility to provide students with the necessary skills and knowledge to adapt to changes in the labour market, digitalisation, globalisation, and the transition to an ecologically sustainable model. In addition, it underlines the need for greater collaboration between education and industry, as well as the need to fund further training for teachers and proposes the establishment of mechanisms to support teachers' professional development, including lifelong learning opportunities and the exchange of good practice. It also highlights the importance of strong and inclusive lifelong learning strategies that allow those who dropped out of education to return to education and those who need to acquire or update their skills to access higher education and vocational training programmes. [10]

The European Training Foundation, in its contribution to Smart Specialisation, states that "By engaging with Applied Research, VET institutions can play an active part in the innovation process, generating rapid feedback on new breakthroughs and feeding it immediately into education and training systems. Innovation is also more than technology. It includes social innovation in the organization of firms and production, as well as financial innovation creating value in firms brought about by well-educated and trained staff. Accordingly, investment in high quality upper-secondary and higher-level vocational education and training are extremely crucial factors for innovation (e.g., Lundvall, 2002; Rethinking the Bruges Communiqué on enhanced European Cooperation in VET; 'Rethinking Education: Investing in skills for better socio-economic outcomes the 2020 Council Recommendation on VET). According to the Joint Research Centre of the European Commission[11], VET needs to

[10] https://www.europarl.europa.eu/factsheets/en/sheet/139/education-and-vocational-training
[11] Markowitsch & Hefler, JRC Working Papers Series on Labour, Education and Technology

incorporate research-based knowledge, playing an active role in the processes leading to more or less pronounced levels of job polarization (Fernandez-Macias, 2012)

This is complemented by UNESCO's 20022 strategy for technical and vocational education, which highlights the key skills that are necessary for learners to adapt to the ever-changing world of work and the importance of continuing education and training for professional development in the digital age. In addition, it addresses the need to strengthen collaboration between different actors in education, including educators, employers, and policy makers, to address the challenges posed by the digital age.

NEARVET was designed to respond to these challenges, and specifically those which the European Commission under the Partnerships for Innovation (Forward Looking Projects), Priority 4: (Structures and mechanisms for Applied research in VET). Results of such projects, as the call states, "*should have the potential to be mainstreamed, and contribute to the modernisation of VET systems and their engagement in applied research and experimental development, while providing learners with opportunities for challenge/project-based learning."*

NEARVET does so by elaborating an innovative mechanism of systematic inquiry and development of Applied Research in VET. NEARVET draws upon state-of-the-art methods in the co-creation and validation of applied research methods in VET through andrological philosophies and user-led and user-validated methods and techniques. It is founded over a variety of methodological approaches and sources, rooted in the need of combining solid and acknowledge research methodologies with the incorporation of viewpoints of different audiences, from a variety of contexts. As required by the call, NEARVET sets out to:

- Identify, assess, test, and develop structures and mechanisms for applied research in VET, to broaden its engagement in R&D and innovation systems;
- Build the capacity of VET systems with the close involvement of teachers and trainers, as well as VET learners, to undertake applied research and manage innovation projects together with other organisations, and in particular SMEs.

In particular, NEARVET focuses on addressing a central issue within the It seeks to address a question that is often left unaddressed – i.e., *'if applied research in VET is critical - who are the applied researchers?*'. NEARVET realises its ambitions through an interdependent, highly participative work programme, that :

(a) elaborates a methodology concept, within which it will draw upon state-of-the-art methods in the co-creation and validation of applied research methods in VET through andragogical philosophies and user-led and user-validated methods and techniques

(b) identifies, defines and specifies the competences required to act effectively in the performance of applied research in VET, including the elaboration of standards and the performance criteria and attainment levels in relation to knowledge and skills to conduct effective applied research in VET

(c) provides and nurtures a community of practice rooted in a wide and relevant network, fostering exchange of knowledge and innovation through applied research and collaboration between VET practitioners, stakeholders, employers, enhancing VET's role in innovation, research, and development across the EU

(d) co-creates and validates a set of practical resources and methods, through the establishment and facilitation of a digitally enabled transnational platform and Hub

(e) introduces a comprehensive legacy framework, supporting transferability and sustainability in a long-term perspective, including the exploitation of its results in five additional countries in addition to the six involved in the proposal

NEARVET recognises that EU countries need to invest in their innovation systems at the national and regional level, to be competitive in a globalized economy. However, whilst Universities are critical to this challenge, NEARVET argues that the innovation literature has tended to overemphasize the role and effectiveness of university-based Research & Development (R&D), to emphasize knowledge creation rather than knowledge diffusion and exploitation, and to prioritize research universities and other types of educational institutions (VET) and opportunities.

This Study contributes to objective (a) stated in 2.4 above, which is concerned with deepening and specifying the NEARVET Methodology Concept, with a view to forming the subsequent elaboration of its objectives and results, as summarised in section 2.4 (a) – (e) above

2.5 Concept Study: Method and approach

The design approach used to develop this Methodological Concept was initially elaborated by the NEARVET consortium at a discussion and working session held in Berlin on the 23rd and 24th March 2023. The purpose of the working session, following an immersion into the NEARVET concept, and its aims and objectives, was to provide initial input from which further investigation would be undertaken, in the framework of NEARVET's Work Package to define the concept further, based on an in-depth analysis and research programme that would deepen the needs analysis articulated in the initial application.

This Study draws upon the results taken from desk research and a literature review exercise conducted in Sweden, Italy, Germany, Greece. Cyprus and Spain during the course of 2023. This exercise was prepared by Rinova, using an applied research framework (in recognition of the fact that not all of the partners were either qualified researchers or experienced with literature reviews), through which the consortium members were provided with a specification for undertaking the desk research and literature review, as well as guidelines for writing up their findings. The findings were produced, in each case, as draft national study reports. The findings were collated and, in turn, edited and stratified by Rinova, not as country reports, but as 'chapters' against the initial 'attention areas' that had been identified (see 2.6 below).

Prior to the production of this Methodology Concept in September 2023, a formative version of this Study, together with the results of the desk research, was first produced in June 2023. This earlier version provided the results of the desk research and drew a 'first level' set of initial observations and conclusions. It was shared at that time with the consortium in order to inform an accompanying programme of work, in which a series of interviews were to be undertaken by the consortium members with stakeholders identified as 'key informants' and with whom these initial desk research findings could be drawn upon. This final version of the Methodology Concept updates the previous formative version and takes its analysis, observations, conclusions further, with a view to informing the elaboration of the subsequent NEARVET work programme and its next step, which is to develop a 'Blueprint' and Competency Framework. It will also be accompanied by a further study, coordinated by Fachhochschule des Mittelstandes, in which the results of those interviews are to be presented.

2.6 Introducing the Results

The results are structured on those 'attention areas' that were identified through discussion and the desk research. In NEARVET, at this stage of the design process, 'attention areas' are defined at two levels:

- Attention areas that are identified as the thematic and 'topic' areas that require further and deeper investigation and elaboration (through primary engagement with stakeholders via exploratory research conducted by qualitative method, via interviews and focus groups

- Attention areas that will form the framework to be addressed by the elaboration of the subsequent NEARVET Blueprint, its competences, resources and community of practice.

With regards to the attention areas in the first level, these are identified in this report – and presented as a series of thematic chapters (3-8) that follow, thus:

- The present situational analysis, in Europe and specifically in relation to Sweden, Italy, Germany, Greece, Cyprus and Spain;

- The state of the art with regards to relevant information sources and published literature – from academic articles to website and blog posts, government level policies and programmes and illustrative case studies;

- The state of the art with regards to case studies and examples of collaboration in VET through applied research or related initiatives and methods, between two or more stakeholders drawn from Universities on the one hand, and VET providers, business and industry and the public sector on the other;

- the challenges in relation to the skills, knowledge and mindsets required by VET teachers, in order to be able to conduct and supervise, or otherwise participate in, applied research projects in VET;

- the challenges in relation to the skills, knowledge and mindsets required by private sector Managers, businesses and employers in order to be able to conduct and supervise applied research projects in VET;

- the challenges in relation to the skills, knowledge and mindset required by academic institutions and their researchers to conduct and supervise applied research projects in VET (incorporating, where identifiable, the applied research skills required by academic staff, VET graduates and others.

With regards to the attention areas at the second level, the Methodological Concept draws upon the conclusions of the desk research at chapter 9 to develop a set of observations at chapter 10 to inform the NEARVET Blueprint.

3. Translating the concept of applied research in VET: Issues concerning the understanding and usage of the term

Overview

The purpose of this section is to explore the way that, and the extent to which, the term 'applied research in VET' is used, appears, or is otherwise referenced or understood, in literature and published sources in Sweden, Italy, Germany, Greece, Cyprus and Spain.

In **Sweden**, by way of context, VET programmes are differentiated thus:

IVET – as in many European countries, IVET is an upper secondary education. Except giving knowledge and skill for a specific profession, it also has a component of citizenship and general knowledge.

CVET – Traditionally, CVET in Sweden has been used for re-skilling and upskilling. Especially in time of economic recession, CVET has been used to raise the skill of unemployed people. It has also been used to keep the number of open unemployed people down. Lately it has been used to prepare the labour force for digital economy and industry 4.0

Higher VET – This is a post-secondary education at university level but non-academic. It is way to respond to immediate shortages of highly skilled people for local and regional economy. Employers together with providers define the curriculum and each program has board consisting of a majority of employers who is going to hire the graduates. This form of VET is research-based VET, in the sense that the latest development within the occupation is transferred to the students. Most of the teachers and trainers are directly from business or research centres.

In Swedish, "*applied research in VET*" is translated by "*Tillämpad forksning inom yrkesutbildning*." In the Swedish context, applied research is conducted to explain and offer a solution to current societal problems. The opposite of applied research in Sweden, as in academia in general, is basic research, which is undertaken to unconditionally seek new knowledge about how the world is made up without any immediate requirements for applying the results.

Applied research in the VET context in Sweden is used to define the need to include new knowledge and skill because of innovations in occupations. The reason behind it is that Swedish science academy changed its position2010. It is not easy to place practical research in one of the usual categories which are usually used to characterise research. A division

usually made is between what is called ‘curiosity research’ and such research that is associated with ‘utility.’ While the former is driven by a desire "to know", the latter aims for the research to be usable and useful. However, the majority of the examples in the report from the Swedish science academy are characterized by a quest for increased knowledge as well as utility.

Another distinction the academy made was between basic and applied research. Applied research is expected to utilize the results from basic research in concrete contexts. In its purest form, this distinction involves an assumption that the research investigates and establishes basic, general relationships. On the basis of this, predictions can be made and form the basis of the application in various fields. If one instead sees the contribution of basic research as producing certain ways of understanding and perceiving phenomena and problems, however, the meaning of applied research becomes different.

Regarding VET in Sweden, there is not a great deal of research concerning interdisciplinary undergraduate and postgraduate education. This applies to an even greater degree to vocational training. However, the higher VET system is aiming to facilitate motivation and curiosity among the students by emphasising:

I. Project work regarding real problems in companies (project management is a subject there
II. Group work on projects
III. Critical Digital literacy
IV. Curation and production of new knowledge or present updated knowledge
V. Collaborative learning

There is a clear need for further work on applied research in VET in Sweden. According to a study (Digitalisering i yrkesutbildningen inom samhällsbyggnads-sektorn: en förstudie, 2020) the majority of the interviewed teachers have worked as vocational teachers for more than 10-12 years. Almost all the interviewed teachers have a background as a professional worker and vocational teacher training. Some have also other education and professional backgrounds, for example from the supplier industries. The continuing education needs of vocational teachers vary from teacher to teacher. According to the Swedish National Agency for Education's survey, high school teachers need competence development in:

I. Teaching for students with special needs.
II. Information and communication technology as a tool in teaching.
III. Knowledge to be able to build up students' digital skills, including:
    a. knowledge of programming,
    b. to manage calculation programs,
    c. to work with image, sound and film,
    d. to know laws and rights on the internet,
    e. to work preventively against violations, as well as

f. to promote safe use of the internet.

In **Italy,** VET is said to be held in relatively poor esteem, and it is reported that Italy has the lowest participation in the EU in lifelong learning. The debate about needs and scope of Research and its link with economic and social development and innovation, has attracted increasing attention over the past 20 years. The reflection obviously also concerned the field of education. While European policies strengthened the connection between research, labour market and VET (e.g. the skills ecosystem within CoVEs), in Italy it seems that the public debate has, so far, remained confined to the sphere of education and/or companies without specific reflection in the sphere of VET. The National Recovery and Resilience Plan allocates resources for education and research with the intention of strengthening the conditions for supporting research and innovation. Still, no clear and direct connections are established between VET, companies and research. The latter is only clear connected to the relationship between research institutions and companies. CRESPI (Italian Centre for Educational Research on Teacher Professionalism) in its paper to contribute to the research on the education and training of teachers and their professional competences, states that Ricerca-Formazione (Teacher Professional Development Research) is a methodology which entails that educational research is carried out within the schools and with teachers, in order to develop/transform teaching and education and enhance teachers' reflexivity.

In Italy, it is arguable that the level of cooperation between the public and private sectors is below the average levels of European countries and represents one of the main bottlenecks of the national innovation system, despite the great capacity of Italian researchers, also highlighted by scientific publications. Italian research takes place mainly within public and private research institutions; to a lesser extent, in large companies and universities. Small and medium-sized enterprises (SMEs) with low internal research capacity, but with innovation needs, can carry out joint research projects with universities and research centres acting as research implementers for SMEs. Even the associations or representative structures of SMEs can interpret the needs of their companies and rely on research executors.

ITS Academy and COVE: institutions for applied research - Higher VET training (ITS Academy in Italy) represents today a real axis for the development of the industrial system also for applied research, prototyping, continuous training and business services. CoVEs (such as the ITS Academy National Network in Italy) aim to collaborate with local SMEs by sharing equipment and offering incentives for staff to engage in applied research and development projects, with the involvement of VET learners, and providing SMEs with the necessary technical support, tools, methodologies and training to enhance their offer of apprenticeships and adult upskills/retraining pathways. COVEs should support or act as innovation hubs and technology diffusion centres, which could support the innovation of companies, and at the same time share equipment and incentivize staff to collaborate with local SMEs in applied research and development projects, with the involvement of VET learners.

Investment in Italy - A national and structural research strategy in Italy has been designed in the last 2 years, within the funding of the new PNRR (National Recovery and Resilience Plan), which will be supported by the "Italian Science Fund" and the "Italian fund for Applied Science". In the Italian Recovery and Resilience Plan, against a total allocation of 11.44 billion euros, the general objectives consist of "strengthening research and promoting the dissemination of innovative models for basic and applied research conducted in synergy between Universities and companies" (6.91 billion euros), "support processes for innovation and technology transfer" (2.05 billion euros) and "strengthen research infrastructures, capital and skills to support innovation" (2.48 billion euros). In particular, the PNRR addresses the critical issues related to the low level of R&D spending and the low number of researchers, with the awareness of having to improve the synergy between public and private in the strategic interest of the country, through the creation of partnerships of national importance or with a territorial vocation and a greater investment in young researchers.

In **Germany,** 'applied research in VET' is translated as "angewandte Forschung in der Berufsbildung," but the two aforementioned terms are usually considered separately. No relevant research literature on the specific subject of "applied research in VET" has yet been identified. The term 'applied research,' as in general, refers to scientific activities and disciplines that, in contrast to basic research, are motivated primarily by the goal of utility and direct practical application of the knowledge gained.

Vocational education in Germany consists of two parts: a theoretical part in vocational school and a practical part at work in a company. It usually lasts between 2 and 3.5 years. Vocational training in Germany is governed by the "Berufsbildungsgesetz" (Vocational Training Act). It regulates in-company vocational training, vocational training preparation, further training, and vocational retraining. The Vocational Training Act also defines the prerequisites of the vocational training relationship. Thus, the theoretical and practical combination of these two areas (Applied Research/ VET) should produce profitable and innovative results for the vocational training of the future. Given that Applied research is solution-oriented and applies knowledge and inventions to find solutions, applied research is highly appropriate in the context of vocational training. The vocational education and training system comprises offers of vocational preparation and qualification after a preceding general education qualification phase. The spectrum ranges from vocational orientation and preparation programs to training programs with different organizational forms (full-time school-based to dual-organized), duration and qualification level. Duration and qualification level up to advanced training and further education in the service of vocational adaptation (retraining), reorientation, professional development or with the aim of career advancement. In Germany, when people talk about the dual system of vocational education and training, they usually refer to the system of simultaneous training in a company and at a vocational school.

In **Greece**, Applied research in VET is an area that is still developing. There is a growing recognition of the importance of research for improving the quality and relevance of VET programmes, but there are also challenges related to the limited funding and resources available for research in this field, as well as the need to build capacity and promote collaboration between researchers, VET providers, and employers. The translation of 'applied research in VET' into Greek language is 'εφαρμοσμένη έρευνα στην επαγγελματική εκπαίδευση και κατάρτιση.' With reference to the perceptions of VET teachers in Greece regarding research in VET it is found that many teachers expressed a lack of familiarity with research concepts and methodologies, as well as a perception that research was disconnected from the practical realities of teaching and learning in VET contexts. This suggests that there may be a need for increased awareness and education regarding the value and relevance of applied research in VET in Greece, as well as efforts to bridge the gap between research and practice in this field.

Applied research in VET in Greece generally refers to the same concept as in Europe more widely: research that aims to address practical problems and challenges in the field of vocational education and training. In some European countries, applied research in VET may focus more on the development of innovative teaching and learning methods or the design of new vocational training programs, while in Greece, it may focus more on evaluating and improving existing VET programmes or examining the impact of VET on the labour market. Additionally, the specific priorities or challenges facing VET in different European countries may influence the focus and scope of applied research in that context. For example, in some countries with high youth unemployment rates, applied research in VET may prioritize developing strategies to improve youth employability, while in other countries, the focus may be on addressing skills shortages in specific industries.

There are several web-based information sources that provide information about various aspects of VET in Greece, including qualifications, training providers, accreditation and quality assurance, and research and innovation. While some specifically mention research and innovation in VET, they do not provide detailed information about applied research in VET in Greece specifically. However, the websites can be useful for gaining a broader understanding of the VET system in Greece and the policies and initiatives that support its development. Some of them are:

1. National Organisation for the Certification of Qualifications and Vocational Guidance (EOPPEP): EOPPEP is a public organization that is responsible for the certification and recognition of qualifications and competences in Greece. Their website provides information on VET programs, qualifications, and training providers in Greece, as well as research and innovation initiatives in the field of VET. You can visit their website at: https://www.eoppep.gr/

2. National Centre for Vocational Orientation and Career Guidance (EKEPIS): EKEPIS is a public organization that provides vocational orientation and career guidance services in Greece. Their website provides information on VET programs and qualifications, as well as research and innovation initiatives in the field of VET. You can visit their website at: https://www.ekepiksevmatismou.gr/
3. Hellenic Quality Assurance and Accreditation Agency (HQAA): HQAA is a public organization that is responsible for the evaluation, accreditation, and quality assurance of higher education institutions in Greece. Their website provides information on the accreditation and quality assurance of VET programs and qualifications in Greece, as well as research and innovation initiatives in the field of VET. You can visit their website at: https://www.adip.gr/

Overall, while there are still challenges and limitations associated with applied research in VET in Greece, there is also growing recognition of the importance and potential impact of research for improving the quality and effectiveness of VET programs, and there are opportunities for collaboration and innovation in this field.

In **Cyprus**, a working definition of applied research (not specific to VET) provided by the Cyprus University of Technology explains that *"applied or industrial research can be defined as the research or critical investigation which aims in the acquisition of new knowledge with a focus to be used in the development of new products, processes or services in order to contribute to the significant improvement of current products, processes or services"*. (Papailiou, no date). Continuing with the further use of the term in the country context, through applied research projects, it promotes the cooperation between the education and research institutions and the social and production institutions of the economy, having as a general aim the exploitation of the research outcomes by the economic and social actors. Moreover, due to the complex nature of the current problems that are faced by the economy and society, there is a need for an interdisciplinary approach in engaging and tackling specific issues. (Papailiou, no date).

