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SELFIE WBL scoping study: a potential role in linking companies and regional innovation with VET schools

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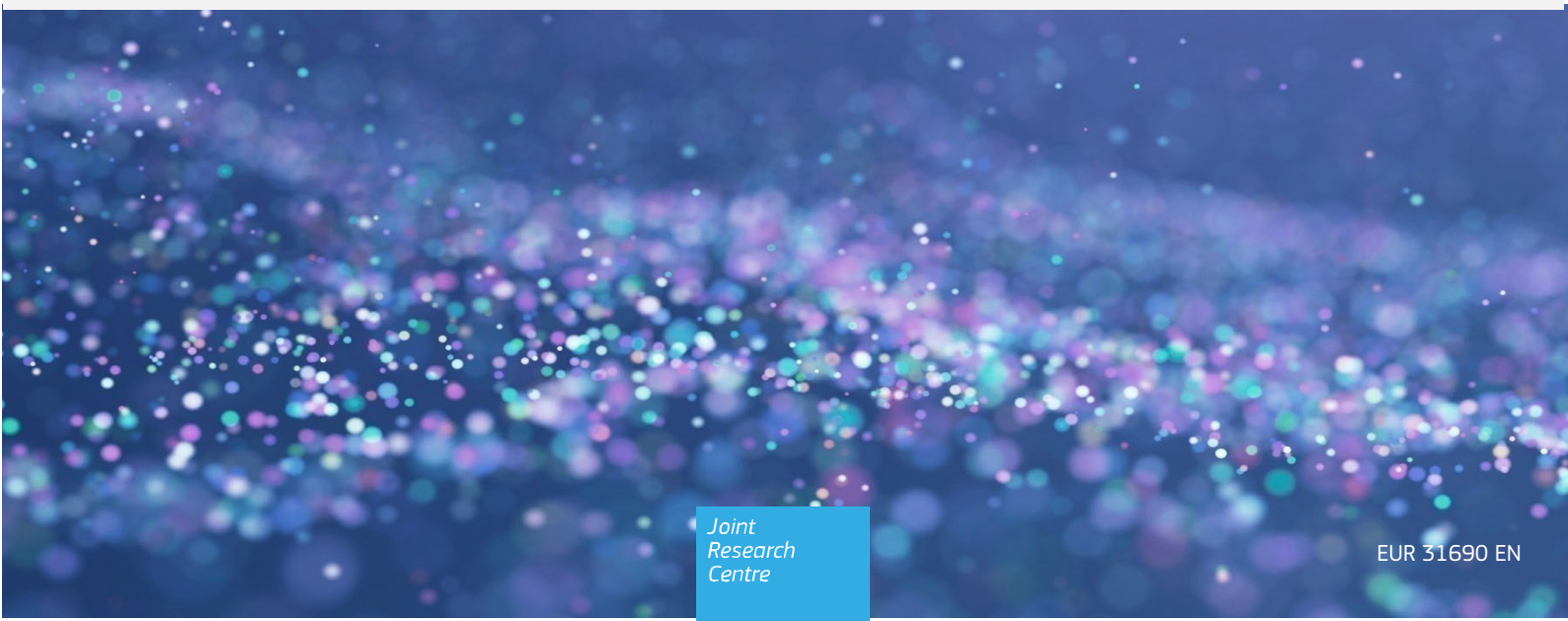

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Abstract

The objective of this publication is to report on a scoping exercise to understand applications of SELFIE WBL (Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies for Work-Based Learning), a tool for self-reflection of digital capacity, to work-based-learning activities. Specifically, how to leverage SELFIE WBL in VET institutions and related training companies to improve upon current SELFIE WBL applications.

The information included in the current report is based on the findings on a study done in 2022, focused on gather relevant information about potential ways to better connect regional and local innovation from companies and their needs with VET institutions and how SELFIE WBL can support on this process.

First, a literature review was done about relevant topics (innovation in companies, needs of companies in relation to promoting innovation, VET institutions role in innovation, among others), to identify key points (or lacks of information) to discuss with relevant interviewees, focused on how to connect innovation from companies to VET institutions and how SELFIE WBL could contribute there. According to these key topics, a creation of a set of open questions (or topics to be covered) was required to be covered during the interviews with VET teachers, in-company trainers, stakeholders, and other relevant profiles. Finally, the interviews process to collect their feedback and based on the analysis of the information collected, draw conclusions.

In summary, the report discusses the role of SELFIE WBL in connecting business and regional innovation with VET schools. It highlights the need for a self-reflection tool to improve these connections and fill the existing gap in the market. The report emphasizes the importance of understanding innovation, skills, and VET's role in supporting innovation. It suggests developing a normative model of VET's role in innovation to provide a basis for the tool's parameters. The report also addresses the need to bridge the gap between schools and companies, expand the potential user base, and balance top-down and bottom-up interests. Furthermore, it outlines an action plan indicating the next steps for further research, stakeholder mapping, and engagement, as well as developing a normative model and conducting experimental innovative projects. These steps would provide a solid foundation for the future development and implementation of SELFIE WBL for innovation in the VET sector.

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This research was led by Andrew McCoshan, Luca Mobilio and Maria Melstveit Roseme (Ecorys) together with Cesar Herrero (European Commission – JRC).

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Executive summary

This report examines the potential role of SELFIE WBL (Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies for Work-Based Learning) in strengthening the connections between business, regional innovation, and VET institutions.

The report identifies a gap in the market for a self-reflection tool that can improve these connections and emphasizes the need for further research and development in this area.

The report emphasizes the importance of understanding innovation, skills, and the role of VET in supporting innovation. It highlights the complexity and ongoing debates surrounding the concept of innovation, as well as the lack of established connections between specific skills and innovation.

The report suggests the need for a better understanding of skills for innovation and a consensus on VET's role in fostering innovation. To develop a basis for the self-reflection tool, the report recommends the creation of a normative model that outlines VET's role in innovation. This model would identify the aspects of VET that contribute to innovation and operationalize the range of skills implicated in the innovation process. Stakeholder engagement and research into different types of innovation, such as pure science-based, applied research, and innovation diffusion, would inform the development of this normative model.