Research and development (R&D) in Cyprus are relatively limited and was developed mainly after the mid-90s, whereas accession to the EU was the driving force for an increased emphasis in R&D. However, an additional factor is that the Cypriot government perceives research, development and innovation as integral parts of its economic development target. Consequently, higher education institutions and research centres have increased their research efforts and output due to increasing national and international funding opportunities that came as a result of the above-mentioned forces. (HRDA, 2009). The Cyprus University of Technology places at the forefront applied research that is connected with various critical sectors of the economy naming the hospitality industry, energy market, sustainable development and the environment, health, biotechnology, information

technologies etc. It has generated a specific development and cooperation model that highlights the key role of the social and production factors of the Cypriot economy, in identifying problems in various products, processes and services that have to be communicated to the relevant education and research institutions to undertake applied research focused on practical solutions and applications. In essence, the model connects the production factors of the economy with the research institutions which after having received a specific problem in one of the above-mentioned fields they record and investigate the problem, conduct applied research and provide the research results to the relevant industry for application. (Papailiou, no date)

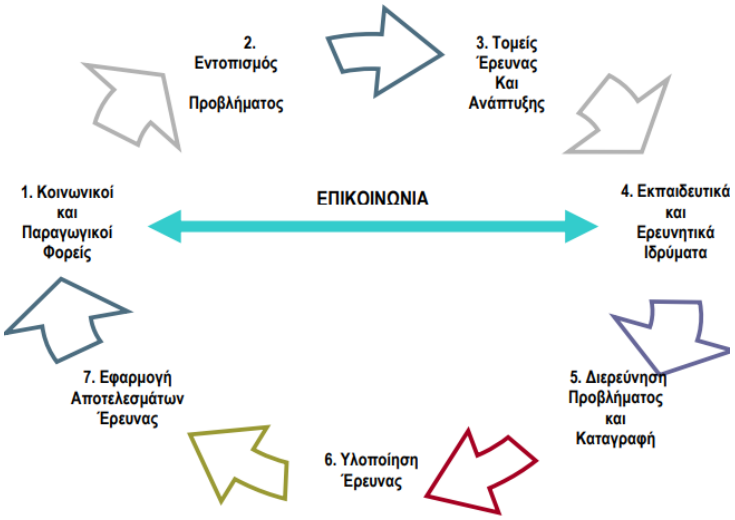


Figure 1: Model of development and cooperation (found in Papailiou)[12]

The strategic priorities of the government for the digital transformation of the sectors of the economy; the encouragement of the use of blockchain technologies in both the public and private sectors; the promotion of digital entrepreneurship; and the promotion of sustainable development in production point to the importance of applied research in VET and the skills required. (Theocharous, 2020). Furthermore, the economy of Cyprus experiences a fundamental redirection towards the blue (HRDA, 2017); and green economies (HRDA, 2018) and the respective workforce skills needed for the relevant job positions. (Theocharous, 2020). Two other major developments / drivers are:

[12] (Glossary (clockwise): 1. Social and production factors, 2. Problem identification, 3. Sectors of Research and Development, 4. Education and Research Institutions, 5. Recording and Investigation of the problem, 6. Conduct of research, 7. Application of research results, Two-way communication (arrow)).

- *sustainability* as a major concern for industry and the labour market and the involvement of learners in defining environmentally just transition plans; and
- *the demographic change* that the Cypriot society faces due to the increased numbers of foreign workers and the need of this workforce to unlock its potential. (Cedefop,2021)

Thus, all the challenges faced in the Cyprus economy during the past decade and the priorities set by the competent authorities for the future instigate the need for shifting from the existing model of economic growth to a sustainable, innovation driven model, supporting long-term growth and social prosperity. To achieve that, it is necessary to adopt a long-term national strategy for technological, social, and economic development, based and driven by research and innovation. (Cyprus research & innovation strategy framework, 2019). Hence, there are no conceptual issues and problems in the use of the "applied research" term in VET in the Cypriot context in which there is a clear understanding of the positive correlation that has with business and societal development. Nevertheless, the definition should be revisited so as to think about its broader scope and its inclusivity in terms of the stakeholders participating and benefiting through their direct engagement in applied research activities.

In **Spain**, it is estimated that in 2030 there will be 92,500 unfilled VET jobs. The sectors that will require the most VET workers in the coming years will be commerce, manufacturing and healthcare. Given the lack of VET technicians, a new VET law approved in March 2022 will provide an increase in resources in the system, where there will be an increase in the supply of VET places and, as a consequence, more young graduates with the necessary qualifications will be able to improve their access to the labour market. It will also facilitate the adaptation of graduates to the needs of the productive fabric, which will increase the employability of VET technicians, thus improving social and business perception. The branches that account for 53.3% of students enrolled in vocational training are health, administration and management, IT and socio-cultural and community services.

A study by CaixaBank Dualiza (a Caixa Bank body that promotes vocational training and lifelong learning) and Orkestra-Basque Institute of Competitiveness of the University of Deusto, "Report 2022: A new VET Law for new times" highlights the importance of vocational training (VET) in the current context of technological change and the demand for specific skills in the labour market. The Observatory of VET in Spain proposes a new VET Law that addresses the challenges of vocational training in the future. The report points out that VET needs to be more flexible, accessible and adaptable to the needs of the labour market. It also highlights the need to improve the quality of VET, career guidance and the employability of graduates. In addition, it identifies a number of priority areas to work on in the new VET Law, including the creation of a competence certification system, the promotion of innovation in VET, the improvement of Dual VET provision and the expansion of online VET provision. At the same time, it addresses the importance of collaboration between companies and educational

institutions to improve vocational training and employability and the need to improve the image of VET and increase its attractiveness among young people and companies.

In this context, however, and as highlighted in other countries, the concept of "applied research in VET" can be confusing for those who are not familiar with the basic concepts of research, as it is assumed that 'research' is only conducted in academic settings to generate new knowledge and is not applicable to real life situations. Although it may be possible, in Spanish, to find a more appropriate translation for this concept, it is not advisable to invent a new term or descriptor, since the Ministry of Education in Spain extensively uses it. Therefore, in certain settings, rather than creating a new concept, it is necessary to contextualise and explain the concept when presenting it to the actors involved, as lack of understanding could limit the effectiveness of the project. Thus, this concept refers to research that seeks to apply the knowledge acquired in basic research to the resolution of practical problems or the development of products and technologies useful to society. It focuses on the search for new knowledge or processes, or the improvement of existing ones, and the creation of concrete and practical solutions to solve specific problems.

As indicated, for instance, in the recently published Aragonese Smart Specialisation Strategy (S3 Aragon), the relevant terms evaluated that 'echo' the issues being addressed in NEARVET, in R&D, are research, innovation and experimental and technological development, which comprise creative work carried out systematically to increase the volume of knowledge, including knowledge of man, culture and society, and the use of this knowledge to create new applications (Frascati Manual, OECD, 2002) and encompasses the three activities of basic research, applied research and experimental development (Frascati Manual, OECD, 2002).

Moreover, *Challenges and strategies for action on vocational training research in Spain (2020)* sets out to identify the main challenges to be faced by research on vocational training in Spain, together with the most advisable strategies and actions, contrasted and agreed by groups of experts committed to the development of VET, in order to respond scientifically to the major technological, economic and social transformations of the fourth industrial revolution. It identifies 12 key challenges, including the need to establish a common reference framework for quality research, a research agenda on VET, a strategic plan for research and innovation, thematic lines of research, a national research centre, a state network of researchers and resources and stable funding for research. The importance of involving key agents and actors in research, access to microdata and the creation of databases, the need to make the importance of research visible and to highlight its value, the promotion of the dissemination of knowledge and the transfer of results and the promotion of communication channels with the administrations to boost VET research were also highlighted.

These results led to several important conclusions: there is unanimity among all the actors involved in the need for a greater focus on vocational training research in the Spanish context. Furthermore, the importance of collaboration and co-responsible involvement of the different actors involved in vocational education and training, including administrations, schools and universities, was highlighted. On the other hand, the opportunity to develop an ecosystem for research in vocational training in Spain was identified, promoting synergies between different actors and encouraging interdisciplinary work between research groups, related master's degrees, among others. Finally, it was emphasised that research in vocational training should be oriented towards Spanish social and economic needs, focusing on the labour environment, the evaluation of the training system and the training company.

Thus, applied research in vocational training is crucial to improve the quality of vocational education and training in Spain, as it can identify the needs of students and companies, and help to develop educational programmes and thus more effective professional profiles that are more appropriate to the needs of society and the labour market. Similarly, it is necessary to provide vocational training agents with specific resources related to the application of theoretical knowledge and developed research techniques. By working on applied research projects, vocational training agents can learn to apply their theoretical knowledge and practical skills to solve real problems and improve existing processes in an organisation or in society at large. This activity needs to involve the active participation of stakeholders as they are directly "affected" by the issue being researched. In this sense, both research managers and stakeholders work together to identify problems and needs, design and implement solutions, as well as evaluate the results obtained, all of which will lead to informed decisions and develop solutions that are sustainable over time. In this way, direct information is obtained on the needs of students and companies, encouraging the development of programmes that meet their needs, identifying the improvement of teaching and evaluation processes, and incorporating new technologies and educational methods in the vocational training system.

4. The skills required by VET teachers, in order to be able to conduct and supervise – or apply or teach the results of - applied research in VET

Overview

The purpose of this section is to examine specific skills that have been identified by, or are considered necessary in Sweden, Italy, Germany, Greece, Cyprus and Spain in relation to conducting, engaging or supervision assignments in the field of applied research in VET, as identified in published sources.

Before undertaking the desk research at country level, it was noted that CEDEFOP had published a very recent and highly relevant report since the European Commission's call for proposals for applied research in VET. Published as a research paper in 2022, this major study[13] addressed directly the fact that VET teachers', trainers and other VET staff have multiple roles and need to be supported to develop skills and be provided with tools in a whole range of fields, for instance "*to master new technologies, to deliver online and/or blended learning, to work in multicultural environments, to support the smooth integration of refugees, to identify promptly learners at risk of dropping out, support early leavers to reintegrate into education and training, and understand that the changing labour market needs to empower and equip students with skills for the future.*" The report is striking in that it makes no direct reference at all to applied research in VET. However, it does highlight a range of relevant issues that impact on the concept, in terms of the changing demands on a range of relevant VET occupations, including in workplace learning, are manifesting themselves.

In **Sweden**, concerning digitalisation and key competencies in the framework of Industry 4.0, the Swedish research defines the following new demands:

a) Digital skills:
    i. Applies critical digital literacy skills: the ability to critically assess the quality, validity and potential of learning content that uses new media forms and to leverage these media for persuasive communication and problem-solving
    ii. Processing skills: the ability to process, critique, categorise and evaluate large volumes of information

[13] *Teachers and trainers in a changing world Building up competences for inclusive, green and digitalised vocational education and training (VET),* CEDEFOP, 2022
https://www.cedefop.europa.eu/files/5586_en.pdf

iii. Discriminates and filters content for importance and contextual value
iv. Applies the skill of abandonment to reject information with little or no value to the context
v. Has the ability to reorganise, repurpose, supplement, and further develop learning content

b) Promoting Critical Digital Literacy (CDL) and Managing Required Changes
   i. Demonstrates ability to help learners select the most appropriate approaches (i.e., information retrieval systems) for accessing needed information.
   ii. Uses various techniques that help determine the learners' overall CDL competence and their training needs.
   iii. Demonstrates ability to help learners evaluate critically information and its source while incorporating relevant input into their knowledge base.
   iv. Uses knowledge and skills acquired through their training to develop learners' skills in using media and library resources as tools for research and learning.

c) Collaborative f2f or online Learning

   i. create collaborative relationships,
   ii. create and sustain a participatory environment,
   iii. formulate and apply a strategy of enquiry to enable individuals to explore issues and develop insights,
   iv. evoke the creativity of a group,
   v. plan appropriate group processes,
   vi. guide groups to appropriate and useful outcomes
   vii. facilitate collaborative online learning based on a repertoire/collection of methods, concepts and tools

In **Italy**, according to Angela Caruso (researcher and professor at the University of Pescara “G. D’Annunzio”) in her article "*The teacher between research and training*", professional updating, research and innovation are fundamental pieces of the trainer's activity and of the organisation of VET in general. In addition to content knowledge, the trainer is required to have relational, psycho-pedagogical and methodological skills linked to the preparation of an appropriate training pathway. Knowledge of one's own discipline is a fundamental prerequisite, he/she must be an expert in it to such an extent that he/she can read it and use it in the elaboration of didactic itineraries, creating motivation and making learning effective (Genovese, 2006).

In order to build a professional teacher profile, essential competences include research and experimentation skills, which are indispensable to identify the most effective didactic paths, the most useful methodologies and strategies (Cerini, Gianferrari, Grossi, 2007). Again, according to Caruso, the trainer must be 'competent' in epistemological and disciplinary

knowledge, in mastering didactic and pedagogical tools, in juggling research, reflection and evaluation. The trainer thus becomes a professional capable of developing learning and innovation in his or her work by relying on his or her experience, colleagues, and theory to enhance and evaluate his or her practice. The trainer is therefore required to participate in a high number of professional activities (conventions, seminars, conferences), and whose main task is to develop self-training mechanisms capable of originating knowledge by reflecting on everyday working practices (Fabbri, Striano, Melacarne, 2008, p. 17). The teacher, therefore, assumes an active role in the process of discovery and research, even during his or her working practices, when faced with situations of uncertainty, finds new leads for investigation.

It is necessary to start from the practice in order to identify the research objective of the trainer, because "*the practices of education provide the data, the arguments, which constitute the problems of the investigation; they are the only source of the fundamental problems to be investigated. These practices of education are also the ultimate proof of the value to be attached to the result of all research*" (Dewey, 1984, p. 24). From this perspective, it is appropriate to recall the 2012 and 2018 National Indications of the Ministry of Education, University and Research MIUR), which remind us that "*Schools have full freedom in choosing the research paths to activate, which, however, must be drafted onto the needs expressed by teachers and found in the school population and the territory".*

There is a need for teacher training that is not theoretical but practical, organised around the principles of "you learn by doing" (hands-on) and "you learn by researching"; these must be expressed. In the 2018 national indications of the MIUR, the enhancement of collaborative work opportunities (exchanges, 'professional loans', joint activities, etc.) within school institutions is encouraged; this, while being aware of the limitations posed by the different legal statuses of staff and contractual constraints.

As a **Case Study for reference**, the Italian report of the Erasmus+ cooperation project, "Fit for 4.0: Training trainers and teachers for the 4.0 paradigm" and specifically the set of competences teachers and trainers should possess to adequately facilitate learners in complementing their technological know-how and gaining citizenship to the 4.0 labour world. It stated the *competence of innovation* is identified among those necessary for the performance of teaching activities in order to make VET sustainable and up to date. This specification states the levels of delivery for how the competence applies or the extent to which the competence must be mastered by teachers and trainers working at EQF levels 4, 5 or 6, respectively[14].

[14] The full set of competences – available in several languages can be found (EN version) as Output 1, at https://www.fitfor4-0.eu/output at pages 20 to 38.

In **Germany**, the change in occupational and lifeworld structures due to economic, demographic and technical changes requires a reorientation of training structures in all segments of the vocational training system. Serious obstacles to the professionalization of the professions include the still low social recognition of some of the activities and the lack of uniform federal control and standardization for some of these training programs.

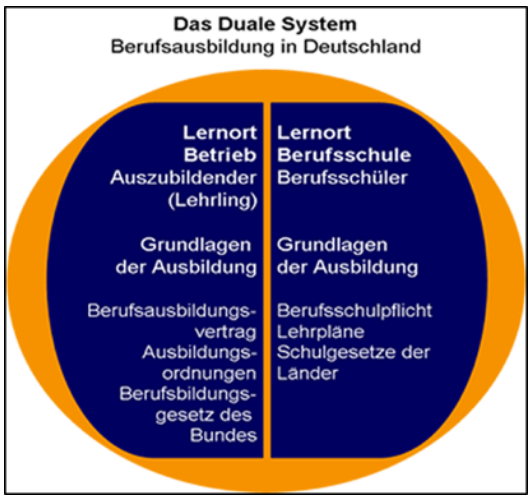
The technological and social innovations are new to teachers and individuals alike. The previous ways of transforming professional knowledge and skills from one generation to the next are facing challenges from the rapid pace of information technology development. Vocational training has a twofold role to play here. This consists of uncertainties, to take on social and societal responsibility for a humane future and to offer support for the future. On the other hand, however, the necessary knowledge and skills must also be promoted in order to be able to cope with the professional requirements in the current as well as future world of work.

Skills/needs of VET-teachers:

- advancing digitalization and digital networking are impacting the future work areas of skilled workers (independent production planning, automated parameterization, AR/AV-supported work processes etc.): need for STEM qualifications, new safety culture (data protection), holistic action (planning, organizing, doing, controlling) need to be taught -> It is about more than the mere use of digital media and technologies for the design of teaching, but about the promotion of digital competencies among learners through the sustainable integration of digital media in subject didactic and subject-specific teaching
- radical change of role: trainers become coaches or process facilitators, who enable personalized learning
- revision of training content also means a change in learning methods
- learn to offer opportunities for distance learning, learning platforms etc.
- learning site collaborations: Cooperation and coordination between the players involved in vocational education and training at the different learning locations of dual vocational education and training (learning location cooperation) is considered a key success factor of the dual system (vgl. auch Fallsstudie S. 163)
- internalize quality management systems: Input (equipment of the training facility, qualification of trainers, training plans, etc.), process (learning methods, motivation of the trainers, etc.), output (learning success, final grade, etc.) and outcome (transfer of what has been learned etc.)
- ability for systemic thinking and interdisciplinary cooperation
- competencies such as creativity, initiative, and the ability to work independently or to organize oneself
- in order to teach future key qualifications, vocational schoolteachers need to be more practice-oriented and more oriented to current problems is necessary

- build interdisciplinary thinking
- internalize additional learning techniques
- link training officers more closely with the training workshop
- preparing apprentices for the requirements of Industry 4.0

The core element of the vocational education and training system is training in the sense of vocational preparation for an occupation, which is generally based on a general education qualification and leads to a vocational qualification and is compatible with the employment system. Theoretical learning in the training schools and practical work in the companies is the usual way of vocational education in Germany. Many companies cooperate with vocational schools in order to generate a steady supply of trainees and, later on, employees.



In this context, new/different/innovative way of learning/teaching:

- create open time structures; trainees can deal with it responsibly
- learning in projects, in the training workshop and in the company,
- takes on a prominent position
- learning in the department is becoming increasingly important
- use of digital devices
- learning platforms are gaining in importance
- other learning methods are becoming more important: design thinking, moderation techniques.
- it is about dealing with complexity, rapid dynamics and global networking.
- digital media, and thus future competence, is not generated by chance, but must be developed systematically.

Guiding questions that arise against the background of “Applied Research in VET”:

- What do the changes in training look like in concrete terms?
- How have trainees changed and what do they expect from learning 4.0?
- Topic Methods: Is learning in projects the answer to Industry 4.0?
- How must training officers and full-time trainers have to position themselves in the future?
- What suggestions do the companies have for new or other professions?
- What role does continuing education play in Industry 4.0?

In **Greece,** these skills are summarised as:

- *Research:* VET teachers need to have a strong understanding of research methodologies and techniques, as well as the ability to design and conduct research studies. They should be able to collect, analyse, and interpret data, and draw conclusions from their findings.
- *Technical:* VET teachers should have technical skills related to their field of expertise, such as knowledge of specific software programs, equipment, or tools. This is particularly important for applied research in VET, which often involves the use of new technologies and techniques.
- *Communication:* VET teachers need to be able to communicate their research findings to a range of audiences, including students, colleagues, and industry partners. They should be able to present complex information in a clear and concise manner and be able to adapt their communication style to suit different audiences.
- *Collaboration:* VET teachers should have strong collaboration skills, as applied research in VET often involves working with industry partners or other stakeholders. They should be able to work effectively in interdisciplinary teams and be able to negotiate and manage relationships with external partners.
- *Pedagogical:* VET teachers should have strong pedagogical skills, including the ability to design and deliver effective learning experiences for their students. They should be able to use a range of teaching methods and techniques and be able to adapt their teaching style to suit the needs of individual learners.

In **Cyprus,** no research has been identified that deals directly with the skills necessary for VET teachers/trainers in order to implement applied research. However, from other sources, the following have been identified:

1. The need to reinforce knowledge transfer and the promotion of innovation and creativity for the benefit of society demand the increase of PhD holders who in their majority will not follow the traditional pursuit of academic career in contrast they should be exploited in the industry, technology parks, knowledge incubators, etc. (Papailiou). In other words, this author suggests the skills of PHD holders i.e., research skills to be exploited in applied research projects within VET and the industry.

2. In addition, in Korelli, Y. and Kyriakou-Liveri, C. (2019), there is number of issues that is highlighted:
    - The need for reinforcing the cooperation between VET centers and businesses and thus need to promote networking skills.
    - The use of the action research methodology at the level of VET schools.
    - The elaboration of the action research and problem-based learning
3. Also, the strategic priorities of the Cypriot government for the digital transformation and the encouragement of the use of blockchain technologies in both the public and private sectors; the promotion of digital entrepreneurship; the digitalization of the industry; the promotion of sustainable development and production point out, at a great extent, the set of skills required by the VET teachers under the current developments. (Theocharous, 2020)
4. Furthermore, the economy of Cyprus experiences a fundamental redirection towards the blue (HRDA, 2017); and green economies (HRDA, 2018) and the respective workforce skills needed for the relevant job positions.
5. Other two major developments are, firstly, sustainability as a major concern for industry and the labour market and the involvement of learners in defining environmentally just transition plans; and secondly, the demographic change that the Cypriot society faces due to the increased numbers of foreign workers and the need this workforce to unlock its potential. (Cedefop,2021) Thus, both developments could entail driving forces for applied research in cooperation with the civil society, national authorities, private sector and other public or private research institutions.
6. Moreover, there are numerous end users of the results of applied research, meaning the social and production factors. On the other hand, it is not just the responsibility of these factors to identify problems to be solved but rather the research and educational institutions on many occasions are the ones which highlight problematic areas. (Papailiou, no date)
7. New legislation has been enacted few years ago for the companies' startups-spinoffs which come as an outcome of research. By this way, the public universities are free to create their ideas' accelerators and start up incubators.

Moreover, based on the findings of a relevant VET research report initiated by CEDEFOP some useful conclusions can be drawn with regards the relevancy and the applicability of the NEARVET project in the Cypriot context. (HRDA, 2009). More specifically, HRDA which acts as the VET policy maker in Cyprus, prepared in the past with no participation of the VET centres of the region, the relevant report by selecting four (4) topics naming the "Benefits of VET", "VET and employment-related mobility and migration", "Anticipation of skill needs", and "Labour market Groups at Risk" which two of them were predetermined by CEDEFOP and the other two were chosen by ReferNet Cyprus according to national priorities. In the meantime, organizations responsible for funding were contacted such as the Research Promotion

Foundation and the Foundation for the Management of European Lifelong Learning Programmes to approve the list of studies; while research centres were contacted such as public and private universities, ministries and government departments and private organizations in order to collect information on VET research (therefore HRDA has implemented applied research in the area of VET). This process culminated in the extraction of the research studies in Cyprus under the relevant four (4) topics (HRDA, 2009). The results of the studies revealed numerous fields that VET applied research could be performed with the participation of the relevant industry sectors so to examine innovative solutions and new approaches of how things can be done at the business level. For example, under the topic "VET and employment-related mobility and migration" applied research could be funded and implemented in cooperation with the relevant Ministries (Asylum, Labour and Social Insurance, Education and Culture) so to promote targeted vocational learning and education programs focusing on migrant and refugee population; thus, to increase labour supply on certain industries that face shortages and promote social cohesion and economic development through the effective management of foreign workers.

Providers offering CVET are directly involved in applied research projects to identify and solve issues within a company or organisation. This could be named a training needs analysis but in reality, this is much more than TNA since the CVET provider needs to identify the problem first, design a solution and then train the company on the solution. On the level of the VET providers, several VET providers in Cyprus are involved in applied research projects mostly in the framework of the implementation of European or co-funded projects. For example, MMC in cooperation with Frederick university has implemented the project E-minds during which it identified real industry problems (social and green) that were provided as challenges to VET and Higher education learners to resolve in a multidisciplinary approach (thus learning through applied research)

The national education system, including lifelong learning, has a leading and decisive role to play in developing fundamental skills, competences and character qualities required by the workforce of the 21st century, in order to adapt and excel in a rapidly changing technological environment. However, this cannot be achievable if openness and transparency in applied research is not promoted. Thus, open research and open science have a fundamental role in ensuring that applied research and innovation, particularly the part supported by public funds (national and Union), has the maximum possible impact, enhancing accessibility, transparency and cooperation among the various stakeholders involved in knowledge generation, dissemination and application. The current situation in Cyprus reveals suggests that the research and innovation governance system of the country does not include at the policy recipient level and specifically as "knowledge generators" the Vocational and Education centres (Cyprus research & innovation strategy framework, 2019)In the Cypriot context there is a strong tendency towards "applied research" and a clear perception on its merits to economic development. However, there is a disproportionate engagement between the

relevant education and research institutions indicating that VET at the present time does not have any direct participation of this form of research. As a result, from the side of VET institutions in Cyprus there is a clear opportunity and need for them to be actively engaged in this crucial activity due to the fact that the Cypriot government acknowledges its importance in development and due to socio-economic situation of the country.

In **Spain**, to be a vocational education and training (VET) teacher it is necessary to have a university degree related to the professional branch in which you wish to teach, as well as specific pedagogical and didactic training. Specifically, the regulations establish that in order to be a VET teacher you need to be in possession of:

a) Diploma, Technical Architect, Technical Engineer or the degree of Bachelor, Graduate, Engineer and Architect of the corresponding speciality, or other Higher Vocational Training Technical qualifications declared equivalent, for teaching purposes.

b) Pedagogical and didactic training through the completion of a University master's degree in Teacher Training for Compulsory Secondary Education and Baccalaureate, Vocational Training and Language Teaching, or that established for the pedagogical and didactic training of Higher Technicians or equivalent.

In order to teach in Spanish, non-native speakers must have a certificate of Spanish at level C1 or higher. Although it is not compulsory to have a foreign language qualification to become a vocational training teacher, with the exception of specific subjects that require an advanced knowledge of a foreign language, it is currently necessary to have a qualification accrediting level B1 or higher in a foreign language to access the master's degree in teaching. Similarly, it is important to stress that knowledge of foreign languages can be a competitive advantage, especially in the private and state-subsidised education sector, as many jobs in business and industry require a command of a second language. For this reason, more VET professionals are training in other languages in order to be able to offer a more complete education adapted to the needs of today's world of work. It should be noted that in some Autonomous Communities in Spain, such as Navarre, Catalonia, the Balearic Islands and the Basque Country, knowledge of the co-official language of the community is required in order to teach in public schools. It is important to bear in mind that the regulations on language requirements for teaching may vary depending on the Autonomous Community and the type of school (public or private), so it is necessary to consult the specific legislation of each region for more detailed information.

The master's degree in teaching or the aforementioned pedagogical and didactic training, which is required to work as a VET teacher in Spain, provides a complete and varied training for future VET teachers in Spain. Specifically, some of the contents included in its current training programme, which are detailed below, can be particularly useful for the development of the necessary skills to implement applied research in VET in their teaching role:

a) Knowledge of the evolution of the world of work in order to be aware of the trends, changes and needs of the labour market. It is particularly important for future teachers

to transmit to future professionals the constant changes that the world is undergoing and to be prepared to face all the challenges that arise.

b) Psycho-pedagogical and professional guidance that helps future teachers to know the processes and resources so that, on the one hand, they can assess and diagnose the learning difficulties of a student, in order to provide appropriate educational attention and, on the other hand, help students to explore and understand their interests, skills and strengths that will allow them to make informed and conscious decisions about their professional career. In this way, it seeks to foster the integral development of the student, both in their academic life and in their professional future.

c) Training to be able to make innovative teaching proposals. In this way, future teachers learn how to develop new teaching strategies and propose solutions adapted to the specific needs of each training degree. At the same time, the analysis of teaching performance is addressed in order to encourage continuous self-diagnosis, so that the contents are continuously adapted to the demands of the labour market. All of this contributes to improving the quality of VET teaching and to ensuring that students acquire the technical and transversal competences necessary to successfully face the world of work.

A research article on teacher education for technical and vocational education in the 21st century in Spain, published in 2019, analyses the changes in VET teacher and highlights the importance of their continuing education and professional development.[15] In order to be able to transmit adequate and up-to-date knowledge to their students, in technical and transversal skills that will enable them to be the great professionals of the future. As for future lines of action in relation to research applied to VET, a concrete path is shown by ORDER ECD/1332/2020, which regulates the implementation of Training Stays in Companies or Public or Private Institutions for teachers who teach in vocational training cycles, in Sports Education, or in Plastic Arts and Design in public schools in the Autonomous Community of Aragon. In relation to the collaboration between educational centres and companies, one of the actions being carried out in Spain by the Department of Education and Science is the implementation of training stays in companies for vocational training teachers, the call for which is announced annually. The aim of these programmes is to provide ongoing training for teachers who teach in vocational training cycles, so that they are able to adapt to scientific and technological changes in a professional environment to cover the training needs arising from the continuous changes in the processes of the industrial and service fields. Likewise, the aim is to encourage cooperation between the teaching centre and its productive environment, thus seeking to integrate the teaching staff in the work processes, instruments

[15] M.L. Rico Gómez, A.I. Ponce Gea (2020). "El docente del siglo XXI: Perspectivas según el rol formativo y profesional", at https://www.redalyc.org/journal/140/14070424004/html

and organisational methods of the company or institution so that they can be aware of the current needs of the professional family or speciality where they are teaching.

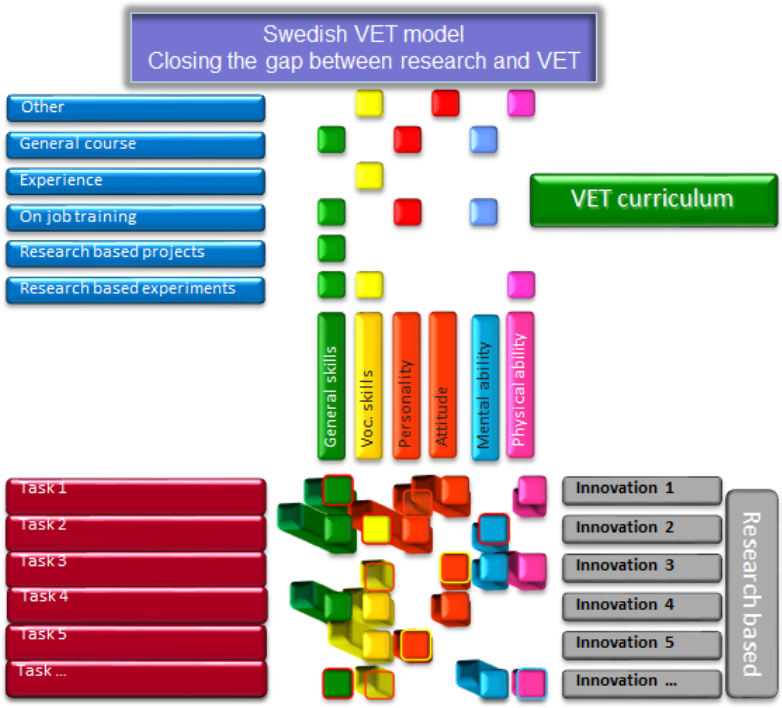
5. The skills required by private sector Managers, in order to be able to participate in, conduct and supervise applied research projects in VET, or cooperate with the VET provider sector

The purpose of this section is to examine specific skills that have been identified by or are considered necessary on the part of those 'coming at applied research in VET' from commerce and industry,' and in particular employees and staff working for employers, businesses and companies in Sweden, Italy, Germany, Greece, Cyprus and Spain.

In **Sweden**, cooperation with enterprises is a prerequisite for VET education, especially in the technical/industrial sector, and it is demanded by the government that they cooperate. The skills needed by the managers in private sector according to the Swedish research are:

i. ability to establish a common language to describe skills
ii. ability to measure of skills related innovation developed by research
iii. ability to identify essential skills for the future research related innovation
iv. ability to identify the skills gap between research related innovation and related VET programs

In order to visualise the above, the Swedish system work accordingly:



The above system works at different level in different sectors, however regarding employers, following skills is required:

i) ability to build trust with VET providers
ii) ability to sustain the cooperation (structured-based cooperation and not based on specific individuals)
iii) Ability to communicate with providers, especially regarding qualification needs related to innovation
iv) Ability to present up to date WBL mentoring including challenging research project training relevant to occupational innovation

According to the available research, the Swedish system works more efficiently in technical sectors than non-technical sectors, such as services sectors.

In **Italy**, as opposed to what has happened in recent years for other aspects relating to Research, there has not been a significant modelling of the profiles of tutorial figures, neither by training institutions, nor by other bodies operating in the sector. The Company Tutor-Manager is identified on the basis of certain requirements, among which the most frequent ones are:

- the possession of adequate professional competence;
- the willingness to carry out the role of accompanying and supervising students;
- the guarantee of ensuring the expected commitments.

The activities and skills that can characterize a Tutor-Manager who comes from the corporate environment are indicated thus:

- *FACILITATE LEARNING* Demonstrate what it means to apply, in concrete terms, what has been previously explained in theory; Giving “permission” to dare or to make mistakes; Understanding and correcting mistakes by accepting them; Use the error in an educational key; Being patient.
- *INFORM AND UPDATE* - Transmit the "know how" that underlies the good work of (and in) the company: habits, customs, practices in use and which are not written anywhere.
- *DIRECT AND LEAD* - Support and stimulate the person to a continuous and fruitful reflection on the learning and experiences inherent in the construction of his professional profile.
- *GIVE SUPPORT* - Providing support to the researcher/learner to better manage the anxiety deriving from entering the company, from responsibilities in the company and from the need to build a life and professional path.
- *MONITOR AND EVALUATE* - Make a professional assessment of the work of the resource in Training and who is doing Applied Research (without being influenced by first impressions, stereotype or prejudices).

- *RELATION* - Knowing how to manage conflicts, tensions, misunderstandings; Facilitate integration with the work staff; Building a feeling of trust; Motivate towards work; Encourage continuous learning
- *EXPERIENCE* - Know how to diagnose and recognize the onset of problems; Be a model of 'inspiration' and imitation; Recognize mistakes and use them for training purposes; Stimulate the comparison between the experiences of collaborators
- *COMMUNICATION* - Communicate clearly and effectively; Knowing how to relate to the apprentice in listening to expectations and difficulties; Knowing how to relate to work colleagues to facilitate the integration of the Apprentice/Researcher into the work context; Knowing how to relate to the training tutor for the construction of a learning project consistent with the application context of the knowledge learned in the training context

In **Germany**, working with businesses is a prerequisite for vocational education, whether in the private or public sector. The skills needed by managers in the private sector, according to German research, are as follows:

- know how to make change processes transparent for employees and thus counter the fear of change
- knowledge from further training and acquisition of key qualifications
- adapting to the rapidly changing areas of demand
- independent acting
- ability to establish a common language
- ability to identify and measure of skills related innovation
- construction and maintenance of VET providers
- good communication and anthropology skills

In **Greece**, there are several examples of cooperation between VET schools and businesses aimed at solving specific issues in Greece. These collaborations can take various forms, such as work-based learning programs, apprenticeships, internships, or joint research projects. Some examples include:

- The Greek-German Chamber of Commerce and Industry offers a dual vocational education and training (VET) program in collaboration with vocational schools and German companies operating in Greece. The program combines classroom learning with on-the-job training, providing students with practical skills and experience that are tailored to the needs of the labour market.
- The Hellenic Association of Pharmaceutical Companies (SFEE) collaborates with VET schools and universities to offer internships and apprenticeships to students in the pharmaceutical industry. The program provides students with practical skills and

experience in areas such as research and development, quality control, and production.

These examples do not provide specific insight into the skills required by private sector managers or employers in the applied research in VET agenda, but they do demonstrate how cooperation between VET schools and businesses can help to bridge the gap between education and the labour market and can provide students with practical skills and experience that are relevant to their future careers. Thus, there is a need to develop a culture of research and innovation in VET, and to promote greater collaboration and knowledge exchange between the academic community, VET providers, and employers. Another study that focused on the perceptions of VET teachers in Greece regarding research in VET found that there is a need to increase awareness and education regarding the value and relevance of research for improving teaching and learning in VET contexts.

In **Cyprus**, one relevant development during 2013/14, though not focused on the needs of private sector managers, was initiated by the Department of Secondary Technical and Vocational Education (STVE) of the Ministry of Education and Culture (MoEC) implemented a programme entitled "Industrial Design and Innovation" aiming at the promotion of industrial design and innovation through cooperating with the private sector. Within the context of the programme, partnerships for creativity and innovation have been developed. For the implementation of the programme, the Department set up a Working Group in each of the eleven (11) Technical Schools participating in the programme. The eleven Working Groups comprised teachers and students and about 100 persons were involved. The teachers' objective was to acquire additional specialized, practical and professional knowledge, skills and competences in the subject of industrial design, research and innovation, in order to help them teach this subject in an effective manner to students of upper secondary technical and vocational education. The students' objective was to become acquainted with the subject of industrial design, applied research and innovation, by acquiring knowledge, skills and competences in the areas of identifying the need for a product, doing market research, developing and discussing ideas and concepts, presenting various design concepts in the form of 2D and 3D rendering, and developing concrete 3D models of the designed products. During the programme, the students were given the opportunity to effectively implement the knowledge triangle (education-research-innovation). (HRDA, 2014).

Otherwise, there is no currently substantial country-based evidence that points out clearly research and development initiatives undertaken by VET centres, technical schools and/or companies in the field of VET in an effort to tackle specific business problems and/or expand the knowledge on that domain. With regards to Applied research implemented directly by the industry, at a sectoral level, through the funding scheme of the Research and Innovation Foundation many Cypriot enterprises in the designated priority sectors of: energy, tourism,

transport-shipping, agriculture-food industry, built environment-construction industry and health will be supported to be involved in research, technological development and innovation (RTDI) activities, for the development of new or significant advancement of existing products/services/production methods of high added value with market entry potential. (Research in Enterprises, 2023).

In **Spain**, there is in fact a rich set of examples of initiatives that have either been led by, or substantially developed with, private sector initiators and representatives. For instance, in the case of TNIKA – the widely-referenced VET centre active in this 'space,' the Department of Education of the Basque Government and Siemens Gamesa sign a collaboration agreement as a result of the activities of the Working Group on O&M training in the wind energy sector coordinated by ACE (March 2023). The purpose is to promote the teaching of renewable energies in vocational training centres in the Basque Country in both public and private centres. The aim is to enable the company to attract talent through vocational training and to incorporate students from these programmes into its workforce when required. The multinational also undertakes to train teachers in the installation and maintenance of wind farms. In addition, the Basque government's vocational training service has promised to incorporate various teaching content proposed by Siemens Gamesa in the various training courses it offers related to energy in general and wind energy in particular. Finally, the Basque government will help Siemens Gamesa to design, process, manage and deliver these specialisation programmes, and the multinational will in turn provide the network of Basque vocational training centres with material related to wind farms.

Moreover, Clusters are also playing a fundamental role in Spain. As an example, TECNARA, the ICT Cluster of Aragon collaborated with the Department of Education in the adaptation, improvement and search for teachers of the new VET specialisation course "Digital Transformation: Internet of Things (IoT)" that was launched in 2020. Several leading companies in the sector and cluster partners contributed to the content development and delivery. The success of the first edition was such that the student insertion rate was 100%.

A **case study** is represented by a collaboration between the Department of Education and the Aragon Automotive Cluster to promote Dual Vocational Training in the automotive sector (2018). The automotive sector in Aragon is facing great difficulties in finding qualified personnel in areas such as welding, stamping, mechatronics, robotics, injection, moulding and machining, among others. This not only affects automotive manufacturing companies, but also other companies that supply products or services to the sector's value chain, limiting its growth. Despite the sector's decent job prospects, with a 100% insertion rate for vocational training students, places in vocational training cycles are often not filled due to a lack of information on the part of young people and their families. To solve this problem, the Department of Education and the Aragon Automotive Cluster (CAAR) joined forces in 2018 to

work together along 4 main axes: initial training, competence updating, specialisation and professional guidance. For each of these areas, the following initiatives have been carried out:

- The dual modality of the Middle Level Cycle of Polymer and Metal Forming by Moulding has been implemented. The Cluster acts as an intermediary between the educational centre and the training companies, and the figure of the CAAR tutor has been created. The students are trained alternatively in the educational centre and in the company associated to the Cluster through a training contract. The training is aimed at key profiles for the sector, and the companies aim to incorporate these students into their workforce after completing the training.
- Through the collaboration of the cluster with several collaborating entities, a Learning Factory was created, located in the Innovation Centre for Vocational Training of Aragon (CIFPA), which is a space for the training of dual vocational training students. It is a public-private collaboration space where training is also offered for active workers in the sector and for unemployed people.
- The Specialisation Programme was created for team leaders in the highly automated automotive industry. This programme is aimed at Advanced Degree students in specialities related to the profiles demanded by the sector, and its content is based on the competences identified by CAAR companies and the Professional Qualifications Agency of Aragon. It is taught in a dual format, alternating 65% of the time at the CIFPA Learning Factory and 35% of the time at the centre.
- Finally, an academic-professional orientation initiative was developed for students in the 4th year of ESO and 1st year of Bachillerato. The project seeks to increase the number of professional references for students and to present different professions in the sector with possibilities for personal and professional development. Workers from CAAR companies talk about their professional experience to the students, who can associate them with a specific profession and identify the skills required for the job. After the session, if there are students who show interest in a particular profession, they are given information about all the available training pathways leading to these professions.

The FP Trial collaborative model offers another example: learning in the educational centre, in Comexi and in the company where they are as apprentices (2018-2019). As a result of the advance of new emerging technologies in the development of the printing industry, the company Comexi detected great difficulties in finding professionals with a suitable technical profile. Given that there was no regulated training cycle that included the specific content required by this industry, in 2013 the company decided to develop, in collaboration with the technicians of the Department of Education of the Generalitat de Catalunya, a curricular adaptation of the medium-level training cycle in Graphic Printing in Dual mode, in order to adjust it to the specific needs of the sector. The company called this developed model "FP Trial", because the students had three learning places: the educational centre, the company where they were doing their internships and Comexi, as the company made available to the

programme its workshops with the most advanced machines and technology in the sector, as well as experienced technical specialists, and even adapted classrooms for this purpose. The students combined this training with other companies in the sector where they were doing their internships, thus receiving training in line with the latest developments in the industry. The success of the project led to the incorporation of the Intermediate Level Training Cycle in Digital Pre-printing in 2018 due to the demand from participating companies and interested students.

Another exemplar initiative is offered by the collaborative project between an educational centre, companies in the sector, employers, and the Public Administration for the professionalisation of the metal sector (2019-2020). The COMASTECH Project arose from the need for qualified personnel to ensure the generational replacement of the TM Comas company, located in Catalonia. To achieve this, in 2019 the company led the process of creating a vocational training centre in collaboration with the Department of Education and the sector's employers' association in Girona specialising in mechanics and mechatronics and is currently authorised to offer Higher Level training cycles in Production Programming in Mechanical Manufacturing and Industrial Mechatronics, both in Dual mode. The main objective of the school is to offer practical training and prepare students for real work in companies.