Furthermore, the report highlights the importance of bridging the gap between VET schools and companies to ensure effective collaboration and engagement in the self-reflection process. It suggests the customization and flexibility of the tool to meet the needs of different stakeholders, as well as the promotion of VET providers' role in innovation to encourage uptake. To expand the potential user base and address the lack of understanding around innovation, the report recommends a significant effort to promote the role of VET providers in innovation alongside the introduction of the self-reflection tool. It also stresses the need for balance between top-down policy monitoring and bottom-up engagement, particularly if the self-reflection tool is utilized for sectoral and regional policy purposes. In conclusion, the report outlines an action plan for further research, stakeholder mapping, and engagement to develop a normative model, as well as the implementation of experimental projects to support the tool's development.

These steps aim to lay a solid foundation for SELFIE WBL's application to innovation in the VET sector and improve the connections between VET institutions, businesses, and regional innovation for sustainable development and enhanced learning experiences.

1 Introduction

We live in an increasingly digitised and interconnected society, due to the digital transformation that is changing every aspect of our daily lives, from the way we communicate and interact to the way we learn or work. Digital skills are increasingly necessary for studying, working and participating in society.

For these reasons, digital competence, as proposed by the European Parliament and the Council in 2006 and again in 2018 as one of the key competences that every citizen should acquire throughout life for their full development, is increasingly necessary. It is understood as the set of skills, knowledge and attitudes that enable the safe, critical and responsible use of digital technologies in all areas of life. Being digitally competent can be seen as a fundamental task for citizens in the 21st century.

In line with Parliament and Council Recommendations on key competences throughout life, and in response to the request of Member States, the European Commission, and within it, the Joint Research Centre (JRC), in collaboration with multiple stakeholders in education across the European Union, has developed several frameworks and tools to foster the development of digital competences in different contexts and for different profiles.

1.1 DigComp. The European Digital Competence Framework for Citizens

First, the JRC developed the European Digital Competence Framework for Citizenship, DigComp to support the development and assessment of digital competences. The first version of the conceptual framework (v1.0) was published in 2013 and was revised in 2016 (v2.0). In 2018, proficiency levels were added (v2.1), and in 2022 (v2.2) the framework has been updated to introduce more than 250 examples of knowledge, skills and attitudes needed to interact with recent developments such as: fake news and disinformation campaigns, remote work or teleworking, artificial intelligence systems, data search and management, well-being and safety, digital accessibility and, addressing ecological and sustainability aspects in the interaction with digital technologies.

In addition to that, for educational institutions, there are specific frameworks and tools.

1.2 DigCompOrg. The European Framework for Digitally Competent Educational Organisations

The European Reference Framework of Digitally Competent Educational Organisations (DigCompOrg) is an initiative of the European Commission focused on educational contexts (mainly).

DigCompOrg provides a comprehensive and generic conceptual framework that reflects all aspects of the process of systematically integrating digital learning in educational organisations from all education sectors. It is adaptable to the particular contexts within which educational organisations, intermediaries or project developers operate (e.g., sector-specific elements, sub-elements or descriptors may be added).

The impact of digital technologies, content and processes can be seen in all educational sectors (e.g., schools, higher education and also informal and non-formal learning), affecting all aspects of the educational value chain (e.g., curricular reform, teaching and learning practices, assessment, initial and continuing teacher professional development) and encompassing all educational actors (teachers, learners, school leaders).

Digital learning technologies, in the context of DigCompOrg, constitute a key enabler for educational organisations, which can support their efforts to achieve their particular mission and vision for quality education. Deep, as distinct from superficial, integration of digital technologies requires significant educational innovation and implies a process of planning for change on three basic dimensions: pedagogical, technological and organisational.

DigCompOrg complements rather than supersedes other frameworks and tools already in use for specific purposes: e.g., the DigComp framework that can be used to develop relevant aspects of students' digital competence.

The primary purposes of DigCompOrg are: (i) to encourage self-reflection and self-assessment within educational organisations as they progressively deepen their engagement with digital learning and pedagogies; and (ii) to enable policymakers (at the local, regional, national and international levels) to design, implement and appraise programmes, projects and policy interventions for the integration of digital learning technologies in E&T systems.

DigCompOrg is designed to focus mainly on the teaching, learning, assessment and related learning support activities undertaken by a given educational organisation. As such, it is not intended to address the full range of administrative and management information systems that may be in use within the organisation.

DigCompOrg includes elements, sub-elements and descriptors that may be regarded as linked to 'organisational responsibilities' (e.g., infrastructure) or to 'individual responsibilities' (e.g., teaching and learning practices). This reflects the fact that a digitally-competent educational organisation needs a balanced combination of strong leadership and governance (for vision and top-down strategies) and staff and stakeholders capable of taking personal responsibility (for self-initiated actions and bottom-up efforts and initiatives).

The DigCompOrg framework can be used by educational organisations (i.e., primary, secondary and VET schools, as well as higher education institutions) to guide a process of self-reflection on their progress towards comprehensive integration and effective deployment of digital learning technologies.

DigCompOrg can facilitate transparency and comparability between related initiatives throughout Europe, and it can also play a role in addressing fragmentation and uneven development across the Member States.

DigCompOrg can also be used as a strategic planning tool for policymakers to promote comprehensive policies for the effective uptake of digital learning technologies by educational organisations at regional, national and European level. It can also be used as a means to create awareness about the systemic approach needed for effective use of digital learning technologies.

1.3 SELFIE and SELFIE for work-based learning (SELFIE WBL)

Based on the framework, a self-reflection tool (SELFIE) for primary, secondary and vocational schools was developed and launched in October 2018 to give greater visibility to the framework and to put it into practical use. SELFIE can be used by primary, lower and upper-secondary general, upper-secondary vocational and post-secondary non-tertiary education schools. VET (vocational education and training) schools can already use the SELFIE tool within their institutions. SELFIE does not yet address the fact that VET schools may offer work-based learning schemes that combine school- and workplace-based experiences for students. In order to cover this need, a new module has been developed for SELFIE, focused on work-based learning (WBL).

SELFIE (https://education.ec.europa.eu/selfie) stands for "Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies". It is a free, web-based, self-reflection tool to help general and vocational schools develop their digital capacity. It is available in 40 languages and by late 2023 it has been used by more than 5.5 million users from 38,000 schools from 84 countries (https://schools-go-digital.jrc.ec.europa.eu/). It was developed by the Joint Research Centre and the Directorate General for Education, Youth, Sport and Culture (DG EAC).