By way of conclusion, with implications not only for companies and private sector managers but for all, the new Spanish Vocational Training Law, approved in March 2022, sets out that, in order for the Vocational Training System to be effective, it is necessary to establish a close relationship and cooperation between three key actors: administrations, educational centres and teachers, as well as companies and families. These actors are the fundamental pillars that make the Vocational Training System solid and effective.

In this line, it is believed that the implementation of innovation and applied research projects will foster the creation of a collaborative and effective environment between vocational training centres and related companies or organisations in various productive sectors, especially in small and medium-sized enterprises. To this end, companies or organisations involved in applied vocational training research must have a range of technical, managerial and interpersonal skills.

Firstly, *technical skills* are essential for companies to be able to apply the results of the research they are involved in, which are often focused on the development and implementation of innovative techniques and technologies. Therefore, it is essential that companies have specialised skills to implement these solutions and actively contribute to the project. In addition, technical skills allow companies to keep up to date with the latest developments in their sector and constantly improve their processes and services to remain competitive in a market that is constantly evolving. To achieve this, it is important for companies to have a thorough understanding of the vocational training system in their country, including legal requirements and available training programmes, in order to

implement the latest developments in training in their sector and achieve an improvement in their competitiveness.

On the other hand, *management skills* also play a crucial role in this process. An appropriate organisational structure must be in place to ensure the proper execution of the project, as well as proper fiscal management to ensure that the project is completed without any financial repercussions. In addition, the company must have transversal skills such as effective communication, as it is of great importance to know how to clearly communicate the objectives of the project to all the parties involved and to have collaborative skills to know how to cooperate with the rest of the agents involved.

It should be noted that all of the aforementioned skills should be worked on together with proper team management and good decision making, as these are fundamental aspects for the development and execution of the project and the continuous analysis of the results, in order to guarantee the quality and success of the applied research, as well as to solve any problems that may arise in the process.

6. Examples of how Universities have undertaken applied research in VET (i.e., with VET centres, VET teachers or with companies in the field of VET

Overview

The purpose of this section is to identify, at the country level, activities or assignments that can illustrate or inform the development of the NEARVET concept, using real or concrete examples or case studies that were either led by Universities or where University involvement was intrinsic or embedded in the identified VET activity. Such activities or examples as may be 'labelled' as applied research in VET, but alternatively may have been drawn from related examples that were not necessarily identified as such, in Sweden, Italy, Germany, Greece, Cyprus and Spain.

In **Sweden**, some sectors are leading the work regarding bridging the link between applied research and VET. A couple of years ago research was initiated (The M evaluation) conducted as an expert review of 43 completed research projects within five so-called program areas: community planning, building planning, building technology, local energy sources and energy saving. The experts consisted of thirteen researchers and ten "practitioners". They worked in six separate groups and each group reviewed between four and ten projects. In the report, the purpose of the evaluation is stated to be "to assess the following three aspects in a selection of projects:
- It studied the relevance of the problem
- The quality of the completed work
- The relevance/availability of the results for different consumer groups, VET one of them.

Lately, some universities in Sweden launched the "Qualification analysis" project. On the one level theoretical analyses were prepared on 'qualification of labour' such as that of education societal functional context ("the political economy of education"). On the other level, 'qualification requirements' and 'qualification development' were analysed in connection with automation and the introduction of new technology ("empirical qualification research"). The project has led to closer cooperation between research centres and VET institution. It resulted in the following concrete project, presented here as a **Case Study:**
About the project **-** The Challenger project aimed to promote innovation through applied research in vocational education and training, to build stronger innovation capacity and impact at European and regional level to address global challenges and opportunities and contribute to creating value for people, the economy and the environment, through new or improved solutions. The project's goals are to:

- Design and establish an innovative, sustainable and efficient structure to promote innovation through the use of AR in vocational education.
- Strengthen and improve the integration of innovative teaching methods within vocational education to promote innovative and entrepreneurial thinking.
- Mapping, designing and setting up resources for innovation and entrepreneurship, with the guidance of supervisors and mentors for role models.

Important measures and results – To identify best practices for applied research in vocational education, existing systemic barriers and solutions to integrate the new structure of applied research into the vocational education system and vocational education curricula according to EQF 4, 5 and 6. Based on the results, it will develop the following:

a. The framework and all necessary systemic and operational background elements of the structure, called Next-Generation community makerspace;
b. The users' innovation journey
c. The framework for the role of the teacher/mentor in promoting innovation culture and their professional development.

The project designs self-directed courses for students and role models who are part of the new structure and the resources that will support them. It tested the elements of the new structure and the professional development of role models within the framework of the establishment of six open community spaces as research gateways in partner regions. The Makerspace will shape and prepare the goals to be able to design, develop and use innovative solutions for the regions to achieve meaningful impact and benefit for all. The main target groups and stakeholders are VET students, teachers and supervisors in vocational training, industry experts, entrepreneurs, researchers, decision makers, regional authorities and other interested creative people. The focus among the target groups will be on an even gender distribution.

In **Italy,** there are a number of relevant examples that can be highlighted. For instance, in the first half of the 1980s, through funding from the Ministry of Research, the first two Science and Technology Parks were established: Area Science Park in Trieste and Tecnopolis in Bari. The purpose of this type of structure is to support the development through business creation and development. They carry out R&D activities, business incubators, technological intermediation and support for innovation, operating as mediators between SMEs and the knowledge of the Poles of technological and scientific excellence, from Universities and Research Centres, systematizing the functions of many subjects who interact in the field of innovation and technology transfer.

There are also the Competence Centres, in particular MADE, promoted by the Polytechnic University of Milan, in partnership with local organizations and companies. MADE is the

Competence Centre for Industry 4.0 that guides manufacturing SMEs towards digital transformation. Supported by the Ministry of Economic Development, MADE is one of the eight highly specialized Competence Centres envisaged by the National Industry 4.0 Plan. MADE is a structure that supports small and medium-sized Italian companies in the transition path towards industry 4.0. The MADE educational space provides knowledge, methods and tools for accessing digital technologies, ranging from design to engineering, from production management to delivery and end of the product life cycle. The Competence Centre hosts 25 technological assets and 20 demonstrators, each dedicated to a particular 4.0 technology. Collaborative robotics, big data, remote maintenance, industrial cyber-security, lean 4.0 and additive manufacturing, artificial intelligence and IoT, are therefore the tools that, together with the knowledge of the 48 partners, are offered by MADE to all companies interested in starting a path towards technological transition incorporating *Orientation to companies*: introduction of Industry 4.0 technologies through seminars, company visits and workshops, tours of the Competence Centre, specific demos on use cases. *Training for companies:* ad-hoc training activities (training and train the trainers) within the teaching factory. *Innovation projects, industrial research and experimental development*: transfer and implementation of innovation through various channels and activities (industry 4.0 strategies, innovation projects, demos and tests, technology scouting, validation of industry 4.0 projects, technological consultancy).

The University of Trento describes the applied research projects on its website, in which the University is involved. For instance*:*

ISTITUTI TECNOLOGICI SUPERIORI – ITS ACADEMY - The I.T.S. Academy constitute the non-university tertiary training segment that responds to the demand of companies for new and advanced technical and technological skills to promote innovation processes. They represent an important opportunity in the Italian training sector as an expression of a new strategy based on the connection of education, training and work policies with industrial policies, with the aim of supporting interventions aimed at productive sectors, with particular reference to innovation and technology transfer needs of small and medium enterprises. The six technological areas concerned: Energy efficiency, Sustainable mobility, New life technologies, New technologies for Made in Italy (Agri-food system, Home system, Mechanical system, Fashion system, Business services), Innovative technologies for goods and activities cultural – Tourism, Information and communication technologies.

CITY OF MILAN - ASSOLOMBARDA - POLITECNICO'S SCHOOL OF MANAGEMENT: The School of Management of Politecnico of Milan has seven Laboratories – involved in knowledge transfer activities, more than thirty Observatories – on-going practice-oriented research projects that focus on hot topics selected in collaboration with partner organisations in the business and policy-making communities, and five Centres bringing together Faculty members according to their research interests. This organisation brings great flexibility to our research work and stimulates multi-disciplinary research projects and collaboration. In 2015, Milan introduced a

new Food Policy to pioneer a more sustainable food system throughout the city, introducing a multidisciplinary and participative approach to reduce food waste. In 2016 the City of Milan, Assolombarda (the Lombardy section of the Italian Entrepreneurial Association) and the School of Management of the Politecnico di Milano signed a memorandum of understanding, entitled “Zero Waste”, drawn up to reduce food waste and implement a new method for recovering and redistributing surplus food which would then be donated to people in need. The School of Management of the Politecnico di Milano conducted a feasibility study of the model and has been in charge of monitoring operations at the hub and for the entire system whilst measuring the impact of the project over a 12-month period, building a logistical model that now is being scaled up and replicated in other areas of the city. All district Hubs provide practical answers to the demand for city-wide food waste reduction and access to food by those in need, ensuring a small-scale food collection and redistribution service. Over the course of the year, the number of social players benefitting from the service, i.e., the companies associated with Assolombarda which are involved in the project have participated through their canteens by donating surplus food, thus helping to reduce waste. In addition, large-scale retailers provide different types of food daily which passes through the Hub and is redistributed to the various parties; eleven supermarkets and five company canteens are part of the initiative. The next important innovation is the opening of an additional Hub in District 3, in the Lambrate area. This involves the participation of AVIS Milano (a Blood Donors Association) and Banca di Credito Cooperativo (BCC), the winner of the recent public call for tender announced by the City of Milan to collect the necessary resources to set up new Hubs across the city.

Fraunhofer Italia Research Scarl – Innovation Engineering Centre (Replicability of applied research institutes on the Fraunhofer Gesellshaft model) - The Fraunhofer Gesellshaft is a German organization that brings together 60 institutes of applied science. Starting in 1973, only 30% of the Fraunhofer was financed by public funds (federal government or local government). 70% of revenues come from contracts with companies or calls for applied research projects, both nationally and internationally. Fraunhofer Italia Research Scarl – Innovation Engineering Centre is the first independent foreign company in Italy of the Fraunhofer-Gesellschaft and was founded in Bolzano in December 2009 by Assoimprenditori Alto Adige and with the support of the Autonomous Province of Bolzano. It is a non-profit research organization operating since 2017 in its new headquarters at the NOI Techpark in Bolzano, the innovation house of South Tyrol. In 2019, the “ARENA application centre” of Fraunhofer Italy was created. ARENA is a physical space located at the NOI Techpark in which Fraunhofer Italia's applied research activities are carried out. Here the researchers of Fraunhofer Italia work side by side with public and private stakeholders of all sizes and sectors on current applied research topics with the aim of a double transformation: digitization and sustainability.

In **Greece,** there is no specific literature or reference identified thus far that provides insight to this issue in relation to applied research in VET. In general, there is a need for greater collaboration and partnerships between academic staff, VET providers, and industry in order to ensure that research is relevant and applicable to the needs of the VET sector. Professional development, training, and support for academic staff are essential in achieving this goal.

In **Cyprus,** universities are prominent actors of the research (basic and applied) and innovation governance system, and they hold a prominent position as "knowledge generators." (Cyprus research & innovation strategy framework, 2019) Therefore, a big bulk of research activity in Cyprus is performed by the Higher Education Institutes with the role of the public universities being crucial. Yet, the research and innovation system in Cyprus is relatively young and is evolving with the aim to increase its efficiency. The main barriers of the system have to do with the above-mentioned inflexible governance structure, the weak coordination between the various actors involved and the lack of an explicit long-term strategy for applied research, innovation and development. Furthermore, the development of applied research and innovation system is hindered by poor cooperation between the research and academic community with the business sector, the low involvement and investments of the private sector in R&I activities and the limited extroversion of the Cyprus system on the specific field. (National "European Research Area" (ERA) Roadmap for Cyprus 2016-2020).

At the present time the major actors from the higher-education system of that is preoccupied with applied research activities is consisted of three (3) public Universities (University of Cyprus, Cyprus University of Technology and the Open University of Cyprus) which perform the core of the country's basic and applied research and innovation activities; and of five (5) private Universities (University of Nicosia, European University of Cyprus, Frederick University, Neapolis University and University of Central Lancashire in Cyprus) which are heavily devoted in teaching and less focused in activities of applied research and innovation. (European Commission, 2018). Despite this fact, the R&I strategic plans of the three (3) public universities have been adjusted in the last two years to become more directed towards the Smart Specialization Strategy priorities of the country, but their primary orientation is still based on traditional research areas (such as theoretical sciences) and only remoted related to the priorities of the Smart Specialization Strategy that in the context of Cyprus aims to have a significant effect on the framework for development of the country considering the fact that Cyprus has experienced a severe financial crisis which makes the rationalization of public spending an imperative. (Smart Specialization Strategy for Cyprus, 2015).

Another crucial factor is that research and innovation is still underdeveloped in public universities mainly due to legislative barriers. Hence, a new legislation was introduced for discussion and approval that promotes commercialization of the applied research results by public universities approved by the Council of Ministers so to mitigate this gap and increase the contribution of public universities in producing exploitable knowledge for the industry and the real economy. (European Commission, 2018).

Due to all this work that is taking place mainly at the strategy and policy level there are **case studies** in which universities have conducted applied research with VET centres in a variety of research projects, e.g.

- The European University of Cyprus has partnered, among other tertiary institutions, with the Athens Lifelong learning Institute and the Centro De Estudos Interculturais under the Erasmus+ programme to implement the project titled: "Accessing Newly Arrived Migrants Knowledge in Science and Math using Augmented Teaching Knowledge" (accessed in: https://augmented-assessment.eu) ; in addition, through Erasmus+ funding the aforementioned university partnered with RedLab in the project titled: "ASEAN Network for Green Entrepreneurship and leadership" (accessed in: https://angel-project.eu).
- The University of Nicosia having partnered with EDEX- Educational Excellence Corporation Ltd under the Erasmus+ programme in the LIFE TWO project, titled: "Learning Interculturality from Religions Towards Outreach Activities;" and consisted part of a consortium with regards the project "Piloting ECVET to the national VET system of Russia and Uzbekistan"
- The University of Central Lancashire in Cyprus partnered and produced a Memorandum of Understanding with Synthesis Centre for Research and Education Ltd for the implementation of the project titled: "Creativity, Innovation and Business Idea Programme "IDEODROMIO" for Gymnasium, Lyceums, Technical Schools and Private Schools of Vocational Education and Training for the school year "2022-2023".
- MMC has worked together with the Frederick University to identify business problems, integrate them in their common teaching as "entrepreneurial challenges" and resolve them with the participation of learners (both HE and VET leaders) in the Erasmus+ project EMINDS[16]

[16] https://erasmus-plus.ec.europa.eu/projects/search/details/2017-1-CY01-KA203-026768

In **Spain,** the European Commission has referred specifically to exemplars when highlighting, or illustrating, the potential of applied research in VET. In particular, there is the matter of the work of TNIKA in Spain - a centre promoted by the Basque Government's Department of Education, whose aim is to promote research and applied innovation in order to advance new learning processes and environments and reduce the skills gap between the emergence of ideas and technologies and their application in society. This work has been highlighted by the European Commission in its formative prioritisation of developing the concept of applied research in VET. There is also the widely referenced (the ETF, the European Commission and indeed the NEARVET concept) quote referenced by when considering the concept of applied research in VET from Unai Ziarsolo from the TNIKA, that "*There's a lot of debate about terminology ... The universities say that what VET centres provide isn't research. Personally, I don't care what you call it. We're providing services to SMEs and industry that help them to solve practical problems. For us, that's what Applied Research is."*

Research and innovation are key instruments for the improvement and progress of VET. Both enhance the value of this educational pathway, expand its knowledge, make it useful, stimulate critical thinking, show evidence, combat misinformation, offer understanding, prediction and prevention, and help in decision-making. Furthermore, they study history, recognising the past and correcting mistakes, favouring progress and new advances with the ultimate aim of improving and optimising processes. In Spain, there is currently a need for a research ecosystem on vocational education and training, as research is a driving force for development and has great transformative power. It enables new, more effective and efficient responses to society's main challenges to be found, which is fundamental for creating knowledge and making progress in innovative VET that responds to needs and optimises its processes.

The study *Retos y estrategias de acción en torno a la investigación sobre la FP en España,* also led by the University of Barcelona and the University of Murcia, once again focuses on vocational training research for the improvement of the education and labour system in Spain. In this sense, the importance of working in a collaborative and multidisciplinary way is highlighted, involving researchers, governmental, academic, economic and social entities committed to the development of this research. The aim is to create an ecosystem of research on VET that fosters the generation of synergies and allows for the sharing of resources and knowledge. Furthermore, it emphasises the need for research to be oriented towards the needs of the educational, business, labour and social world in general. It must be prepared for current and future challenges, focusing on the perspectives of the world of work and the need for evaluation of the VET system. Finally, the study underlines the importance of creating a network of researchers that brings together and fosters a critical mass, connecting existing research teams, generating synergies and spaces for sharing ideas, achievements and concerns, promoting dialogue with the administration, fostering public-private partnerships with other stakeholders and increasing the visibility of research results related to VET.

However, despite the foundational influence of TNIKA from Spain on the agenda of applied research in VET in Europe, there remains a significant lack of literature on the concept of applied research - in VET specifically or related subjects and disciplines - in most universities in Spain. The concentration of publications in this field in essentially, just two universities (University of Barcelona and University of Murcia) suggests that other universities may not be providing it with any specific attention or importance. This lack of research in VET in terms of applied research requirements has potentially had consequences to date in the Spanish VET system and, going forward , could lead to a lack of innovation and updating in VET curricula, which in turn could negatively affect the preparation of VET students for the current labour market; the professional development needs of practitioners, and the specific innovation and solution challenges faced in particular contexts by companies at the individual, regional and sectoral level. It is also possible that, as mentioned in the first point, the concept of "applied research in VET" is not being used literally in academic studies and that different assumptions and taxonomies are utilised within universities that have closer relevance to the NEARVET concept. It is difficult to say, but this lack of use of the concept may be leading to a lack of easy access to the research carried out and the results obtained, leading to a possible loss of information.

7. Support, development or training that academic staff (i.e., researchers) need to be able to apply their research findings, or their research skills, specifically in VET

Overview

In this section, the focus on Universities continues, in that information and examples were sought that would be helpful in identifying the specific support, development or training needs on the part of academic or University staff to apply research findings in VET. In the event, the definition of 'academics' in this context was sometimes extended to incorporate VET staff themselves when acting as 'researchers, in Sweden, Italy, Germany, Greece, Cyprus and Spain

In **Sweden**, this issue has been in the centre of VET research. Notably by Ryal Technical University in Stockholm. Teacher education is specific to the extent that it is an academic vocational education that contains many topics and elements, and which has thereby been faced with difficulties with the research connection. The teacher education reform in 2001 meant major changes not only for undergraduate but also for postgraduate, because it opened up various possibilities for research. Several new examination subjects within the field have thereby emerged and research schools with different orientations have established.

Schools and municipalities also need research-educated teachers, in order to be able to carry out development work, has been noticed and various solutions to respond to the need has been created. In some cases, municipalities have chosen to finance research training for their teachers with the aim of connecting research on pedagogical work and pedagogical practice closer together. (Carlgren, I. (2005) Praxisnära forskning – varför, vad och hur? I J. Carlgren, J. Josefson & C. Liberg (Red.) Forskning av denna världen II – om teorins roll I praxisnära forskning. Vetenskapsrådets rapportserie, 4: 2005.)

For a few years now, a high school with a vocational program and two researchers at the University of Gothenburg have had one collaboration that combines school development and practical research. Teachers work with systematic development of the teaching in program and cross-subject learning groups, which are led by a colleague who is called a teaching leader. The task of the learning groups is to plan, test and follow up improvement efforts in order to systematically strengthen the conditions for students' learning and development. Teachers and researchers meet regularly to analyse and strengthen the work of the learning groups and the teacher leader's role as intermediate leader. The learning groups work with the same theme during a planned period. In 2022, assessment and grading will be processed. Initially identified areas such as formative assessment, feedback, basis for assessment and criteria for assessment. The teachers' analysis results in a decision to start developing

formative teaching and formative assessment. The learning groups are based on own experiences and research combined with testing, following up and analysing various initiatives in one's own teaching. The teacher leaders lead continuous learning group meetings. Between these meetings, teaching leaders and researchers meet to together analyse the current situation. The presentation will partly focus on how the assignment as middle manager and the role of agent for change and improvement is formed in and via the collegial work, partly describe experiences and talk about formative assessment in vocational education. The principal is directly involved through participation in several types of meetings. The training needs highlighted for researchers to transfer their result to VET are:

Communication **-** Even beneficial, compatible and useful scientific evidence remains unused if it does not reach the practice level. Research points out that school research is often perceived as difficult to access. Research further points out that today's research is in competition with the construction of knowledge that takes place outside the university which rapidly spread with the help of, among other things, IT. The number of sources to search for evidence to use in practice, as well as its availability, has increased. The latest ideas and methods that are communicated come from sources closer to the teacher's practice

Researcher's knowledge about teachers and the social system of the school **-** A plan of work to change that which is intended to stimulate teachers to seek evidence in research comprises several workplans. It is about convincing teachers to search for, adapt and use of evidence from teaching research and, also, about the research being communicated with practice, have in-demand qualities and offer solutions to the practical problems, not simply to satisfy the curiosity of the researcher.

In **Italy,** to date, there are no specific sources yet identified from the general literature that describe the support, development or training that academic staff (i.e., researchers) need to be able to apply their research findings, or their research skills, specifically in VET. Until a few years ago, a university degree was de facto the passport to start a career in research laboratories, but about two decades ago, Italy, too, introduced, with great delay compared to other industrialised countries, the PhD, a three-year theoretical-practical course that aims to provide young people with in-depth knowledge and, above all, to enable them to learn how to do research. On-the-job experience is also sufficient to qualify a professional as a researcher, even if he or she does not have a university degree: in industry, it is common to find researchers who have not a university degree but a high school diploma. Currently, in Italy, a researcher can work:

- in the *public* sector, such as universities and public research organisations. In the university sector, one can only work as a researcher after passing a selection process that takes place through a competition. To take part in the selection, a doctorate or an equivalent qualification in another country is usually required. In universities, the position of researcher is the first

step in the career ladder. The next steps are those of associate professor (or second rank) and full professor (or first rank). Access is by public competition based on qualifications and examinations.

- in the *private* sector, such as private research organisations, profit and non-profit industrial and service companies. The researcher works within private companies generally as an employee with fixed-term or open-ended contracts. In private companies, consultancy companies and professional firms, it is also possible to work as a self-employed worker - consultant.
At least a university degree in the subject area in which one wishes to carry out research is required.
In public and private research organisations, the career starts in research assistant positions and may culminate in the management of research centres or organisations or in a move to other managerial positions.

The main *unstructured* figures (limited period of two to four years, depending on the case) are:
- The *doctoral student* or "specializzando" is the student in the third level of studies after the master's degree, who is trained to carry out research activities after having passed a competition by means of qualifications and examinations, benefiting from a scholarship. In Italy, the doctorate is a course of study and therefore the doctoral student is a student. According to the ministerial decree of 9 April 2001, doctoral students are entitled to the same services as students on degree courses.
- A *research grant holder* is a position normally held by a graduate student who obtains a grant through a competition. Each research grant may last a minimum of one year and a maximum of three years.

The main *structured* (contracted) positions are:
- *researcher* who may be:
    - fixed-term type A who has a three-year contract that can be extended for a further two years
    - type B fixed term, which has a three-year non-extendable subordinate contract, but on a tenure track (i.e., with the possibility of tenure without the need to win an open competition). In particular, type B researchers can become associate professors (with an open-ended contract) if during the three years they have obtained the National Scientific Qualification as associate professor (or full professor) and if at the end of their contract they receive the approval of the structure in which they work.
    - open-ended contract
- *associate professor* (or second rank)

- *full professor* (or first-rank). The functions of Rector, Faculty Dean, as well as the functions of coordinating PhD courses and coordinating research groups are reserved for first-rank professors.

In **Germany**, vocational and higher education in Germany have traditionally been separate educational sectors that are insufficiently interconnected. Gaining a higher level of permeability between them is promoted by further developing the transitions. More recently, universities have been conducting skills analyses aimed equally at vocational schools and their dual partner institutions. A small **case study**, by way of illustration, is briefly outlined below:

The research project is called: Berliner Modell Lernortkooperation (BER-LOK) which can be translated as "Berlin model of learning site cooperation" and has the goal of promoting the learners' action competencies in the best possible way. For this purpose, the model is divided into many quality dimensions: 1. inform, 2. coordinate, 3. collaborate and 4. provide the structure to sustain cooperative relationships. Each of these four quality dimensions is determined in more detail by three quality characteristics each (graphic of the model can be viewed virtually via the following link at page 163: https://www.erziehungswissenschaften.hu-berlin.de/de/wipaed/international/projekte/ber-lok-4.0 or on page 163 on its "*Wie wollen wir arbeiten?*" (2022) report: https://www.wbv.de/shop/Editorial-6004914w007). In the results of the model project, seven conditions can be identified for the success and the intra-institutional transfer of learning site cooperations:
1. reliable accessibility 2. regular cooperation events 3. coordinated overall concept 4. trust and exchange of expertise 5. learner orientation 6. individualized support 7. active participation of chambers, guilds and industry associations

In **Greece**, academic staff in VET should have a strong understanding of the VET system and the needs of the labour market. This includes an understanding of the skills and competencies required by employers, as well as the needs of learners. Therefore, it is important that academic staff are provided with opportunities for professional development and training in VET-specific areas, such as curriculum development, assessment and evaluation, and pedagogy. Academic staff should be supported in developing research skills that are relevant and applicable to the VET sector. This includes training in research methods, data analysis, and project management, as well as knowledge of the policies and practices of VET. Opportunities for collaboration with industry and VET providers can also help to ensure that research is relevant and applicable to the needs of the VET sector.

Further, academic staff should be provided with support and resources to disseminate and apply their research findings. This includes opportunities to present research at conferences

and events, as well as support for publishing in academic journals and other media. VET providers can also provide opportunities for academic staff to engage in knowledge exchange with practitioners, and to apply their research findings in the development of VET programs and curricula.

In **Cyprus**, according to the 3rd Strategic pillar of Research Excellence of the "Innovate Cyprus" Strategy framework, scientific excellence lies essentially at the heart of a national research, innovation and development strategy. Thus, promoting, recognizing and rewarding research excellence, while developing a critical mass of high-quality human base in science and technology will enhance the literacy of cutting-edge technologies and contribute to the improvement of the research activities at institutional and national levels. Additionally:

1. promoting and facilitating continuous professional development, accompanied by lifelong learning and training throughout the professional career of academic researchers including entrepreneurial development and business mentoring programs.
2. the simultaneous promotion of the mechanisms for career development of academic / research staff on the basis of excellence, exploitation of research and in attracting private funding.
3. supporting universities of the public and private sector to develop vibrant research environments that will nurture and attract talent are considered to be critical success factors (Cyprus research & innovation strategy framework, 2019)

On that aspect, scientific and technological excellence and the quality of applied research per se promote the increase of foreign direct investments and the repatriation of academic / research staff creating a virtuous cycle that encourages the development of that academic staff and supports their ability to apply their research findings throughout the whole spectrum of relevant knowledge generating institutions. (Papailiou, no date).

In **Spain**, in an article carried out by the University of Barcelona and the University of Murcia (Echeverría, B. and Martínez, P. (2021). "Hacia un ecosistema de investigación sobre formación profesional en España) it is indicated that, in order to promote research in vocational training in Spain, it is necessary to create an ecosystem that connects the technological, research, innovative and entrepreneurial potential with the infrastructures and talent of its researchers and social agents. To achieve this, it is necessary to establish solid networks connecting science, socio-economic actors and society in general.

Applied research in VET arises from collaboration between researchers, training centres, universities, companies and investors. In order to achieve the objectives in relation to VET, it

is necessary for all agents to be involved in the process of building a culture of research and innovation in VET. This should foster a continuous process of reflection-action-reflection, offering real spaces for exchange, participation and decision-making on the important role of VET in the development of society.

8. The main and possible attention areas required for academic researchers, VET teachers and trainers; intermediary staff, others in applied research in VET

In **Sweden**, the Swedish research points to the following:

For *teachers:*

a) Digital skills:

i) Applies critical digital literacy skills: the ability to critically assess the quality, validity and potential of learning content that uses new media forms and to leverage these media for persuasive communication and problem-solving
ii) Processing skills: the ability to process, critique, categorise and evaluate large volumes of information
iii) Discriminates and filters content for importance and contextual value
iv) Applies the skill of abandonment to reject information with little or no value to the context
v) Has the ability to reorganise, repurpose, supplement and further develop learning content

b) Promoting Critical Digital Literacy (CDL) and Managing Required Changes

i) Demonstrates ability to help learners select the most appropriate approaches (i.e., information retrieval systems) for accessing needed information.
ii) Uses various techniques that help determine the learners' overall CDL competence and their training needs.
iii) Demonstrates ability to help learners evaluate critically information and its source while incorporating relevant input into their knowledge base.
iv) Uses knowledge and skills acquired through their training to develop learners' skills in using media and library resources as tools for research and learning.

c) Collaborative f2f or online Learning

i) create collaborative relationships,
ii) create and sustain a participatory environment,
iii) formulate and apply a strategy of enquiry to enable individuals to explore issues and develop insights,
iv) evoke the creativity of a group,
v) plan appropriate group processes,
vi) guide groups to appropriate and useful outcomes
vii) facilitate collaborative online learning based on a repertoire/collection of methods, concepts and tools

For *researchers:*

a) Communication
b) Translating the research to an understandable and practical level
c) Knowledge about the culture in the school (teacher/students)

For *employers*

a) Ability to build trust with VET providers
b) Ability to sustain the cooperation (structured-based cooperation and not based on specific individuals)
c) Ability to communicate with providers, especially regarding qualification needs related to innovation
d) Ability to present up to date WBL mentoring including challenging research project training relevant to occupational innovation

In **Italy,** there is no specific literature, at least of a general kind, on applied research in the VET field and, therefore, not on the related researcher professions. A specific reflection on this matter points to the 'project designer' in VET. Within the VET field two kind of project designer and manager operate:

The VET course project designer is strategic for successful of VET courses, especially thinking about teaching problem oriented, rather than the generation of knowledge. This planner is called upon to read the needs of the labour market, sometimes from a predictive perspective, and to translate them into effective training paths, structured according to competences, safeguarding both classrooms learning and the on-the-job training dimension.

The European project designer (Europrogettista) has become increasingly important in recent years as a fundamental element of research, development and innovation within VET organisations. The Europrogettista is a key player of real applied research, as he or she draws up projects that respond to precise priorities and specific needs in different sectors, providing concretely applicable solutions to truly identified 'problems', which are translated into factual, tested and verified actions.

Indeed, the project idea can arise from very different kinds of evaluations, such as:

- the response to a specific need of the enterprises, civil society or institutions from local specific areas;
- the realisation of scientific research, an artistic product or a business idea;
- the desire to intensify exchanges with other actors to broaden the use of information, experience and good practice.

The skills required are varied and include:

- technical skills, fundamental for project evaluation and planning. An economic-legal background is useful as a thorough knowledge of the institutional context and European regulations is required
- financial skills for project budgeting and reporting
- knowledge of foreign languages: English is essential, but it would be desirable not to be unfamiliar with French and German, the other official languages in which European documents are drafted
- computer skills
- project management skills
- transversal skills such as problem solving, the need to keep continuously updated, work process management and the ability to cultivate public relations.

In **Germany**, the following applies:

- further developing training structures for the future
- a regular exchange between the vocational schools and the training companies is indispensable for coordination
- the training of intercultural and social competencies is to be given a stronger weight and thus take account of the increasing internationalization of the working world
- in order to meet the changing requirements, the structures of the dual training system must be further developed
- increasing attractiveness as a key factor in increasing participation in vocational education and training
- individual counselling and support for participants in vocational training leaves much to be desired
- transparent qualifications enable a better match between the supply of and demand for qualifications
- steadily expanding digital capabilities
- adequate handling of challenges of our time
- ensure uniform language between scientists and employees in training occupations

In **Greece,** these are indicated to be:

1. *Academic researchers:*

- Professional development and training in VET-specific areas, such as curriculum development, assessment and evaluation, and pedagogy.
- Training in research methods, data analysis, and project management, as well as knowledge of the policies and practices of VET.
- Collaboration and partnerships with VET providers and industry to ensure that research is relevant and applicable to the needs of the VET sector.
- Support and resources to disseminate and apply research findings, including opportunities to present research at conferences and events and support for publishing in academic journals and other media.

2. *VET teachers and trainers:*

- Professional development and training in VET-specific areas, including the development of industry-specific skills and knowledge.
- Training in pedagogy and teaching methods, as well as knowledge of assessment and evaluation techniques.
- Access to research findings and resources to support their teaching practice and improve the quality of their programs.
- Collaboration and partnerships with academic researchers, VET providers, and industry to ensure that their programs are relevant and meet the needs of employers and learners.

3. *Intermediary staff:*

- Knowledge and understanding of the VET system, including policies and practices.
- Understanding of the skills and competencies required by employers and the labour market.
- Facilitation of partnerships and collaboration between VET providers, industry, and academic researchers.
- Support for the dissemination and application of research findings to improve the quality of VET programmes and meet the needs of the labour market.

4. *Others:*

- Awareness of the importance of VET and its role in supporting economic growth and development.
- Collaboration and partnerships with VET providers, industry, and academic researchers to support the development of relevant and high-quality VET programs.
- Support for the dissemination and application of research findings to improve the quality of VET programmes and meet the needs of the labour market.

In **Cyprus**, there are a number of structural changes in the economy of Cyprus that will directly affect the areas that need attention so as for the involved profiles to be in a position to conduct and supervise applied research in VET. Specifically, under the:

- 4th strategic pillar of the innovation strategy framework, the mission of public and private universities and research institutes has to be redefined to include knowledge transfer along with education and research.
- 3rd strategic pillar of the strategic plan, there is a direction towards the upgrading of quality criteria of academic programmes in tertiary education. The young generation has to be encouraged and equipped with the necessary competences and skills to become researchers and innovators of the next generation.

The country's plan assigns central importance to the development of an education system at all levels - from primary to tertiary and lifelong learning - that will provide to the future human capital with the foundation literacies, competencies and character qualities necessary for the needs of the economy as it unfolds in the 21st century. Hence, among others, will put emphasis on education in STEAM subjects (science, technology, engineering, arts and mathematics), creative thinking, adaptability and cognitive development. (Cyprus research & innovation strategy framework, 2019) This reality can be verified through the continuous quest at a European level of finding the right response to growing skills shortages while better adjusting the education and training systems to the needs of the labour market (Business Europe, 2019).

As a consequence, matching supply and demand is an imperative for all actors involved, meaning that labour market actors, VET providers, universities, public authorities and competent institutions need to be engaged in a constant constructive dialogue for developing and renewing standards in order to fight against skills mismatches. (Voronov et al., 2017). Therefore, with regards to the overall context of the country and moving to the individual profiles /target groups, the following is highlighted:

1. Academic researchers: in order to develop a critical mass of high-quality academic staff / researchers that will have the ability to conduct and supervise applied research promoting, recognizing and rewarding research excellence is a pivotal area of attention. In addition, the continuous improvement in the literacy of cutting-edge technologies which will have a positive correlation in the improvement of the applied research activities is another area of attention which is directly connected with the digital technologies' skill area of the framework. Moreover, the need of the younger generation to become the researchers of the future places the focus on the pedagogy segment of the framework, meaning the use of applied research per se as pedagogy. Furthermore, striving to adjust the education system to the needs of the labour market points out to the area of skills connected with knowledge brokerage which has a significant role to play in conducting applied research in terms of its relevancy to business problems, apply the research results in real-time conditions, and ultimately achieve buy-in from the side of the business sector. However, apart from the focus on the skill areas included in the framework, significant attention should be paid on the mechanisms and environment for career development of academic / research staff on the basis of exploitation of research and in attracting private funding. In other words, to support universities of the public and private sector to develop vibrant research environments that will nurture and attract talent. (Cyprus research & innovation strategy framework, 2019)
2. VET teachers and trainers: primarily it is of crucial importance to pay attention in a wider structural problematic area. Hence, in the Cypriot context, it is of crucial importance VET centres, as private education entities, to be included in the research and innovation governance system presented in the strategic framework of the country as "knowledge generators." (Cyprus research & innovation strategy framework, 2019).

Something which is not the case at the present time and thus, creates further implications in the involvement of VET teachers and trainers to applied research activities and the dissemination of the given results to the wider community. It is important for VET centres to find their niche in this system so to be able to focus on the skill areas of applied research in VET. However, as with the group of academic staff / researchers' attention areas required are digital technologies and use of applied research as a pedagogy and knowledge brokerage. Yet, specifically for this target profile, the skill area of research literacy of VET teachers and trainers, acting as knowledge generators, must possess special attention if VET centres aspire to play a crucial role on the field of applied research.

3. Private sector managers: taking as granted that applied research is a collaborative effort, it may transpire that various skills' areas of the framework are to be put in attention among the organizations' managerial staff. Thus, embrace more generic skills in communication and pedagogy (to sell the results of the research in the business setting) and which can be honed to build research capability. Considering the involvement of many stakeholders due to the interdisciplinary nature of business problems, managers should be knowledge brokers which calls for translating and synthesizing the research so that it is relevant to others; in networking and collaborating with industry and community groups, as well as with the project team while creating sustainable practices through hubs and research and innovation ecosystems. However, none of the previous is achievable without effective leadership, planning and organization. However, while a full range of academic research skills are not necessarily required for working on applied research projects, private sector managers should have a measure of what it is termed "research literacy." Last but not least, research and innovation are achieved through a combination of individual and collective efforts; therefore, the organizations undertaken it through their managers should promote the research capacity of the organization and articulate the value of applied research. (Beddie and Simon, 2017)

4. VET learners: compelled to be prepared with the needed competencies and skills that match the needs of the labour market and the overall direction given, due to emerging needs and trends in the economy, such as sustainability, digitalization and Artificial Intelligence, ethical procurement, corporate social responsibility, social entrepreneurship and investment etc. should master all the skill areas provided in the framework in a lifelong basis. The areas of the provided framework consisted of generic/transversal skills and more targeted/technical skills are essential for coping with the demands of the majority of the industry sectors; while paying more thorough attention to the segments of research literacy and knowledge brokerage can play a vital role in the generation of future research that is much needed by the Cypriot economy. This is something that can be verified by the promotion by National authorities of

continuous professional development, accompanied by lifelong learning and training throughout the career of researchers included also in business mentoring programs and training schemes (Cyprus research & innovation strategy framework, 2019).

In **Spain**, the new vocational training law, which came into force in March 2022, aims to promote more flexible training adapted to the needs of the labour market. This new law also establishes the creation of new vocational training qualifications in areas of high labour demand, such as industry 4.0, circular economy or renewable energies, in addition, the catalogue of certificates of professionalism has been expanded and the process of recognition of professional competences acquired through work experience has been simplified. The aim of all this is to improve the quality of vocational training and increase the employability of students, adapting the training offer to the needs of the labour market and promoting collaboration between the different actors in the education system.

Along these lines, the article "Spain's new VET law and its analysis: A technical look" published in 2022, stresses that in order to achieve the effectiveness of the new system, it is essential to guarantee the necessary coordination between the Ministries of Education and VET and of Labour and Social Economy to ensure the complementarity, on the one hand, of the Vocational Training System and, on the other hand, of vocational education and training related to active employment policies and on-the-job training. Moreover, in M.L. Rico Gómez, A.I. Ponce Gea (2020). "El docent del siglo XXI: Perspectives según el rol formative y profesional", a research article on teacher education for technical and vocational education in Spain in the 21st century published in 2019 analyses the changes in VET teacher education in the 21st century and highlights the importance of their continuing education and professional development. In order to be able to transmit adequate and up-to-date knowledge to their students, in technical and transversal skills that will enable them to be the great professionals of the future.

"Job shadowing" is a practice that is increasingly widespread in Europe, which has proven to be a good practice in work-based learning and innovation in vocational training. Job shadowing consists of observing a worker in his or her workplace, with the aim of learning about his or her specific skills and tasks. In VET, job shadowing is a valuable tool for students to learn first-hand how the skills and knowledge acquired in the classroom are applied in the real world of work. Although this practice is widely used in Europe, its implementation in Spain is limited. This learning methodology is beneficial for VET students, as it allows them to learn first-hand how a company works and the real requirements of the labour market, as well as to apply and improve their skills and knowledge. In this sense, although it is not an area of attention, it would be interesting if vocational training centres could be more active in brokering or considering implementing this practice progressively. In this way, it could contribute to improving the training and employability of VET students and trainees, reduce

the gap between training and the real world of work and promote educational innovation. In addition, this practice could help training centres to establish closer links with the local business fabric and to better adapt to the needs of the labour market, which remains at times a 'gulf' in Spain.

Another of the practices mentioned above and which may be of great interest to vocational training centres are training placements in companies or public or private institutions for teachers who teach in vocational training cycles. By enabling teachers to acquire knowledge and skills in a real working environment, these placements can improve the quality of the teaching provided in vocational training cycles, as well as the degree of updating and specialisation of the teaching staff. In addition, this type of experience can also foster networking and relationships with companies and organisations in the sector, which can be beneficial for both the school and its students, who may have greater opportunities for job placement or access to professional internships. However, it should be noted that, despite the potential benefits of training placements for VET teachers, in practice, these experiences are hardly being implemented due to lack of time and resources of teachers. Many teachers can be overloaded with work and commitments, which makes it difficult for them to be available to participate in such initiatives. Therefore, promoting the implementation of these placements, recognising their value and importance for the improvement of the quality of professional training, accompanied by appropriate reform and policy measures may all have a contribution to make.