In the case of SELFIE WBL, its creation was done in close collaboration about JRC and DG Employment, Social Affairs and Inclusion (DG EMPL). This new module was launched in October 2021, and since there, more than 50.000 participants have used it.

The tool integrates three variations of a validated questionnaire, which is designed for the school community: school leaders, teachers and students. Given the different profiles and needs of schools in different countries and regions, SELFIE is customisable allowing schools to integrate their own questions. Responses to the questions are anonymous.

After the completion of the questionnaire, SELFIE generates a report for the school to review. This report is available in the dashboard of the tool but also in PDF and Excel formats. This way SELFIE returns data to the schools and supports them in taking informed decisions with respect to the integration of digital technologies based on what works and what needs improvement.

SELFIE has four distinguishing characteristics underlying its design. First, the digital capacity of schools is not reflected in one person's views or responsibility. Instead, it is a concern of the whole school community. This is reflected on the SELFIE reports, which offer a multisided view on the use of technologies based on the data collected from the school leaders, teachers and students.

Second, SELFIE provides a structure to reflect on the digital transformation of schools with a pedagogical perspective, which is derived from DigCompOrg, and a conceptual framework (Kampylis et al 2015) on the digital capacity of educational organisations.

Third, SELFIE approaches digital transformation as a process of continuous development, and as such it is meant to be used iteratively for the planning of schools' digital development, monitoring of implementation plans, re-evaluating, re-planning, etc. To this end, the development of two shorter versions of SELFIE – min and midi – is in progress, and resources supporting the planning of a digital strategy have been created by the SHERPA Erasmus + Project (https://selfieptk.eu/). The SHERPA toolkit along with other resources produced by other stakeholders (e.g. the Spanish Ministry of Education) are gathered on the SELFIE website (https://education.ec.europa.eu/selfie/resources#guidance). This allows schools not only to monitor their progress but also to focus on different aspects in each iteration addressing in this way the rapidly changing landscape and the complex nature of using digital technologies in schools.

The fourth characteristic is the adaptability and expandability of SELFIE which takes two forms. One is that schools can add their own questions in the tool to address their particular needs. The other form of adaptation is that the SELFIE items are being expanded to include other emerging topics of relevance to the use of digital technologies in schools: blended learning and well-being in digital education (in progress).

1.4 VET. Vocational Education and Training

If we put the focus on Vocational Education and Training (hereafter, VET), as a natural bridge between the education and training world and the world of work, we can say that the VET sector can play an important role in facilitating the digital transformation process both to the learners and to the future workers.

VET is high on the European agenda. It is important to understand its needs and characteristics in relation to the digital transformation that is affecting all areas of our lives, from the education field to the access to the labour market.

It is important to support VET institutions and companies to make the most of digital technologies for teaching, learning and training.

Within the VET educational stage, there is a modality, known as work-based learning (which also includes apprenticeships), defined as: "knowledge and skills acquires through carrying out – and reflecting on – tasks in a vocational context, either at the workplace or in a VET institution. Work-based learning can refer to a variety of different forms, namely apprenticeships, internships, traineeships and on-the-job learning by employees", (2013 Council Recommendation on establishing a Youth Guarantee).

The 2020 Council Recommendation on Vocational Education and Training for sustainable competitiveness, social justice and resilience defined the key principles to ensure that VET is able to adapt to labour market

needs and to provide quality learning opportunities. Therefore, it is crucial to support the digital transformation of VET provision both in school-based and work-based environments.

In addition to that, there are several European Commission policies that support the digital transformation of the VET sector: Digital Education Action Plan 2021-2027, 2020 European Skills Agenda and the Osnabrück Declaration on VET as an enabler of recovery and just transitions to digital and green economies.

However, compared to general school level education and higher education, the effect of digital technologies in VET is generally an under-researched area. There is a general lack of data on digitalisation in VET, which has made it difficult to identify overall trends with confidence, e.g. to be able to state how far particular technologies have been taken up in VET. VET also faces the challenge for researchers that a full understanding of the effect of the latest technologies needs to take into account both VET institution and the workplaces in which the work-based learning element of VET takes place (either as part of school-based courses or apprenticeships).

It is important to support VET institutions and companies to make the most of digital technologies for teaching, learning and training. SELFIE for the work-based learning (SELFIE WBL) is an excellent tool to support schools and companies become fit for the digital age contributing this way to the digital transition, one of the key policy priorities of the European Commission.

This adaptation of SELFIE to WBL context has been a much-needed step for the digital transformation of VET and the dual VET model offering a common reference and a link between VET institutions and companies.

2 Presentation of the work carried out

It is necessary to mention that this research was commissioned by the European Commission Joint Research Centre to Andrew McCoshan, Luca Mobilio and María Melstveit Roseme (Ecorys), through the contract SELFIE for WBL: Connecting companies working in innovation and VET providers (Contract CT-EX2014D181494-102 MA).

This contract was focused on analysing the information collected through different research methods (mainly interviews) to draw some conclusions, ideas or trends about how to better connect innovation and needs from companies at regional or local level with VET schools and how SELFIE WBL can support and contribute to this process.

2.1 Purpose of study

This report presents the findings of an initial examination of the role SELFIE WBL could play in improving the connection between i) innovation within companies and regions and ii) VET schools. It was an unanalysed area before, so the idea was to explore SELFIE WBL potential role in better addressing companies´ needs in terms of innovation from VET provision.

2.2 Methodology

The methodology of this report comprises of three steps: i) review of literature, ii) primary research and iii) interviews. Next, each one of the steps are defined in more detail.

In particular, the first step of this work was to review the literature to frame ''company and regional innovation'', including its nature, prevalence and key factors affecting companies' capacity to innovate. This review also examined the potential role of VET in supporting such innovation.

The second step consisted of, based on the findings from the literature review, they provided the basis for an initial concept note, which informed the development of key research questions for the primary research (Annex 1) and which has subsequently been developed to form Chapter 3 of this report.

The third and last step of the work was focused on the interviews. On the basis of the concept note and the key research questions (Annex 2), an interview guide (Annex 3) was subsequently designed in order to undertake qualitative interviews with key stakeholders. The approach to the interviews is further detailed below.