Otherwise, it is reasonable to conclude that the concept as articulated by the European Commission and the NEARVET initiative is diluted and not sufficiently recognised, despite the presence of exemplar and foundational initiatives in the country. Despite the fact that major actions are being carried out that are closely related to the concept, this term is not explicitly referred to in most cases. This can lead to confusion about 'what is meant' and a lack of unity in terms of the actions being carried out in this field, which in turn can hinder the promotion and advancement of the concept, and consequently, in the implementation of improvements in VET in Spain. In this sense, it is necessary to disseminate and explain in an authoritative way the concept of 'Applied Research in VET' in Spain to gain greater acceptance and understanding of its value. It is essential that awareness-raising and sensitisation work is carried out so that the NEARVET concept is recognised and valued by all the actors involved in vocational training. This will help to promote greater collaboration and coordination between the different institutions and organisations involved within the Spanish system, which will enable more effective progress to be made in improving the quality of teaching and preparing students for the world of work.

9. Conclusions: Defining Applied research in VET

Applied research and knowledge dissemination are essential ingredients in innovation. They are required to both create highly skilled and adaptable workers and support the commercialization of ideas that can increase productivity. Yet, as evidenced by the research undertaken in NEARVET, neither are a systemic part of the current VET sector.

In some areas, as the desk research unfolded, a very wide range of activities, topics, subjects and themes were drawn upon to explore the attention areas set out for this Study. Together with evidence emerging from interviews with stakeholders (see separate study), there are rich examples which show the potential for a more systematic approach to this area.

Moreover, there is no consensus across all sectors and in all contexts about what 'applied research' should mean. On a concrete point, the specific term 'applied research in VET,' as shown in the results of the desk research and literature review, is not the subject of widespread attention, nor is it widely understood. It does not benefit from a common understanding of, nor does a consensus surround, its meaning or purpose. Simply the use of the term '*research*' itself, in the terminology and definition of this field, invokes various responses from practitioners in VET. This is the case *at all levels* – and notably, on the evidence explored thus far, widely so within the European VET community.

This presents a challenge to NEARVET – and to all of those involved in the VET community in Europe to consider how to embrace and define relevant applied research concepts – specifically – in order to address the 'real life' and practical challenges that they face in VET. These challenges may be at the learner level, or the company level – they may be at sectoral, regional, national or transnational level.

However, activities related to *research, development and innovation* are widespread in VET. Attention in VET can often be focused, in this sense, on the related concepts of *'R&D'* and *'innovation.'* Here, VET practitioners – as represented thus far in NEARVET primarily by the country-based report authors themselves - appear far more comfortable in describing how they engage in these concepts than the particular notion of 'applied research.' At a fundamental level, this raises a question as to whether 'applied research in VET,' or the occupation of 'applied researcher in VET' is the most comfortable direction to pursue. Nonetheless, the European Commission has stated as a policy priority in VET that it sees applied research in VET – specifically - as under-exploited and offering great potential.

VET institutions and their practitioners already act as innovation 'agents'. Many have decades-long experience in working closely with, in particular, SMEs, derived from the training

relationship. Some have major projects with partner companies in sectors that range from defence industries, infrastructure, tourism and health. Hundreds more innovation projects exist between VETs and SMEs: they are largely unrecognized.

In this context, we can take our definitional starting point to applied research in VET, from the approach described by OECD's Frascati Manual (2015). This Manual represents the internationally recognised methodology for collecting and using research and development (R&D) statistics and is considered the essential tool for statisticians and science and innovation policy makers worldwide. It includes definitions of basic concepts, data collection guidelines, and classifications for compiling R&D statistics.

Significantly, in its most updated edition (2015) it contains improved guidelines "*reflecting recent changes in the way R&D takes place and is funded and the wider use of R&D statistics and definitions"* (our Italics). This italicised statement points, in a straightforward way, to the rapidly changing economic and social environment within which arenas such as VET are operating. It also points to rapid and changing manifestations in the way that R&D is seen and is financed. In this context, the Frascati manual (2015, p.45), describes three types of *Research and Development* activities (NB our italics, below):

♣ ***Basic research*** – through which experimental or theoretical work undertaken primarily to acquire new knowledge of the underlying foundations of phenomena and observable facts, *without* any particular application or use in view;

♣ ***Applied research*** is original investigation undertaken in order to acquire new knowledge. It is, however, *directed primarily towards a specific, practical aim or objective;*

♣ **Experimental development** is systematic work, *drawing on knowledge gained from research and practical experience*, and producing additional knowledge, *which is directed to producing new products or processes or to improving existing products or processes*."

In this Study, we have taken the above definition of '*applied research'* as our foundation, in the context of VET and in informing our elaboration of the NEARVET concept. In this context, Applied Research gives operational form to ideas. Nonetheless, as we will see, it is not practical to simply separate this definition out, in VET, from the OECD's third statement, '*experimental development.'* This point is returned to in the Conclusions of this Study.

This is important, because **it shifts the 'lens' away from the duality of 'applied' and 'pure' research found in academia, to one that is *threefold* – and incorporates the requirement of practical action**. Moreover, this threefold 'interplay' – between pure research, applied

research and experimental development - is one that is much more familiar to those who are involved in innovation in the VET community.

Therefore, NEARVET **is primarily concerned with two (the second and third) of the three above definitions** in Frascati and the way they connect with Research and Development activities. In this respect, NEARVET is primarily concerned with acts of 'applying' the results of research – or perhaps to be more specific, applying 'data' – however they are generated and irrespective of *whether or not* the 'research' that generated the data has been conducted within the paradigms and disciplines of pure research – to inform the course of practical action.

This is not to say that pure and fundamental research is not relevant to this agenda. For instance, applied research in VET may very well involve the 'straight line' application of research developed in a 'pure research' context by a University to a given situation. However, we have to state clearly, at this juncture, that this is not the focus of applied research in VET as it is defined and specified in NEARVET. Rather, in NEARVET's concept of applied research in VET, the 'real life challenge' at the interface between companies, labour markets and VET institutions to resolve practical challenges or address needs is put at the heart of the matter, rather than the pursuit of new knowledge 'for its own sake' through theoretical development or the testing of a hypothesis, generated from a research question.

Typically, it is doing so through some form of *applied innovation* – typically an *experimental development*. It is also doing so with some combination of those presently, directly and operationally engaged in VET – companies, trade associations, VET providers – through VET teachers, trainers, tutors and VET programme managers and designers – as well as researchers (from Universities or research institutions) and, in some cases, VET students and graduates.

This is implicitly recognised by the European Commission which, in its Call for Proposals for Forward-Looking Projects to address 'applied research in VET' states that *"'Applied research' gives operational form to ideas. It is very closely related to the concept of 'Experimental development', which is defined as systematic work, drawing on knowledge gained from research and practical experience and producing additional knowledge, which is directed to producing new products or processes or to improving existing products or processes*."

In conclusion, in moving towards a definitive definition, we also note the advent and establishment of ARRIVET (Applied Research Results in Vocational Education and Training). This is announced as being "*an international, interdisciplinary publication dedicated to the documentation and dissemination of applied research results. Its focus is on the application of research to the solution of business and industry problems and the use of applied research in vocational learning and teaching*".[17] It has an editorial board that features various stakeholders including representatives of Tanika, the Basque VET Applied Research Centre referenced in this Study.[18] Stated on its website as being due to launch in February 2023, it does not yet list any publications. Nonetheless, the evidence identified thus far and the analysis of the above leads us to the conclusion that we can concur with the definitional statement made ARRIVET from which the NEARVET concept can be developed further, specifically (our emphasis in bold):

> "*Applied research addresses **any person** who is interested in solving practical research problems of business and industry, with particular focus on those committed to **the dialogue between production and instruction, the professional and the vocational**."*

[17] https://arrivet.org/index.php/arrivet/about
[18] https://arrivet.org/index.php/arrivet/about/editorialTeam

10. Observations: Towards a Blueprint for NEARVET

10.1 Profiling and professional development

A methodological framework in a strategic, forward-looking project such as NEARVET should not only be authoritative in its methods and approaches, but also work towards building a specific meaning for NEARVET in a way that is valid and usable for the wider VET sector and contexts in other countries. It needs to reflect the ways of work and approaches appearing in a variety of cases in the cooperation between VET institutions and networks, research centres, and especially businesses, and to uncover their potential definition as applied research 'cases'.

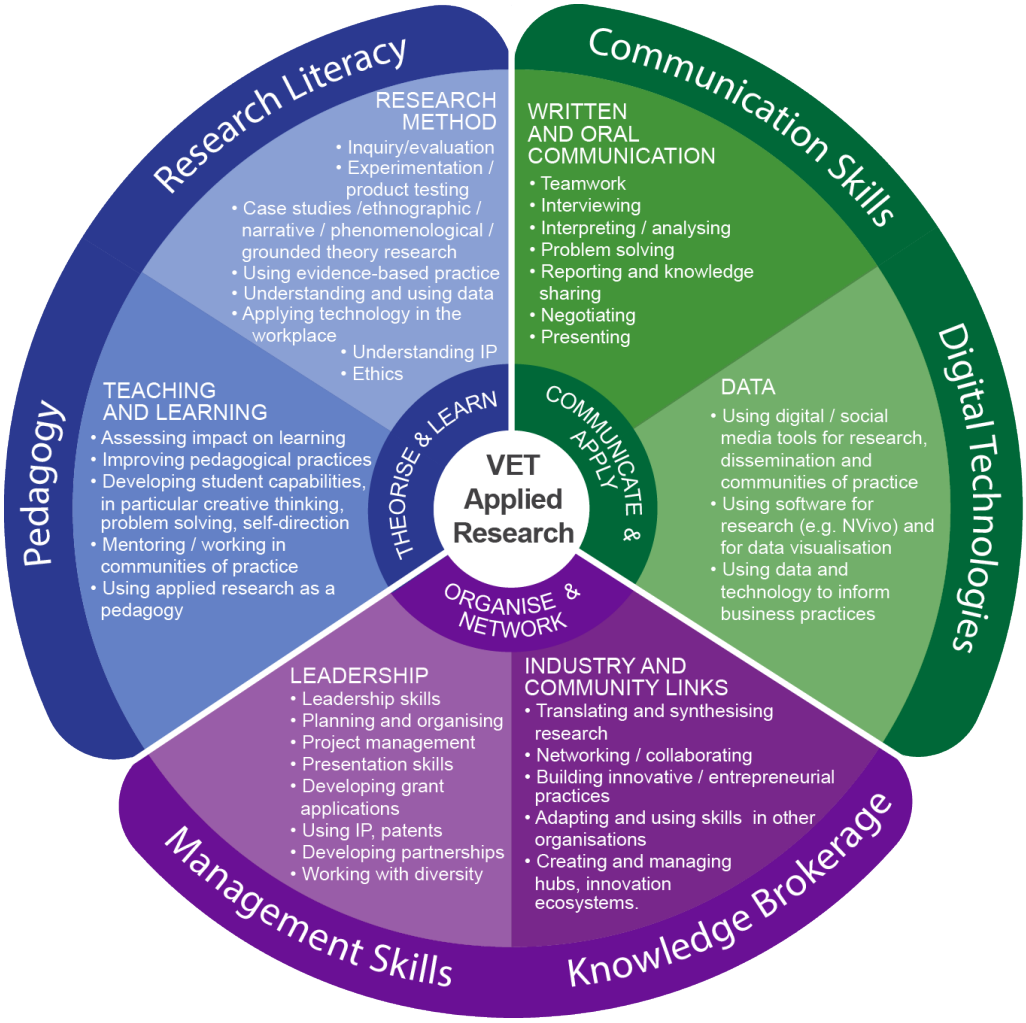
NEARVET's differentiating characteristic, in building its network, is that it seeks to explicitly a question that is often left unaddressed, namely: *'If applied research in VET is critical - who are the applied researchers?*'. Moreover, NEARVET sets out to address two supplementary questions: "'*What are the needs of these applied researchers?'* - and – '*how are they to be met'*?"

In NEARVET, we are specifically seeking to profile and support the professional development needs of those in VET who are, primarily, concerned with activities, tasks, responsibilities in occupations that work across a continuum of areas concerned with applied research and experimental development. From the outset, NEARVET has been clear that that VET applied researchers, as we proceed to define and specify both the practice and the relevant 'actors' are not – nor should they seek to be - the same as university-based researchers. Rather, and instead, they have a strong practical focus on identifying and solving 'real life' problems and challenges in VET.

It highlights that, as VET is concerned with the interaction between education, training and the world of work, applied research in VET, however it is defined, takes place in a context of bringing companies, VET institutions and their practitioners (teachers and organisers), research capabilities and, in some cases, VET students together. NEARVET, therefore, states its intention to define its core purpose within a European community of VET practitioners, researchers, learners and companies. However, it requires further elaboration in order to develop a concrete and practical work programme that is clear about its focus in relation to what, and with whom, its deliverables are to be implemented.

10.2 The NCVER Framework

The Australian National Centre for Vocational Education Research (NCVER) development framework[19] was referenced by the European Commission in its call for proposals in relation to applied research in VET. It arose from the findings of the Australian study into applied research in VET and drew upon examples from other applied research frameworks, from its own literature review. The original purpose of the framework in its Australian context was developed as a tool to assist VET educators and other professionals as a means of specifying the range of skills that are covered by applied research in VET. It is structured on a core set of domains, each of which is broken down further to cover the range of skills and other factors that were relevant to being 'literate' in applied research.



The 'inner circle; of the framework provides three core areas, comprising strategic domains as 'modules' of factors that are, in turn, broken down further into:

[19] Simon, L and Beddie, F.M. (2017), *VET applied research: driving VET's role in the innovation system*, NCVER

(a) Communicate and apply (the green domain)

This area identifies the communication skills and considers aspects of digital technologies, which are required throughout the process of undertaking applied research in VET:

- Working in teams
- interviewing research partners and subjects
- interpreting and analysing a range of documents and data
- problem-solving
- writing and reporting to others and sharing knowledge
- negotiating on outcomes
- presenting findings
- use different communication and analytical tools, including digital technologies and social media.

(b) Organise and network (the purple domain)

Here, this area points to the notion of those planning, organizing or undertaking applied research in VET as *intermediaries* – providing leadership to applied research in VET assignments or projects as knowledge brokers – working across the VET stakeholders with a shared interest in working together to solve practical problems and challenges, to innovate and to create – be they those in the VET system (VET teachers, managers), employers and managers in companies, trade and sector associations, research organisations or VET students (for instance, VET students provided with work-based, problem-solving assignments)

- Making the activity relevant to other stakeholders in the process, through translating and synthesizing the research
- networking and collaborating
- setting up and managing an applied research project / assignment through its distinct phases
- apply for funding (if appropriate)
- manage intellectual property (IP) requirements and apply for patents (if appropriate)
- working with diverse groups of people, developing partnerships with a range of stakeholders
- conducting reviews and evaluation.

(c) Theorise and Learn (the blue domain)

This aspect of the NCVER framework states two elements that will be familiar to, and is perhaps aimed at, in particular those who are either VET teachers, or who are researchers. One of these is what the framework refers to as 'Pedagogy,' summarizing elements of teaching and learning in the process, and are assumed to be elements aimed at students, or supporting students (and trainees). The other is described as 'Research Literacy.' This includes inquiry, evaluation and reflection, on the one hand, although it also specifies specific research methods and disciplines. The skills listed here incorporate being able to:

- improve enterprise practices, including by the uptake of technology
- develop the capabilities of students, especially in those areas identified by employers
- assess the impact on learning or work processes
- mentor others and work effectively in sustainable communities
- use applied research as a pedagogy
- working towards being able to apply evidence and technology to change products and processes
- have some qualitative and quantitative research skills
- experiment with and test products where necessary
- ensure that work follows ethical guidelines
- understand IP requirements.

10.3 NEARVET and the NCVER Framework

For the development and elaboration of this Methodology Concept, NEARVET adopted the NCVER development framework as a core point of reference. The framework was discussed and analysed by the NEARVET consortium at its meeting in Berlin in March 2023. Following an initial assessment, the development framework was considered fit for purpose by the NEARVET consortium in terms of providing an initial point of reference that provided NEARVET with a structure upon which it could build a series of 'areas for attention' when conducting the desk research. It was a very valuable starting point, and its various domains were used to inform the design of the guidelines issued to partners to conduct the desk research in their respective countries, which in turn was used to inform the approach taken to stakeholder interviews.

At the same time, there are three considerations to take into account, at this point, which arise from the use of the NCVER framework in the elaboration of the NEARVET Blueprint:

(a) The heterogeneity and diversity of VET contexts in Europe

Firstly, the NCVER development framework, whilst drawing upon research that had been undertaken applied research in VET in other countries other than Australia, it was developed for use in the Australian VET system. Inevitably, therefore, as it was designed specifically to have practical application in that country, there are certain aspects of it that are highly context specific. In particular, it was designed to be mapped against Australian training structures such as the competencies listed in the Training and Assessment Package and other training and assessment frameworks in Australia (it refers, for instance, to "the current position of the Certificate IV in Training and Assessment as an entry criterion for teaching in VET"). Thus, the NCVER development framework was produced as a tool for use in a specific, non-European country, for the attention of, and use by, an audience of practitioners and policy makers in Australia, who would all have been familiar with their own system and how to apply the various references and provisions of the framework.

NEARVET, however, is operating in a very different context, which is a European one, and for the European Union a policy context comprising its 27 member states, plus countries in the single market area and, potentially, others that are closely allied to some of its transnational educational programmes (e.g. accession states). This is both demonstrated and illustrated by the results of the desk research and is also emerging in the data from the interviews, which shows both a common enthusiasm for greater attention to the development of stakeholders to make innovation and experimental development in VET. Moreover, as recently highlighted by CEDEFOP, the intensity of research and comparative analysis of VET systems, has increased massively in the last two decades but there remains a huge diversity of VET arrangements, conceptions and systems, including the different conceptions and approaches to VET that exist between and within countries. [20]

This situation is confirmed by the desk research results in NEARVET. Even amongst the six countries that have been researched, there is considerable diversity in the range and extent to which applied research in VET is either understood or operated. To some extent, this is a reflection of the diversity in VET systems in the way that, for instance, employers and company representatives are integrated into national VET systems – informing the design or evaluating the efficacy of VET curricula, for instance; or in relation to VET structures, such as those of 'Higher VET' in Sweden in which, again, businesses, but also to some extent research interests, are integral to the operation of the higher VET system. This is in contrast to the

[20] The future of vocational education and training in Europe: 50 dimensions of vocational education and training: Cedefop's analytical framework for comparing VET (2023), CEDEFOP.

picture presented in other countries, where despite a commitment to, and understanding of, the importance of innovation in VET, these multi-disciplinary ways of working together are far less advanced – to say nothing of being fostered or integrated by the national VET systems themselves.

Therefore, when considering the position of VET in Europe and when seeking to build a common European-level intervention – such as the development of a professional development programme in applied research in VET, as represented by NEARVET, this has to be fully taken into account if NEARVET is to be both inclusive *and* relevant. NEARVET, therefore, has to develop its own Blueprint in a way that is relevant and transversal across the European context, but is expert and specific enough to avoid being reduced to the lowest common denominator.

Conclusion 1: The NEARVET Blueprint and its competency framework needs to avoid any contents that make assumptions about the operation of VET 'systems'. It should focus, instead on specifying a 'typology and taxonomy' of applied research in VET projects and assignments, and develop its domains, skills and other factors in reference to those.[21]

(b) Applied research in VET and the Knowledge Triangle

Secondly, as a tool, the NCVER development framework is, arguably, aimed or even exclusively at VET teachers and students. Consequently, in its design, was able to make certain definitional statements about how applied research in VET should 'work' in Australia and what skills those two primary target groups need to have, or need to develop, to perform applied research in VET.

There is no argument that VET teachers and the managers of VET institutions form a very significant and potentially the most significant set of actors amongst the target groups that are defined by NEARVET. Moreover, NCVER is valuable in highlighting how VET teachers and managers, and even VET students, can become, or have a role to play as 'knowledge brokers.' However, an undue focus on VET teachers and VET students with regards to applied research can be seen as somewhat one-dimensional in terms of the range of activities that related to applied research in VET and the range of involved actors.