2.3 Literature review

Whilst there is copious literature on innovation in general, this is not the case with literature on the role of skills and VET, so the literature review had to cope with these two extremes within the confines of the available resources for the work.

In order to identify the key lessons from the general literature on innovation, it was possible to draw on excellent synthetic work done by the OECD and to use a snowballing method to identify other key sources.

Regarding the work on skills and VET, it was possible to cross-reference the limited literature available, starting with reports from the EC and JRC, to ensure coverage of all the key sources.

2.3.1 Identifying interviewees and securing participation

The aim of the primary research was to conduct a total of approximately 10 interviews with key stakeholders in order to better gauge the potential for SELFIE to play a role in supporting the relationship between VET providers and companies in terms of business innovation. To ensure a broad and balanced

coverage across relevant stakeholder groups, we firstly identified the key categories of stakeholders to cover. This list encompassed the following groups:

- Education and training (VET) providers
- Large companies
- SMEs (Small and Medium-sized Enterprises)
- Social partners

In identifying stakeholders across these key categories, the research team produced a long-list of 27 potential interviewees to narrow down from. Interviewees were identified through snowball sampling[1] through Ecorys' and the JRC's wider networks across EU Member States. As a rule of thumb, we sought to conduct a minimum of two interviews across each of the above stakeholder groups, to ensure a balanced sample. We were also mindful to ensure a distribution of potential interviewees across EU countries and regions. Lastly, we considered the need to ensure that smaller companies and education and training providers as well as stakeholders traditionally outside of the reach for EU consultations, were also represented. Within the context of the snowball sampling, the latter consideration was flagged to the network of contact points to inform their support with the identification of less traditionally visible interview candidates at the EU level.

Based on the above considerations, we narrowed the list down to 10 ''first-tier'' stakeholders to contact and after reaching them we were able to secure 6 interviews. The hesitation of some stakeholders to partake in an interview was primarily voiced as feeling inadequately placed to deliberate on the topic of innovation. Based on what still needed to be covered in terms of stakeholder groups and country representation after this first round of outreach, we subsequently reached out to alternate stakeholders on the list. In total, we contacted another 7 additional stakeholders from the list in order to secure the final 4 interviews, in order to have the final number of 10 stakeholders' interviews.

Table 1 below provides an overview of the 10 stakeholders from which participation was secured.

Table 1 Overview of interviews conducted

Country	Type	Name of organisation
Austria	Education and training providers	IBW Austria
Czechia	SME	AVRAR
Germany	Large company	Siemens AG
Finland	Education and training providers	Keuda Group
Italy	Education and training providers	FMTS Experience srl
Spain	Education and training providers	Tknika
Hungary	Large company	FESTO
Cyprus	SME	G.G. Eurosuccess Consulting
EU	Social partners	CSEE ETUCE
EU/ Greece	Social partners/ company	EfVET / P- consulting

[1] Recruitment technique in which initial contact points are asked to assist researchers in identifying other potential subjects.

2.3.2 Developing the interview topic guides

First, it is necessary to mention that the interviews were carried out in English.

The development of the topic guide for the primary research was underpinned by the aims and objectives for the study, embodied and further developed in the key research questions (see Annex 2).

A key challenge for the interviews was to **ensure that the interviewees had an initial understanding of 'innovation' as concept as well as SELFIE for Work-Based Learning (WBL)** in order to adequately frame and focus the discussions. To resolve this, we included a contextual summary page to the topic guide elaborating on the purpose of the study generally and the interviews specifically, before providing an overview of SELFIE WBL and our understanding of innovation. This topic guide was circulated to interviewees at least one week ahead of the scheduled interview date.

Given the complexity of the topic at hand, another challenge was to ensure the topic guide reflected respondents' different roles, areas of expertise and perspectives. To resolve this, we retained a common core of topics for all interviews while also allowing for differentiation where needed by adopting **a semi-structured approach to the interviews**. This allowed for prompting and probing on key topics and areas in which some interviewees had more in-depth knowledge than others.

2.3.3 Management of the data collected from the interviews

Quality and consistency in the interviewing process was ensured through oversight by the primary research lead (Luca Mobilio) and through clear planning and communication within the research team. The various steps of the interview process are summarised below.

Step 1: Piloting of the research tools and preparatory work

The Task Leader conducted the first interview to ensure the interview topic guide was fit for purpose and used this learning to flag key considerations to the rest of the research team prior to commencing the main interviewing phase.

Step 2: Carrying out the case study interviews

The Task Leader maintained a central database, with details of interview progress (outstanding / booked / complete) and key issues arising. The research team conducting the interviews provided weekly email progress updates to the Task Leader.

To schedule the interviews, experts contacted the respondents on the agreed stakeholder list using an email template prepared by the Task Leader.

The interviews lasted between 30 to 45 minutes, utilising MS Teams. The conversation were digitally recorded, using encrypted digital recording devices, with respondents' prior consent, as an *aide memoire* for the interviewer and to facilitate the use of verbatim (anonymous) quotes in the Final Report, to preserve contextual detail.

Step 3: Data recording

The research team subsequently wrote up the summary notes from the interviews using a template structured around the main headings from the topic guide. The write-ups summarised the key findings from the individual interviews.

The write-ups were subsequently compiled in a common folder for the research team to draw on for the final report analysis.

2.3.4 Key challenges encountered while conducting the interviews

In line with the challenges predicted in designing the interview guide, the complex and elusive nature of innovation as a concept and some respondents lack of familiarity with SELFIE WBL, made it challenging to receive focused and concrete feedback from interviewees. Despite sending the questions in advance and adding a summary page of information for participants, this was made more challenging given the conversational, ''on-the spot'' nature of verbal interview consultations. To resolve this, we encouraged participants to send us further information in writing once they had further time to reflect on their answers. However, given time constraints and other considerations most participants were unable to submit further written feedback. While these outlined challenges related to interviewing key stakeholders on this complex issue affected the amount of data to draw on for the final analysis (summarised in the main findings from the interviews section of this report), we were able to extract some important considerations.

3 Main characteristics of SELFIE WBL relevant to the study

According to the previous section, SELFIE WBL has a number of features (such as promoting self-reflection, discussion, identification of the current starting point, providing opportunities to move forward…) that are relevant to the current study and which provide useful reference points in considering the potential ramifications of further developing SELFIE WBL to support innovation. These can be summarised as follows:

- The object of SELFIE WBL, digitalisation, benefits from a strong degree of clarity around the overall concept of the tool which provides a structure for schools and companies to think about what is important for their digital development in relation to teaching-learning and training. SELFIE adopts an organizational approach, addressing various aspects of its operation which can enable effective integration of technologies. This, in effect, provides a normative model of what high quality digitalisation looks like. Such models are key to all self-reflection tools as they enable clear indicators or criteria to be established and SELFIE WBL is no exception.
- Related to this, notwithstanding many on-going debates around the particular 'whys and wherefores' of digitalisation, it has proven possible to establish a consensus within the community of (potential) users around the key characteristics of successful digitalisation (which is likely one of the reasons for strong uptake of the tool).
- SELFIE WBL also benefits from clarity regarding its target groups (VET teachers, students, school leaders and in-company trainers), which has made them relatively easy to define and identify – and to specify them within the tool. This provides the basis for comparing the results from different groups, which in turn provides a starting point for dialogue amongst the key interested parties.
- SELFIE WBL also clearly places responsibility for using the tool with schools since it is the school that designates the coordinator who registers it as a SELFIE WBL user and who identifies who will take part (teachers, school leaders, students, in-company trainers etc.) and then sends them the links to the questionnaires which the digital tool generates.
- SELFIE WBL has a strong element of 'ground level' ownership. It was developed with the school community with their interests at the forefront, rather than with policy-makers' interests primarily in mind and this has decisively shaped its character as tool for self-reflection rather than external benchmarking ([2]). That said, the period since launch has seen the development of interest amongst some national/regional authorities to see if SELFIE results could be used for policy monitoring, e.g. to use SELFIE data to identify trends on how technologies are used in the field and from there to take other measures (and not benchmarking or evaluation of schools that have used SELFIE). The issue is how to balance bottom-up and top-down interests in a way that does not deter use of the tool on the ground.

An important consideration is to what extent the topic of company and regional innovation would be able to support a similar set of characteristics. For example, to what extent innovation can achieve the same level of clarity as 'digitalisation' in terms of its definition. Would it be as straightforward to define the stakeholders involved? Such questions cannot be answered definitively within scope of the current study, but pointers can nonetheless be offered to guide further work.

([2]) Individual schools are quite at liberty to benchmark their SELFIE WBL results against other schools, should they wish.

4 Insights from the literature on regional and company innovation and the role of VET

This chapter examines key aspects of regional and company innovation and the role of VET based on a review of key literature on the topic. It is necessary to say that, although there is a large body of literature on the innovation topic in general, it is important to note that the evidence base regarding the role of skills in innovation and especially the role that VET can play in supporting company and regional innovation, is quite thin.

The chapter starts by examining the nature of innovation and its prevalence, highlighting the different types of innovation that can take place and the wide variations in rates of innovation between countries. It then turns to look at the role played by skills in innovation processes, since skills provide the link between innovation within companies and VET provision. This provides the backdrop to the final sections of the chapter which look specifically at what the literature tells us about the role of VET in innovation. At the end of each sub-section a box is provided to highlight the implications for the development of SELFIE for WBL.

4.1 Company and regional innovation

4.1.1 Nature of 'innovation'

In terms of definitions OECD/Eurostat use the following in the latest edition (2018) of the Oslo Manual:

> A business innovation is a new or improved product [good, service or combination] or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm ([3]).

This definition thus differentiates between, on the one hand, product and process innovations and on the other hand, innovations that are external to the firm (and introduced on the market) and innovations that are internal to the firm. There is also a difference between innovation as an outcome (an innovation) and the activities by which innovations come about (innovation activities). Furthermore, as the OECD previously noted:

> Innovation is a broad concept which encompasses a wide range of activities and processes: markets, entrepreneurship, networks and competition, but also skills and organisations, creativity and knowledge transfers ([4]).

Another dimension of variation is that there is a great variation in the way firms undertake their innovation activities:

Some firms manage their innovation activities through well-defined innovation projects or programmes with dedicated budgets, for which an innovation represents an intermediate or final milestone. Other firms primarily integrate their innovation activities into regular business operations and work to make continuous improvements to their products and business processes, while other firms primarily engage in innovation activities on an ad hoc basis([5]).

([3]) OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.9, Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

([4]) OECD (2009) Innovation in Firms: A Microeconomic Perspective. https://www.oecd.org/sti/inno/innovationinfirmsamicroeconomicperspective.htm

([5]) OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.7, Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

Implications for SELFIE WBL:

SELFIE WBL would somehow need to capture the complexity of innovation. SELFIE WBL is underpinned by an (implicit) model of digitalisation, which is comparatively straightforward and supported by a consensus in the educational community. It may be more difficult to formulate a model of innovation. However, in view of the nature of VET and of SELFIE WBL, a focus on internal innovation in business processes and activities within companies (rather than the outcomes of innovation) would be most appropriate.

4.1.2 Prevalence of innovation

Companies naturally vary in how innovative they are. Eurostat/OECD statistics ([6]) indicate that in the EU around one half of enterprises employing 10 people or more reported innovative activity ([7]) in the three-year period 2016 – 2018, with strong country variations (from 15% in Romania to 73% in Estonia). Companies vary in terms of whether these innovative activities lead to innovations that are 'new-to-market' or internal process innovations that are 'innate' to the company (such as new methods for production, information processing, marketing, distribution etc.). 'New-to-market' innovations comprise the smaller of these two types of innovations, involving 13% of companies with at least 10 employees (2016-18) and ranging from 3% in Romania to 25% in Finland.

Somewhat in line with these statistics, it is known that innovation in most cases is incremental, whether this be technical or organisational forms of innovation and including minor, but continuous, adjustments to processes. It has been argued that the incremental nature of most innovation means that the workforce in general – and the skills it possesses - has a key role to play in innovation ([8]).

Implications for SELFIE WBL:

This picture provides an important context for SELFIE WBL: whilst all schools are likely to engage in digitalisation, not all companies are involved in innovation so the 'market penetration' for a SELFIE with an innovation dimension is likely to be smaller than for the current SELFIE.