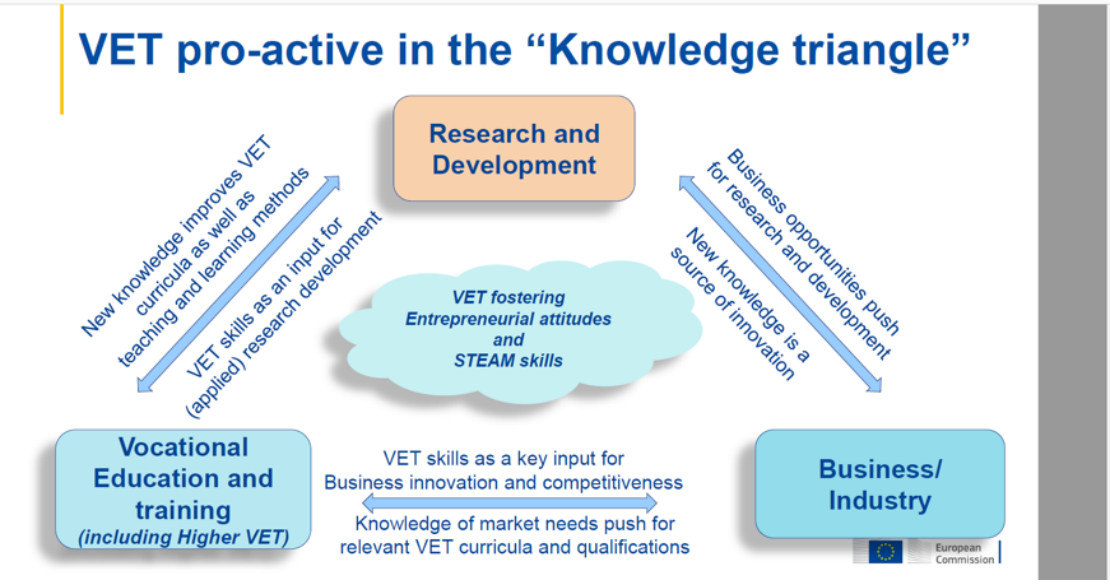
As illustrated by the case studies listed in the results of the desk research above, and in

[21] It is anticipated that the Blueprint, the development of specific competences and the specific contents for the NEARVET Digital Hub will be, in this respect, significantly informed by the outcome of the research being conducted with stakeholders through interviews and focus group interactions.

examples provided by partners in various interviews, applied research in VET has many different manifestations. Work-based learning students or trainees, undertaking problem-based assignments with companies, or VET managers and teachers engaging with labour market stakeholders to better inform the future design of their VET provision are amongst them. However, applied research in VET is also contributed to – indeed instigated by research institutions and Universities, by trade associations and by individual representatives of companies and employers. Applied research in VET is driven by different stating points and different interests. in an effective and impactful way Moreover, not only does NEARVET encompass elements of Initial VET, CVET and Higher VET in different ways, but the role of non-formal VET in relation to the development of innovation in occupational and industrial sectors with less 'well worn' VET pathways (e.g. the cultural and creative industries) should not be overlooked.

In the NEARVET conception, applied research in VET therefore involves, amongst others, researchers, VET teachers, VET managers, employer representatives, trade association and others acting as organisers and intermediaries; VET (including higher VET) students). This points to the fact that there is no one kind of typology of applied research in VET assignments. Indeed, there are, potentially, as many examples of VET projects and assignments that would benefit from applied research actions (including experimental development) as there are scenarios, problems, challenges and opportunities that can be identified in dialogue and actions between business and industry on the one hand, VET institutions, practitioners (including students) and other VET stakeholders on the other. Here, applied research in VET is a multi-dimensional, multi-directional *process.*

This brings to life the Knowledge Triangle integration (KTI) involving activities in education, innovation and business. By bringing the three sides of the Knowledge Triangle closer together, applied research in VET is a process that may be instigated, or initiated by the interests, priorities and needs of any or all of the actors specified above, and performed by any combination of them.



(Figure taken from presentation given by Mr. Joao SANTOS (DG EMPL), *Senior Expert, Unit B3: Vocational Education and Training, CEDEFOP, 2021)*

Conclusion 2: The NEARVET Blueprint and its competency framework will need to be explicit about the different range of actors and how they are involved in the applied research in VET process (researchers, VET teachers, VET managers, employer representatives, trade association and others acting as organisers and intermediaries; VET (including higher VET) students), including different 'types' of applied research projects and assignments. It will need to ensure that it targets skills, knowledge and competencies that differentiate between those actors and their contexts.

Conclusion 3: Applied research in VET does not take place in a vacuum. It occurs due to a range of drivers from different perspectives, needs or challenges, which lead to specific applied research assignments or projects being undertaken. In practical terms, this could be addressed by a structure that elaborates and aligns the Blueprint according to a taxonomy that is based upon these drivers and/or those that are, as a result, likely to initiate them:

- Applied research in VET – that is initiated by individual or 'clusters' of employers or companies ***to address an issue specific to their firm or firms*** (micro-level) in recruitment, skills forecasting, marketing, technology, operations, product or process innovation;

- Applied research in VET – that is initiated by sector bodies and trade associations (meso level) or public policy and planning authorities (macro level) ***concerning regional or national issues of social, economic or educational concern***;

- Applied research in VET – that is initiated by VET managers and VET teachers, in order

to inform or improve the VET curriculum (e.g. design, organisation, recruitment, drop out, relevance to the labour market) or ***to support their own CVET or CPD***;

- Applied research in VET – that is initiated by VET students or trainees, particularly (but not necessarily exclusively) at Higher VET level, in the context of ***undertaking work-based learning or work-experience that is focused on problem-solving or project-based learning (PBL)***;

- Applied research in VET – that is initiated by ***applied research interests*** (from Universities or other research institutions) such as the application of scientific, technological or other academic research results

(c) The challenge of 'research literacy' in VET applied research and NEARVET

Thirdly, with reference to the (blue) domain of 'Theorise and Learn' in the NCVER development framework,', the authors state that "*a full range of academic research skills may not be required to work in applied research projects; however, VET educators and other professionals should hold a measure of what we are terming 'research literacy.'*" They go on to note that "some *VET educators and other professionals will go on to develop expertise in research methodologies.*"[22] The NCVER development framework itself specifies 'Research Method' in this respect, and references specific research methods such as ethnographic, narrative, phenomenological and grounded theory as desired skills. Notably, in this context, there is no reference to the need to develop skills in, for instance, the use of statistical analysis and specific quantitative methods or statistical tests.

It is unclear as to how practical it is, in an initiative such as NEARVET, nor indeed within many of the activities and processes that constitute applied research in VET, to equip any of the actors specified in NEARVET with any consequential or substantial knowledge or capability in 'pure' research methods. The value in doing so can be debated, but it has to be questioned as to whether the approach taken by NEARVET could implement a professional development programme that would equip those actors to the point where practitioners could confidently deploy them – wherever they are drawn from – in specific applied research projects in VET.

It is to be expected that those who participate in applied research in VET projects from the academic community and/or from research institutions would bring knowledge and

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experience of relevant research methods and apply them to the assignments where relevant. This is the 'Knowledge Triangle' in action and including those with 'expert' skills and knowledge of research methods, alongside others who do not have such skills or knowledge can play a key role in fostering innovation and knowledge transfer. However, much applied research in VET projects and assignments do not require knowledge of academic research methods and are undertaken by many actors who are not qualified or trained researchers. Whilst some of those that participate in applied research in VET from other occupational profiles may have some research literacy, very many will not, but they bring to the applied research process other skills – experience in project management, design, operational implementation, managing stakeholders, communications and many more. On the other hand, many academic researchers lack such skills and may require training and development in areas that are required to bring to bear, in an effective and impactful way, their knowledge and skills of research methods, as well as the knowledge they may bring from their subject-specific academic disciplines.

Conclusion 4: This issue points, therefore, a question to be considered further by the NEARVET Blueprint; should it seek to develop some academic 'research literacy' in the competences of all of those who do not have it; or is it necessary to consider that such skills and knowledge are not necessary for many who to lead, instigate or contribute to applied research in VET - and that applied research may be better served by bringing in such expertise where the assignment or project calls for it?

10.4 Developing the NEARVET Community of Practice

A key aspect of the NEARVET concept, the elaboration of its professional development programme and the learning contents that are to be created and engaged with via the Digital Hub is the deployment of a Community of Practice approach.

"Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly"[23]. The notion of *Communities of Practice* has received increasing attention in the field of adult learning and professional education since the concept was developed by cognitive anthropologist Etienne Wenger in the 1990s. [24] A Community of Practice (CoP) is made up of a group of people who come together to exchange common problems and collaborate, share information and exchange practice in the common pursuit of solutions. Communities of Practice are a way of developing

[23] Introduction to Communities of Practice, Etienne and Beverley Wenger-Traynor
[24] *Communities of Practice* (Wenger 1998).

social capital, nurturing new knowledge, stimulating innovation, and sharing knowledge. Their goals can include leading on practice(s), developing guidelines, building knowledge repositories, addressing technical problems and solutions, and peer-learning. Communities of Practice are formed by people who share a concern or a passion for something they do and learn how to do it better as they interact regularly.

This understanding of learning underpins our strategy for fostering the NEARVET Community of Practice. In the first iteration, through the Erasmus+ project of the same name, we establish a digitally-enabled, transnational CoP as the primary vehicle through which the NEARVET concept is further developed and implemented – potentially with a view to it living beyond the project's lifetime. A Community of Practice is characterised by three key features:

The domain. A CoP has an identity defined by a shared domain of interest – in the case of NEARVET, this is the domain of applied research in VET. Members have a distinctive shared competence or expertise that distinguishes them and motivates their commitment to participating. People in the group value and recognise this area of competence and learn from each other. In this case, the domain is represented, in the first instance, by the practitioner staff and engaged personnel of the NEARVET consortium, which was specifically formed to represent a wide range of interests and competences that are relevant to applied research in VET, as well as a wide range of practitioners. They comprise those who are responsible for managing others who are undertaking applied research in VET assignments as well as practitioners who are designing and implementing applied research in VET.

The community. In pursuing their interest in their domain, members engage in joint activities and discussions, help each other, and share information. They build relationships that enable them to learn from each other; they care about their standing with each other. A community of practice can be recognised because members interact and learn together. They are not just colleagues or, for instance, students who happen to be in the same class. This encompasses members drawn from the ultimate 'target group' of 'applied researchers in VET'; with colleagues experienced in curriculum design and development; with colleagues who have experience of facilitating the co-creation of professional development strategies and learning contents and materials; with project managers, who have organisational and logistical experience; and with technologists, who are familiar with technical requirements as well as digital tools and digital production and creation processes.

Nominating just four engaged persons from across the NEARVET consortium will produce a community of some 50 VET practitioners. It may be, however, that further examination will demonstrate that there are some key constituencies that may be under-represented or not represented in the community, in which case the consortium may need to look to supplement the community from outside of its immediate membership.

The practice. A community of practice is not merely a community of interest– a fan club, for instance. Members of a community of practice are practitioners. They develop a shared repertoire of resources: experiences, stories, tools, ways of addressing recurring problems—in short, a shared practice. This takes time and sustained interaction. In the case of NEARVET, this takes us back to the central practice that is being elaborated, "'*What are the needs of these applied researchers?*' - and – '*how are they to be met*'?"

Working together at the transnational level, the NEARVET CoP will, through regular, participative workshops, design their own solutions to address the challenges previously described to co-create, develop and validate new learning materials and methods to extend their competences in applied research in VET, according to the Blueprint and the competences to be developed.

The NEARVET Community of Practice as an Andragogical CPD environment for applied research in VET

When analysing the NCVER development framework with a view to developing the NEARVET Methodology Concept, the NEARVET consortium 'picked up' on the Theorise and Learn (blue) domain reference to 'Pedagogy' (see page above). There is an element in this aspect of the NCVER framework that emphasises elements of 'pedagogy' – notably on teaching to VET students. This is certainly relevant to NEARVET but, taking into account the range of actors identified, NEARVET needs a broader perspective in relation to its 'learning development' Blueprint.

NEARVET recognises that, within its Community of Practice there is considerable the expertise to be found in this range of actors, many of whom are experienced adult professionals working in VET. At the same time, the level of knowledge skills and confidence across the various domains represented in the NCVER development framework is highly varied – as it will be in the wider VET community across Europe. Hence, to capitalise on this expertise and know-how, whilst also address these diverse needs, NEARVET aims to design and adopt an innovative *andragogical* approach to CVET/CPD, rather than one based largely on instructional pedagogy, placing its Community of Practice at its heart.

Andragogy**,** also known as adult learning theory, was proposed by Malcom Shepard Knowles[25] in 1968. Previously, much research and attention had been given to the concept of *pedagogy* – teaching children (in that the term comes from the Greek word 'paidagogos,' a combination

[25] Andragogy – Adult Learning Theory – Malcolm Knowles (1913-1997)

of ‘paidos’ (child) and ‘agogos’ (guide/leader)). Knowles recognized that there are many differences in the ways that adults learn as opposed to children and younger people. His thoughts surrounding andragogy sought to capitalize on the unique learning styles and strengths of adult learners. Knowles’ theory of andragogy identified five assumptions that teachers should make about adult learners:

1. *Self-Concept* – Because adults are at a mature developmental stage, they have a more secure self-concept than children and younger people. This allows them to take part in directing their own learning and development.
2. *Past Learning Experience* – Adults have a vast array of experiences to draw on as they learn and develop and are often motivated to share these with others - as opposed to children and younger people, who are in the process of gaining new experiences.
3. *Readiness to Learn* – Many adults have reached a point in which they see the value of education and are ready to be serious about and focused on learning.
4. *Practical Reasons to Learn* – Adults are looking for practical, problem-centred approaches to learning and development. Many adults return to continuing education and, obviously, undertake professional education for specific practical reasons, such as entering a new field or enhancing capabilities and knowledge to perform their job better.
5. *Driven by Internal Motivation* – While many children and younger people are driven by external motivators – such as punishment if they get bad grades or rewards if they get good grades – adults are more ‘internally’ motivated.

Based on these assumptions, Knowles suggested four principles that educators should consider when designing learning for adults:

1. Since adults are self-directed, *they should have a say* in the content and process of their learning.
2. Because adults have so much experience to draw from, their learning should focus on *adding to what they have already learned in the past*.
3. Since adults are looking for practical learning, *content should focus on issues related to their work or personal life*.
4. Additionally, learning should be *centred on solving problems instead of memorizing content*.

In the modern age, ‘pedagogy’ is not always, or even widely, applied in a way that is so narrowly determined from its origins. Moreover, ‘andragogy’ is not, of itself, a perfect term since the term is gendered, having its origins in ‘andras’ (man). Nonetheless, the point is being made here to strongly illustrate that, from the outset, NEARVET was designed to develop its learning approach – through its seminar programme, its use of multi-disciplinary

and specialist experts in VET in the consortium and its interaction through its Community of Practice, to incorporate andragogical methods of learning in CVET and CPD.

We identify in NEARVET a raft of techniques for complementing established applied research techniques and methods - i.e. Interviews, Surveys, Focus Groups, Data Reporting, Observation – with contemporary and modern approaches to the co-creation of applied research-informed implementation strategies and the validation of applied research results. This occurs, not least, through the recognition that building a Community of Practice in applied research in VET requires an approach to the professional development and capacitation of those in the applied research even amongst very experienced project managers and VET practitioners involved in VET practices and guidance. Within applied research, as indicated by the NCVER development framework, and in relation to the diversity of our target group of actors, there are a whole raft of factors that are relevant to the development of practice or reference approaches that form the foundations and architecture in terms of action planning and solution building through applied research in VET.

The approach to the CoP and the development of contents for the Digital Hub incorporate experiential, creative "learning by doing" such as problem-based learning, project-based learning, design thinking, action learning sets, co-creation and co-production. This is not to say that 'pedagogical instruction' will not form part of the programme – there will be times when 'expert classes' will be required to introduce specific contents and tools – but the emphasis here is to draw upon and 'skill share' the peer expertise that exists – at a high level – amongst the NEARVET consortium practitioners – in different and, once mapped it is expected to be, complementary skills and knowledge. NEARVET follows with the elaboration, development, test and validation of a NEARVET Blueprint (WP3), composed of a competence framework. According to the application, the framework will "*consider a graded structure (basic, advanced and professional level dimensions at appropriate EQF aligned levels), in order to cover the different needs of potential end users and promote equal access to research and knowledge opportunities. Based on the competence framework, the project will develop a needs assessment methodology and related applied tools, to assess the competences, skills and knowledge strengths, weaknesses and needs in specific attention areas, though posing the basis for the competence development to take place within the (WP4) Digital Hub (Community of Practice, learning resources, etc), and directing end users to specific skills and competences based on their weaknesses and thus creating personalized learning pathways."*

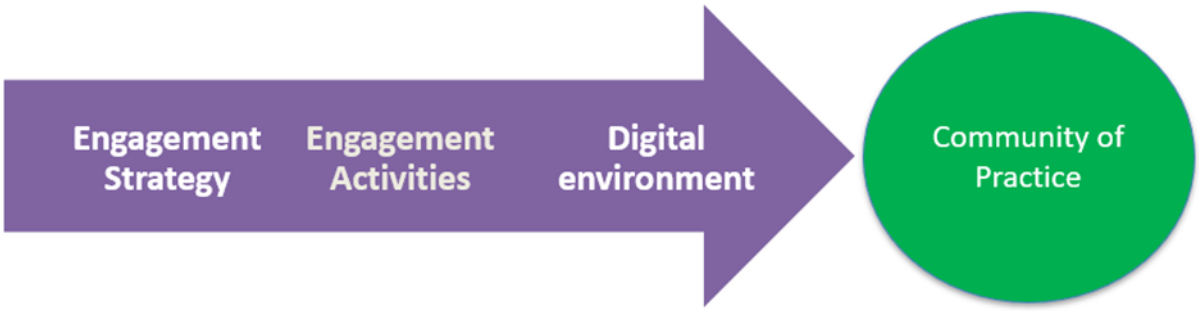
These provisions, described in the application, appear to remain relevant given the results of the desk research and analysis presented in this Methodology Concept. These aspects will be reviewed further on production of the results of the stakeholder interviews and focus group aspect.

In NEARVET, a 'UX' approach (user experience) is developed by the transnational CoP and is aimed at ensuring relevance, appeal and application from the target group through their direct involvement in the CoP with the co-creation experience. Thus, the CoP acts as both a transnational co-creation forum and an 'editorial board' for the production of relevant tools, techniques, professional development resources and learning contents that will, ultimately, comprise the 'Open Educational Resource' that will support the CPD of the target group and form the basis of its subsequent transferability and scaleability.

CoP Email Group - The members of the CoP are all registered on to a common email list – the NEARVET CoP email group. Its members will be invited to participate in ongoing dialogue and review through this group, contributing to discussions about topics and issues of common interest and opting into specific workshop sessions.

CoP Co-creation workshops - The members of the CoP email group come together interactively and directly in 'real time' by participating in a series of online, transnational co-creation sessions (in English). These will be hosted on platforms that have become very familiar to practitioners who were forced to use them during the Pandemic, if they were not already doing so – e.g. Zoom, Microsoft Teams, Skype. For others who are used to more immersive and continuous creative and digital co-creation, platforms such as Discord can be introduced and those able to engage in specific areas (such as more advanced developments concerning Digital skills) will be able to take this engagement and development further. However, within NEARVET, more universally used and understood platforms will be used, and the focus in relation to upskilling will surround learning how to maximise the functionality of these platforms in co-creation (break-out rooms, feedback, add-ons).

The Co-creation workshops are facilitated sessions, conducted in English, which are structured around a 'topic' selected by the Community of Practice as being of interest and of direct relevance to the main 'product' results to be generated by the project. Each online session will be 'topic-led'. The partner or expert leading the session will moderate discussion on the topic online and uploading of the relevant content to the online resource. It is expected that at least one member of the CoP from each partner will attend each workshop as a core group, but precise attendance will vary depending on the topic being discussed. All members of the CoP are invited to join if the topic is of interest to them.



Dr Richard Parkes
Rinova Ltd, on behalf of NEARVET, September 2023

11. Websites, blogs, videos and other sources and references identified in the country context concerning applied research in VET (by country)

Sweden

a) Forskning av denna världen II – om teorins roll i praxisnära forskning (Research of this world II - about the role of theory in practical research) Vetenskapsrådet (Swedish Research Council)
b) Metodutveckling av yrkesutbildning (Method development of VET (Swedish National School Agency)
c) Lärande och skolutveckling med hjälp av Internet of Things (Learning and school development using the Internet of Things) https://www.spaningen.se/larande-och-skolutveckling-med-hjalp-av-internet-of-things/
d) Yrkesdidaktik är mötesplatsen med fokus på yrkesdidaktik för forskare, lärarutbildare och doktorander med anknytning till yrkeslärarprogrammet. (Vocational didactics This is the meeting place with a focus on vocational didactics for researchers, teacher educators and doctoral students connected to the vocational teacher program.) https://www.du.se/sv/forskning/forskning-om-lararutbildning/yrkesdidaktik/
e) A Swedish concrete project for applied research in VET: The Challenger project aims to promote innovation through applied research in vocational education https://www.cng.se/erasmus-challenger
f) Digitalisering i yrkesutbildningen inom samhällsbyggnadssektorn: en förstudie, Persson, Mats Malmö universitet, Fakulteten för teknik och samhälle (TS), Institutionen för materialvetenskap och tillämpad matematik (MTM).
g) Niklasson E, Nilsson O (2019) Utvecklingen av digitalisering i byggproduktion. Examensarbete Malmö universitet.
h) Lindström B (2021) Kunskap i en digitaliserad värld. Pedagogiska magasinet.