At the same time, most innovation appears to involve internal company processes rather than products, which would support a focus for SELFIE WBL on this aspect of innovation.

4.1.3 Factors affecting companies' capability for innovation

Aside from the complexities that surround the definition of innovation, the picture regarding the capabilities of firms with respect to innovation is also a complex one. The next section focuses on the role of skills in innovation, since this is the factor most germane to VET, but there is a wide range of other factors that shape the ability of firms to innovate, which might also need to be taken into account in the development of a tool to connect schools and VET.

([6]) Data in this paragraph is based on https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210115-2

([7]) As defined by the OECD, innovation activities include all developmental, financial and commercial activities undertaken by a firm that are intended to result in an innovation for the firm. OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.5, in Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

([8]) Toner, P. (2011). Workforce Skills and Innovation: an overview of major themes in the literature. OECD Working Paper of the Directorate for Science, Technology and Industry.

Broadly, firms' innovation capability is shaped by both internal and external factors:

- External factors include the wider policy environment set by government including the regulatory and fiscal environment, incentives for innovation etc., the characteristics of markets including customer demand for new products and knowledge flows and networks such as through supply chains ([9]).
- Internal factors include: the overall resources available for innovation, how the firm is financed and owned, management and leadership capabilities including overall business strategies and the ability of managers to bring about change, the overall culture of the firm and its ability to use technology and data resources and analytics ([10]).

Taken together, these factors provide a complex context for innovation and each factor can individually be unpacked in some detail to try to explain how it may support or inhibit innovation. But it is a challenging task to show how such mechanisms work in practice.

Implications for SELFIE WBL:

An important question will be how far the wider context related to companies' innovative capabilities would need to be taken into account in extending SELFIE WBL into the innovation domain and whether this context could be operationalised effectively and efficiently without making the tool too large and complex for users.

4.2 Role of skills in innovation ([11])

From the VET perspective, the question of how it might support company innovation naturally centres on skills. There is a substantial and growing literature on this topic. Skills have a crucial role in innovation:

> Europe's … ability to benefit from innovation depends on access to relevant skills, which is one of the main determinants of Europe's competitiveness and the capacity to drive innovation ([12]).

Nonetheless, it has been found to be difficult to make explicit links between specific skills and innovation; and a large range of skills and competences are typically implicated, not least because of the fact highlighted above that most innovation is incremental and often small scale in nature. Both technical skills and transversal skills such are likely required. Indeed, transversal skills related to developing innovative mind-sets, creative attitudes and 'doing things in new ways' would seem to be crucial to developing in companies the types of cultures that support change and innovation. The ability to collaborate across firms and to work in multi-disciplinary firms (to generate innovations through cross-fertilisation) are also important for innovation. The precise mix of skills involved in innovation are likely to vary by type and stage of innovation and by the structure within a business sector.

At the industry level there has been found to be some relationship between levels of business enterprise R&D personnel and in-house product innovation, although these represent higher skill levels in which many VET

([9]) OECD (2019), "Measuring external factors influencing innovation in firms", Chapter 7, Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris, https://www.oecd-ilibrary.org/sites/9789264304604-en/index.html?itemId=/content/publication/9789264304604-en

([10]) Based mainly on OECD (2019), "Measuring business capabilities for innovation", Chapter 5, Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition, OECD Publishing, Paris, https://www.oecd-ilibrary.org/sites/9789264304604-en/index.html?itemId=/content/publication/9789264304604-en

([11]) This section is based mainly on: OECD (2011) Skills for Innovation and Research. https://www.oecd.org/sti/inno/skillsforinnovationandresearch.htm

([12]) P. 6, European Commission (2020) Workforce skills and innovation diffusion: trends and policy implications. Working Paper. R&I Paper Series. https://ec.europa.eu/info/publications/workforce-skills-and-innovation-diffusion-trends-and-policy-implications_en

providers are not (yet) involved. At firm level, the possibility for analysis has been more limited but seems to point towards both technical and business/management skills being relevant for innovation.

On the company side, evidence suggests that an important factor in innovation is how relevant skills are utilized. Hence there is a link between human resource management and innovation. There has been increasing interest in how to release innovation potential through ideas such as increasing employee autonomy and how to create high performance working and learning organizations.

It seems likely that a corollary of these ambiguities and uncertainties around the role of skills in innovation might by a lack of understanding on the part of companies as to how skills development might support their innovation strategies, and, by extension, how VET institutions might support them. As discussed below, whilst universities now have something of an established track record in collaborating with companies on innovation, VET institution are not at the same level when recording their collaboration with companies.

Implications for SELFIE WBL:

SELFIE would need to consider 'innovation' skills alongside digital skills, how these are defined etc., notwithstanding the lack of strong evidence to link particular skills to innovation.

Lack of clarity about how skills support innovation and by extension the role of VET providers, means that SELFIE could play an important role in helping VET providers and companies to develop a common understanding of how VET can support innovation.

4.2.1 Regional innovation

The concept of 'regional innovation' is more than the sum total of company innovation in a given region: rather, it involves coordinated and integrated action by stakeholders across the public and private sectors - and less commonly the third sector - to provide a supportive environment within which innovation can flourish to support the sustainable economic and social development of a region.

The concept of regional innovation has evolved out of ideas related to the benefits that companies derive from operating in close proximity to one another, most notably perhaps from the work Michael Porter on clusters([13]). Porter's work was essentially an elaboration of the concept of 'agglomeration economies', long used by geographers to explain why similar industries tended to congregate in certain areas: proximity tends to reduce business costs through easier access to skills, suppliers, customers, specialized information and complementary products and services. Porter's work built on this idea to show that rather than globalisation reducing the importance of proximity, it was still key to competitiveness and product/service quality.

Porter also showed that innovation was key since 'competitive advantage rests on making more productive use of inputs, which requires continual innovation' ([14]). Clusters make opportunities for innovation more visible and also enable companies to source what they need for innovations more quickly and regions, by being the location for more than one cluster, can foster innovation across the clusters. 'Local suppliers and partners can and do get closely involved in the innovation process, thus ensuring a better match with customers' requirements.' Finally Porter argued for the role not just of companies but of other actors: 'governmental and other institutions—such as universities, standards-setting agencies, think tanks, vocational training providers and trade associations—that provide specialized training, education, information, research and technical support.'

Such ideas have subsequently been elaborated and linked to other concepts such as regional development, innovation ecosystems ([15]), smart specialisation ([16]) and knowledge triangles ([17]). What these concepts have in

[13] Porter, M.E., "The Competitive Advantage of Nations", Harvard Business Review, March–April 1990, pp. 83-84
[14] Porter, M.E. Clusters and the New Economics of Competition Harvard Business Review. November–December 1998.
[15] An ecosystem can be thought of as a network or interconnected system in which success depends on actors working together in mutual inter-dependence: if a key element is missing from an ecosystem, the ecosystem as a whole is damaged and becomes less effective.

common is the notion that public sector interventions at regional level – including through education and training - are vital to provide an environment to foster company innovation. There is now a general consensus about what this means in practice, which is captured well by Viitanen, who highlights the role of interventions such as incubation environments, test beds, cluster policies and programmes, R&D – and education and training – in providing the conditions necessary for successful 'regional innovation systems' in which new innovations can be converted into marketable products([18]). Equally important are the public and private sectors acting collaboratively, often through public-private partnerships.

The critical role of education and training in providing the skills needed for regional innovation has been long been recognised, with the elaboration of the idea of 'skills ecosystems' (19). Academic literature on this topic, along with public policy, has mainly focused on high skills and consequently on the role of universities. But in recent years more attention has been given to skills at other levels where VET has a greater role to play – both in academic research20 and in the policy domain, not least through the growing interest in Centres of Vocational Excellence. In part, this reflects the fact that VET has tended in practice to play at best a minor role in the evolution of regional innovation systems – or at worst no role at all.

Implications for SELFIE WBL:

A SELFIE for WBL focused on innovation could be of interest to stakeholders involved in regional innovation but this would involve a large range of potential stakeholders and consideration would need to be given to how such a tool would be used and for what purpose, as it would function at a level 'above' that of 'company innovation'.

4.3 The role of VET in company and regional innovation

Compared to the knowledge base on innovation, we know relatively little about the role of VET in company and regional innovation. As noted, in the academic literature, there has been little focus on this topic, whereas in higher education there is a body of work dealing with the role of universities in stimulating innovation, e.g. through 'knowledge triangles'.

4.3.1 VET and innovation types

Nonetheless, useful insights include the distinction that can be made between science-based innovations, innovations based on applied research and innovations related to the diffusion of technology. Curtain has argued that the scope for VET to be involved with 'pure' science-based research that might lead to radical innovations is likely to be small since this terrain is where higher education excels([21]). VET may also have a role to play in applied research: Beddie and Simon note the potential to involve VET learners in applied

[16] Smart specialisation is an innovation policy concept that aims to boost regional enterprise innovation, contributing to growth and prosperity by helping and enabling regions to focus on their strengths.
Smart Specialisation advocates a place-based approach to focusing innovation investment on a few, carefully chosen priorities, where the impact can be greatest. https://enterprise.gov.ie/en/What-We-Do/Innovation-Research-Development/Smart-Specialisation/

[17] There is no standard definition of 'knowledge triangles' but the three elements typically comprise innovation, education and research.

[18] Viitanen, J. (2016) 'Profiling Regional Innovation Ecosystems as Functional Collaborative Systems. The Case of Cambridge', in *Technology Innovation Management Review*, December 2016 (Volume 6, Issue 12). https://timreview.ca/article/1038

[19] See, for example, Finegold, D. (1999) Creating Self-Sustaining High Skill Ecosystems. Oxford Review of Economic Policy 15(1):60-81. DOI:10.1093/oxrep/15.1.60; Dalziel, P. (2012) *Towards a New Zealand System of Skill Ecosystems*. EEL Research Report No. 11. Lincoln University;

([20]) E.g. Buchanan, J., Anderson, P., & Power, G.(2017). Skill ecosystems. In J. Buchanan, D. Finegold, K. Mayhew, & C. Warhurst (Eds.), The Oxford handbook of skills and training (pp. 444–464). Oxford University Press.

([21]) Curtain, R. (2004). Vocational Education and Training, Innovation and Globalisation. Adelaide: National Centre for Vocational Education Research

research projects, which will enhance learning and lead to a more innovative workforce([22]). However, involvement in applied research might be more applicable to higher-level VET rather than VET in general.

Arguably the greatest potential role for VET is in technology diffusion, especially to SMEs. As Curtain argues, the role of such diffusion is not to be under-estimated since the dissemination and adaptation of new technologies from knowledge-intensive to mainstream industries are central to the spread of innovation. Industries like food-processing, timber and textiles have low R&D but make use of knowledge-intensive inputs. Curtain (2004) states:

> From the perspective of innovation as a series of small changes diffused widely, vocational education and training has much more definable role.

As noted above, most innovation is internal to firms and is therefore likely to involve the adoption, adaptation and application of new or improved processes from outside, so this observation suggests that there is quite some scope for VET to support innovation.

It has been argued that such a role for VET in technology diffusion could make a significant contribution to European prosperity. Europe is experiencing a 'productivity paradox': despite the increasing application of digital technologies to business processes in recent decades, growth in productivity has been sluggish, which has slowed economic growth ([23]). The causes of this are complex but a key dimension appears to be poor innovation diffusion across a broad range of companies, sectors and regions due to weaknesses in their capacity to absorb innovations linked to a lack of appropriate skills. It seems that the growing complexity of innovation processes is requiring companies to master increasingly diverse technologies and new business models, which the majority of companies are failing to translate into productivity gains and with some sectors able to adopt digital technologies more easily and extensively than others. This situation is also making it more imperative that economically lagging regions strengthen their innovation capabilities in order to capture more added value, not least by forging a strong relationship between skills development and innovation systems.

Implications for SELFIE WBL:

VET has potential to make an important and distinctive contribution to company innovation, especially the diffusion of technology and thereby to regional and national innovation systems.

VET's ability to contribute to different forms of innovation may make it more complex to adapt SELFIE for use in this domain.