Italy

1. https://www.governo.it/sites/governo.it/files/PNRR.pdf
2. https://cris.unibo.it/retrieve/e1dcb336-adce-7715-e053-1705fe0a6cc9/Ricerca-formazione%20e%20miglioramento%20della%20scuola.pdf
3. https://openspace.etf.europa.eu/blog-posts/applied-research-key-contribution-smart-specialisation
4. https://arrivet.org/index.php/arrivet/about
5. https://www.mur.gov.it/sites/default/files/2022-12/Linee%20programmatiche%20ricerca%20applicata.pdf
6. https://www.bollettinoadapt.it/wp-content/uploads/2020/03/KE0119739ITN.it_.pdf
7. https://www.cescot.emilia-romagna.it/repository/editor_files/tutor%2015_05_2014%20Hr.pdf
8. https://oa.inapp.org/jspui/bitstream/20.500.12916/1763/36/ISFOL%20-%20%20Manuale%20tutor%20apprendistato%20-%20guida%20modulo%203.pdf
9. http://www.insegnareonline.com/rivista/cultura-ricerca-didattica/docente-ricerca-formazione

10. https://www.miur.gov.it/documents/20182/0/Indicazioni+nazionali+e+nuovi+scenari/3234ab16-1f1d-4f34-99a3-319d892a40f2
11. https://www.fitfor4-0.eu/wp-content/uploads/2021/01/IT-Set-di-competenze-per-docenti-e-formatori.pdf
12. https://www.cnos-fap.it/sites/default/files/articoli_rassegna/I%20formatori%20della%20FP.pdf
13. https://ervet-journal.springeropen.com/articles/10.1186/s40461-018-0064-9
14. https://www.made-cc.eu/it/scuola-di-competenze-4-0/
15. https://www.made-cc.eu/it/orientamento/
16. https://www.kilometrorosso.com/servizi/finanziamenti-per-linnovazione/made-competence-center-i4-0/
17. https://www.unitn.it/internazionale/97821/ricerca-applicata-progetti
18. https://www.som.polimi.it/en/labs-centers/
19. https://www.som.polimi.it/en/milans-local-food-hub-against-food-waste-more-than-150000-meals-recovered-for-a-total-of-77-tonnes-of-food/
20. https://www.fraunhofer.de
21. https://www.fraunhofer.it/it/chi-siamo.html
22. https://corsidieuroprogettazione.it/mestiere-europrogettista-cosa-fa/
23. https://www.guidaeuroprogettazione.eu/guida/al-lavoro-progettazione-europea/come-strutturare-un-progetto-il-processo-e-gli-strumenti/
24. https://masterandskills.com/chi-e-leuroprogettista
25. https://www.treccani.it/enciclopedia/ricerca-e-sviluppo_%28Enciclopedia-Italiana%29/
26. https://moodle.adaptland.it/pluginfile.php/34493/mod_resource/content/3/vol_78_2019_casano_massagli_prodi_seghezzi_tiraboschi.pdf
27. https://www.bollettinoadapt.it/istruzione-e-ricerca-nel-pnrr-unoccasione-per-colmare-le-carenze-strutturali-nei-rapporti-con-il-mondo-del-lavoro/
28. https://www.bollettinoadapt.it/wp-content/uploads/2020/03/KE0119739ITN.it_.pdf
29. https://www.mur.gov.it/sites/default/files/2022-12/Linee%20programmatiche%20ricerca%20applicata.pdf
30. https://www.openinnovation.regione.lombardia.it/news/news/view?id=5974
31. https://www.made-cc.eu/it/scuola-di-competenze-4-0/
32. https://www.made-cc.eu/it/orientamento/
33. https://www.kilometrorosso.com/servizi/finanziamenti-per-linnovazione/made-competence-center-i4-0/
34. https://it.economy-pedia.com/11034874-applied-research#menu-3
35. https://openspace.etf.europa.eu/blog-posts/applied-research-key-contribution-smart-specialisation
36. Applied Research – a key contribution to Smart Specialisation
37. https://giove.isti.cnr.it/personaal/CNR CNR - Consiglio Nazionale delle Ricerche, HIIS - Human Interfaces in Information Systems laboratory (Italy)
38. https://www.bankit.art/ ART – Home – Banca d'Italia
39. https://www.intesasanpaoloinnovationcenter.com/it/applied-research/ Intesa Sanpaolo Innovation Center
40. https://open-italy.elis.org/it/page/homepage-2023-it Open Italy
41. https://www.supsi.ch/cmi/ricerca-applicata.html SUPSI - Scuola universitaria professionale della Svizzera italiana
42. https://www.fondazionecariplo.it/it/strategia/piani-di-azione/ricerca-applicata-pda-07.html

43. Fondazione Cariplo
44. https://ervet-journal.springeropen.com/articles/10.1186/s40461-018-0064-9
45. The professional development of VET teachers in Italy: participation, needs and barriers. Statistical quantifications and benchmarking in an international perspective
46. https://iris.univr.it/handle/11562/1083406
47. Competence-based VET curriculum enactment and its implications for vocational teachers and trainers' practices and competence in Italy and Lithuania
48. http://outcomes.stat.unipd.it/sites/outcomes.stat.unipd.it/files/cap3_vol2.pdf
49. Competenze per la Ricerca e Sviluppo: risultati di un'indagine in Area Science Park di Trieste
50. Susanna Zaccarin, Ilaria Silvestri - Università degli Studi di Trieste
51. https://www.mur.gov.it/it/news/martedi-28062022/pnrr-mur-limpatto-della-conoscenza-grazie-un-nuovo-modo-di-fare-ricerca-e
52. PNRR, MUR:l'impatto della conoscenza grazie a un nuovo modo di fare ricerca e innovazione
53. https://www.randstad.it/candidato/career-lab/fare-carriera/10-competenze-da-sviluppare-per-trovare-lavoro-nei-prossimi-anni/
54. Tutte le competenze da sviluppare per trovare lavoro
55. https://www.agendadigitale.eu/cultura-digitale/pnrr-cosi-i-fondi-ue-possono-rilanciare-la-ricerca-e-luniversita/
56. PNRR, così i fondi UE possono rilanciare la ricerca e l'Università
57. https://dottorato.it/content/valorizzare-il-dottorato-di-ricerca-nel-mondo-delle-imprese-proposte-una-riforma-di-sistema
58. Valorizzare il dottorato di ricerca nel mondo delle imprese: proposte per una riforma di
59. sistema - ADI - Associazione dottorandi e dottori di ricerca italiani e Find Your Doctor
60. https://www.repubblica.it/dossier/economia/valore-italia/2022/03/21/news/industria_40_il_new_deal_delle_competenze_per_il_rilancio_dellitalia-341743263/
61. La Repubblica: Industria 4.0, il New Deal delle competenze per il rilancio dell'Italia

Greece

1. https://eleftherostypos.gr/oikonomia/799284-ellada-2-0-se-proto-plano-ereyna-kai-kainotomia-desmi-metron-me-orizonta-to-2025
2. https://paratiritirio.edu.gr/ellada-2-0-ekpaideysi-ereyna/
3. https://griechenland.ahk.de/gr/
4. https://www.sfee.gr/?lang=en

Spain

1. https://www.boa.aragon.es/cgibin/EBOA/BRSCGI?CMD=VEROBJ&MLKOB=1142440305151&type=pdf
2. http://www.clusterenergia.com/formacion/departamento-educacion-gobierno-vasco-y-siemens-gamesa-firman-un-convenio-colaboracion-como-consecuencia-actividades-grupo
3. Specialisation course in IOT for Vocational Training 2021-22 (June 2021). http://tecnara.es/tag/fp/
4. https://www.alianzafpdual.es/buenas-practicas/gobierno-de-aragon-y-cluster-de-automocion-de-aragon/
5. https://www.alianzafpdual.es/buenas-practicas/comexi/
6. https://www.alianzafpdual.es/buenas-practicas/comastech-centre-politecnic-comas/

7. https://dialnet.unirioja.es/servlet/articulo?codigo=6163749
8. https://www.aragon.es/-/ris3-aragon.-estrategia-de-investigacion-e-innovacion-para-una-especializacion-inteligente
9. https://www.aragon.es/documents/20127/3681243/RIS3_ARAG%C3%93N.pdf/4fb1279a-7cfd-d53c-2499-adc41d951be1?t=1620991899182
10. https://www.boe.es/buscar/pdf/2007/BOE-A-2007-4372-consolidado.pdf
11. https://www.boe.es/eli/es/o/2007/12/27/eci3858
12. https://www.boe.es/diario_boe/txt.php?id=BOE-A-2022-5139
13. https://www.educacionyfp.gob.es/prensa/actualidad/2021/12/20211217-innovacionfp.html
14. https://www.revistaespacios.com/a19v40n11/a19v40n11p05.pdf
15. https://eur-lex.europa.eu/legal-content/ES/TXT/PDF/?uri=CELEX:52020DC0625&from=EN
16. https://www.redalyc.org/journal/140/14070424004/html/
17. https://siteal.iiep.unesco.org/sites/default/files/sit_informe_pdfs/siteal_educacion_y_tic_20190607.pdf
18. https://www.editex.es/media/12590/9788413219998.pdf
19. http://tecnara.es/tag/fp/

12. Bibliography (by country)

Sweden

1. Berglund, Ingrid, (2019) Byggarbetsplatsen som skola - eller skolan som byggarbetsplats?: En studie av byggnadsarbetares yrkesutbildning, Stockholms universitet, Samhällsvetenskapliga fakulteten, Institutionen för didaktik och pedagogiskt arbete.(Kunskapskulturer och lärandepraktiker, KKLP)
2. Berglund, Ingrid (2007). En ny yrkesutbildning – genom yrkesbaserat lärande? En studie av tre gymnasieskolor som samverkar med företag. Rapport inom EQUAL-projektet En ny yrkesutbildning. Internet: (Tillgänglig: 2009-08-28).
3. Carlgren, I. (2018) Praxisnära forskning – varför, vad och hur? I J. Carlgren, J. Josefson & C. Liberg (Red.) Forskning av denna världen II – om teorins roll I praxisnära forskning. Vetenskapsrådets rapportserie, 4: 2005.
4. Mats Lundgren (2019) Kollegial professionsutveckling för skolledare och lärare inom gymnasial yrkesutbildning: En fallstudie av en forskningscirkel - Högskolan Dalarna
5. Calissendorff, Matilda/Michelsson, Nellie/ (2022) Yrkeshögskolan i skuggan av högskola/universitet: En kvalitativ studie om hur studie- och yrkesvägledare informerar och vägleder elever inför eftergymnasial utbildning
6. Lasse Christiansen (2022) A Framework for Developing Educational Industry 4.0 Activities and Study Materials
7. Elin Gunnarsson Glenn Sjöstrand (2023) Att bygga upp digital kompetens och petskompetens i små och medelstora företag – Utmaningar och möjligheter
8. Lucas Johansson (2023) Policybegreppet livslångt lärande och dess betydelse i framtidens skola, arbetsliv och politik: En diskursanalytisk litteraturstudie av forskningsstudier Mälardalens universitet, Akademin för utbildning, kultur och kommunikation.
9. Forskning av denna världen II – om teorins roll i praxisnära forskning (Research of this world II - about the role of theory in practical research) Vetenskapsrådet (Swedish Research Council)
10. Metodutveckling av yrkesutbildning (Method development of VET (Swedish National School Agency)
11. Lärande och skolutveckling med hjälp av Internet of Things (Learning and school development using the Internet of Things) https://www.spaningen.se/larande-och-skolutveckling-med-hjalp-av-internet-of-things/
12. Yrkesdidaktik är mötesplatsen med fokus på yrkesdidaktik för forskare, lärarutbildare och doktorander med anknytning till yrkeslärarprogrammet. (Vocational didactics This is the meeting place with a focus on vocational didactics for researchers, teacher educators and doctoral students connected to the vocational teacher program.) https://www.du.se/sv/forskning/forskning-om-lararutbildning/yrkesdidaktik/
13. A Swedish concrete project for applied research in VET: The Challenger project aims to promote innovation through applied research in vocational education https://www.cng.se/erasmus-challenger
14. Digitalisering i yrkesutbildningen inom samhällsbyggnadssektorn: en förstudie, Persson, Mats Malmö universitet, Fakulteten för teknik och samhälle (TS), Institutionen för materialvetenskap och tillämpad matematik (MTM).
15. Niklasson E, Nilsson O (2019) Utvecklingen av digitalisering i byggproduktion. Examensarbete Malmö universitet.
16. Lindström B (2021) Kunskap i en digitaliserad värld. Pedagogiska magasinet.

Italy

1. La produzione e la diffusione della conoscenza. Ricerca, innovazione e risorse umane, Giorgio Sirilli, Fondazione CRUI. Roma, luglio 2010.
2. “Il futuro ha bisogno di ricerca! Ricerca applicata secondo Fraunhofer”, Fraunhofer Italia
3. ISFOL, D'Arista F., Il tutor aziendale per l’apprendistato: manuale per la formazione (estratto), 2013 Isfol.
4. “Competenze per la Ricerca e Sviluppo: risultati di un’indagine in Area Science Park di Trieste”, Susanna Zaccarin, Ilaria Silvestri, Università degli Studi di Trieste.
5. “Ricerca applicata - un trampolino di lancio per le imprese”, Fraunhofer Italia.
6. “Ricerca e sviluppo in Italia | anni 2020-2022”, ISTAT 20/09/2022-
7. “Audizione del Ministro dell’Università e della Ricerca: linee programmatiche su ricerca applicata”, MIUR 13/12/2022.
8. “Ricerca applicata”, Scuola universitaria professionale della Svizzera italiana-SUSPI.
9. “The professional development of VET teachers in Italy: participation, needs and barriers. Statistical quantifications and benchmarking in an international perspective”, Marco Serafini, Serafini Empirical Res Voc Ed Train (2018) 10:3 - https://doi.org/10.1186/s40461-018-0064-9.

“Una alleanza tra mondo della ricerca e imprese per l’occupazione dei giovani. Per una via italiana al modello Fraunhofer Gesellschaft”, Lilli Casano, Emmanuele Massagli, Elena Prodi, Francesco Seghezzi, Michele Tiraboschi, Pubblicazione on-line della Collana ADAPT”. Il Futuro delle Competenze in Italia”, EY, ManpowerGroup, Pearson, febbraio 2021.

11. “Chapter 8: Applied research”, SAGE 2017.
12. “What is it good for? Basic versus applied research”, Science in School-The European Journal for Science Teachers, ISSUE55, 03/11/2021.
13. “VET applied research: driving VET’s role in the innovation system”, Francesca M Beddie and Associates, Linda Simon, Commonwealth of Australia, 2017.

Germany

1. Marcus Eckelt, Thilo J. Ketschau, Johannes Klassen, Jennifer Schauer, Johannes K. Schmees, Christian Steib (Hg.) (2022): Berufsbildungspolitik: Strukturen - Krise - Perspektiven. In: Berufsbildung, Arbeit und Innovation. Band 67.
2. Peter Schlögl, Georg Tafner, Annette Ostendorf, Julia Bock-Schappelwein und Franz Gramlinger (Hg.) (2022): Wie wollen wir arbeiten? Berufliches Lernen zwischen Tradition und Transformation. Beiträge zur 7. Berufsbildungsforschungskonferenz (BBFK)
3. Dr. Chokri Guellali (2017): Qualitätssicherung der betrieblichen Ausbildung im dualen System in Deutschland. Ein Überblick für Praktiker/-innen und Berufsbildungsfachleute. Bonn: Bundesinstitut für Berufsbildung.
4. Ausbildung 2030 – Experten entwickeln Handlungsansätze für die Zukunft. [online] Deutsche
5. Nationalbibliothek: URN: urn:nbn:de:0035-bwp-07143-7
6. Hans Dietrich, Eckart Severing (Hg.) (2007): Zukunft der dualen Berufsausbildung – Wettbewerb der Bildungsgänge. Schriften zur Berufsbildungsforschung der Arbeitsgemeinschaft Berufsbildungsforschungsnetz. Bonn: Schriftreiche des Bundesinstituts für Berufsbildung.
7. Georg Spöttl, Rainer Bremer, Philipp Grollmann, Frank Musekamp (2009): In: Gestaltungsoptionen für die duale Organisation der Berufsausbildung. Hans-Böckler-Stiftung (Hg.): Arbeitspapier 168.
8. Klaus Heimann (2017): BERUFLICHE BILDUNG 4.0 - Herausforderungen und gute Praxis. In: WISO DISKURS. Friedrich-Ebert-Stiftung.

9. Gerhard Bosch (2011): Qualifikationsanforderungen an Arbeitnehmer – flexibel und zukunftsgerichtet. In: Wirtschaftsdienst, Sonderheft.
10. Die Modernisierung der Berufsbildung. Vierter Bericht zur Berufsbildungsforschung in Europa. Zusammenfassung. Luxemburg: Amt für Veröffentlichungen der Europäischen Union, 2010. [online] https://www.cedefop.europa.eu/files/4068_de.pdf

Greece

1. Asonitou, S., Mandilas, A., Chytis, E. & Latsou, D. (2018) 'A Greek Evaluation Of The Course Experience Questionnaire: Students' Conceptions Of The Teaching Quality Of Higher Education Accounting Studies'. International Journal of Business and Economic Sciences Applied Research. 2, pp.51-62.
2. Batsila, Marianthi (2017) 'Linking Vocational Education to the World of Employment: the Case of Business English in Greece'. *EdD thesis* The Open University.
3. Liolios, A. & Boglou, A. (2007) 'Assessment of Current Engineering Education in Greece. Universities and Technological Institutes'. *ICEE-2007*.
4. Stavrou, S. (1995). *Vocational Education and Training in Greece*. Thessaloniki: European Centre for the Development of Vocational Training, Thessaloniki
5. Tsamadia, C. & Chanis, S. (2012) 'Testing the Role of Screening with Vocational Skills: The Case of Post-secondary Initial Vocational Training Institutes in Greece'. *Empirical Research in Vocational Education and Training*. 4, pp.149-161.

Cyprus

1. Beddie, F. and Simon, L. (2017) "VET applied research: driving VET's role in the innovation system" Available at: https://www.ncver.edu.au
2. Business Europe (2019), "Research and Innovation in the New European Political Cycle" Available at: https://www.businesseurope.eu
3. CEDEFOP (2021) "Position paper on the learner's perspective on the Osnabruck declaration" Available at: https://www.cedefop.europa.eu
4. Cyprus Research Innovation Strategy framework (2019), "2019/2023 INNOVATE CYPRUS"
5. Demetriadis, M. and Robledo-Bottcher, N. (2018) European Commission: "RIO Country Report 2017: Cyprus" Available at: https://ec.europa.eu
6. Directorate General for European Programmes, Coordination and Development (2017) "National "European Research Area" (ERA) Roadmap for Cyprus 2016-2020"
7. Frascati, (2015) "Frascati Manual: Guidelines for collecting and reporting Data on Research and Experimental Development" Available at: https://www.oecd.org
8. Korelli, Y. (2014) "VET Research Report: Cyprus 2009"
9. Korelli, Y. and Kyriakou-Liveri, C. (2019) "Vocational Education and Training in Europe" Available at: https://anad.org.cy
10. Korelli, Y., Mouzourides, Y. and Panayides, G. (2014) "Innovation in VET Cyprus" Available at: http://www.cedefop.europa.eu
11. McDonald et al, (1992) "No small change. Proposals for a Research and Development Strategy for Vocational and Education Training in Australia. University of Technology, Sydney
12. Orpen, C. (1985) "Applied research in management" Available at: https://www.coursehero.com
13. Papapiliou- Keravnou, E. (no date) "Applied Research and Benefits of the Development of Cyprus", Cypriot Technological University. Available at: https://www.cs.ucy.ac.cy

14. Research & Innovation Foundation (2023) “Research and Innovation Foundation’s “RESTART 2016-2020” Programmes for Research, Technological Development and Innovation” Available at: https://iris.research.org.cy
15. Romero-Gazquez, J.L. et al., (2021) “ IN4WOOD: A successful European Training Action of Industry 4.0 for Academia and Business”, Available at: https://creativecommons.org
16. Smart Specialization Strategy for Cyprus (2015)
17. Statistical Service of Cyprus (2017)
18. Theocharous, A. (2020) “Vocational education and training for the future of work: Cyprus”, Cedefop ReferNet thematic perspectives series, Available at: http://libserver.cedefop.europa.eu
19. Victorian TAFE Association (2018) “Applied Research and Innovation in VET”, Discussion paper, Available at: https://vta.vic.edu.au
20. Vroonhof, P. et al, (2017) “ Business cooperating with vocational education and training providers for quality skills and attractive futures” Available at: http://www.europa.eu

Spain

1. B., & Martínez-Clares, P. (2020). Challenges and strategies for action on vocational training research in Spain. Bankia Foundation for Dual Training. https://bit.ly/39gOlrn
2. F Peuskadi (2014). Applied Research in Technical VET. The case of Hong Kong. Simpson Poon ES https://youtu.be/Mr-Nve-4CPI (Case study, but not carried out in Spain)
3. Echeverría, B. and Martínez, P. (2021). "Hacia un ecosistema de investigación sobre formación profesional en España" https://revistas.um.es/rie/article/view/424901
4. Bankia Dualiza (2020). "Challenges and strategies for action on vocational training research in Spain". https://www.observatoriofp.es/wp-content/uploads/2021/01/19-01-21-retos-y-estrategias-de-accion-en-torno-a-la-investigacion-sobre-formacion-profes.pdf
5. M.L. Rico Gómez, A.I. Ponce Gea (2020). "El docente del siglo XXI: Perspectivas según el rol formativo y profesional" https://www.redalyc.org/journal/140/14070424004/html
6. SITEAL Axis Document - Education and ICT (2019 Update)
7. https://siteal.iiep.unesco.org/sites/default/files/sit_informe_pdfs/siteal_educacion_y_tic_20190607.pdf
8. Information on the new Vocational Training Act (2022) https://www.educacionyfp.gob.es/destacados/nueva-ley-fp.html
9. The new VET law and its analysis. A technical look - Editex (2022) https://www.editex.es/media/12590/9788413219998.pdf

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