4.3.2 VET's role in innovation

Overall, the notion of VET supporting innovation in companies is likely to be a new one for many VET providers. Although good quality evidence is scarce and the picture varies a lot from country to country, it seems that VET providers who provide facilities such as business start-up counselling and workspaces are the exception rather than the norm, as noted by the EC mapping study of Centres of Vocational Excellence (CoVEs)([24]). The same study also noted that involvement in innovation by VET providers is one feature that distinguishes vocational excellence from 'normal' (high quality) provision. At the same time, there are evidently numerous examples of VET providers supporting innovation within companies, as the examples below show.

([22]) Beddie, F. M., & Simon, L. (2017). VET applied research: driving VET's role in the innovation system. Adelaide: National Centre for Vocational Education Research

([23]) European Commission (2020) Workforce skills and innovation diffusion: trends and policy implications. Working Paper. R&I Paper Series. https://ec.europa.eu/info/publications/workforce-skills-and-innovation-diffusion-trends-and-policy-implications_en

([24])European Commission (2019) Mapping of Centres of Vocational Excellence. Section 8.2. Luxembourg: Publications Office of the European Union, 2019. https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8250

Examples of involvement in innovation by VET providers:

The South West College in Northern Ireland (UK) delivers higher and further (VET) education and collaborates extensively with companies. Many of the courses and apprenticeships offered at the South West College are in line with Northern Ireland's Framework for Smart Specialisation; and the college participates in the 'InnovateUs' programme, which is included in Northern Ireland's Innovation Strategy 2014-2025. The College has a designated InnoTech centre, which carries out a wide range of activities aimed at innovation development and support for local businesses. Among other forms of assistance, innovation and mentoring support for small and microbusiness as well as government-subsidised needs-based training for staff are offered. It also has some separate centres which provide innovative training methodologies. Image, for example, is SWC's creative technologies studio, with advanced technologies at the disposal of students intended to 'facilitate pre-incubation for those wishing to develop their ideas'. The Idea/Makerspace studio provides physical resources, with high-end design and manufacturing equipment for community members to design, create and manufacture products.

Dundalk Institute of Technology in Ireland shares its state of the art research facilities with companies through joint research projects and real life industry and business case studies, conducted by the students for the companies. One company (Ergo), for example, committed over EUR 1 million to establish a research and development division for the further development of software solutions for the financial services sector. The research activity has focussed on developing Ergo software components that simplify complex business processes.

Omnia, in Finland, is a not-for-profit organisation owned by three municipalities. It acts as an umbrella for a number of projects or centres including the InnoOmnia Hub and Omnia AI (Artificial Intelligence) Lab. InnoOmnia, launched in 2011, is a lifelong learning hub which offers a unique combination of services to empower teachers, students and entrepreneurs and to increase innovation at grassroots level through for example: entrepreneurship support for present/would-be entrepreneurs; innovation and piloting new pedagogy for vocational teaching and learning e.g. gamification, mobile learning, entrepreneurial teaching methods; teacher and school leader professional development. All spaces are learning spaces and everyone is both a learner and a teacher.

VIA University College in Denmark includes entrepreneurship and innovation in all its 42 educational programmes, including programmes that are traditionally not focused on developing students in this area. VIA integrates entrepreneurship into the general curriculum for more than 19,000 students. Faculty members have been trained to teach courses in entrepreneurship and VIA offers special electives and courses on entrepreneurship. They have also established student entrepreneurship centres on most campuses. One specific goal is to enable more students to establish their own companies – which more and more students across programmes do. In addition, VIA participates in some EU-funded development projects in the area of student entrepreneurship and innovation. One hundred mentors have also been trained as part of VIA's vocational business education programmes to provide VET students with tailored career guidance.

Source: European Commission (2019) Mapping of Centres of Vocational Excellence. Section 8.2. Luxembourg: Publications Office of the European Union, 2019. https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8250

Given this variety, it might be useful to think of VET's role in respect of innovation in two senses, which we can conceive as sitting at either end of a continuum: at one end of the continuum VET might have a somewhat passive, weak role, whilst at the other end it would have a more proactive and direct role. VET could be seen as having a passive role by virtue of its ability to develop in learners the types of transversal skills needed for innovation (notwithstanding the lack of a proven relationships between innovation and particular skills noted above). VET is well placed to develop the types of skills needed for innovation (team-

work, problem-solving, critical thinking etc.), especially if it embraces more innovative teaching and learning methodologies, e.g. project-based learning ([25]). However, the extent to which transversal skills are explicitly well catered for by VET is a moot point: detailed analysis of VET qualifications indicates that typically they are focused on technical skills and that transversal competences are poorly served ([26]).

Alongside this rather passive role, VET also has the potential to more actively and directly support innovation. This role has been the subject of more interest in recent years. Recent research, in response to developments in EU policy has identified the role that VET might play in regional innovation of the type discussed in this report and hence in regional development or smart specialisation strategies. Hazelkorn and Edwards have found that VET 'has a strong capacity to deliver and play a major role in smart specialisation strategies', e.g. supporting diffusion of innovation, providing relevant skills for industrial development and supporting local/regional innovation ecosystems.[27] They also note that work needs to be done to 'bring VET to the attention of policy makers and practitioners in the field of innovation and smart specialisation, as well as the field of local and regional development more broadly'. There is an interesting contrast here with the role of higher education in innovation, which has been the subject of academic research for some time, reflecting the practical engagement of universities in supporting the conversion of science-based innovations into products that can be taken to market, e.g. through the development of science parks[28] and other ventures which bring together the three components of innovation, education and research into 'knowledge triangles'.

Implications for SELFIE WBL:

Consideration may need to be given to both VET's passive and proactive roles in company innovation. This may provide the basis for developing a developmental model for SELFIE in relation to innovation which could help VET providers move from passive modus operandi to more proactive modus operandi.

4.3.3 Lessons from Centres of Vocational Excellence

As noted, VET's role in innovation features in the concept of Centres of Vocational Excellence (CoVE). The EC's CoVE mapping exercise identified a number of distinct features that VET can or could bring to bear on the topic of innovation:

- Close and practical business links
- Connections to all sectors of business, not just hi-tech, which tend to be the focus of innovation strategies
- Its expertise in low and intermediate level skills development, often overlooked in innovation strategies which tend to focus on high level (research and STEM) skills ([29]).

One of Europe's leading CoVEs is Tknika in the Basque Country of Spain, which has developed a modus operandi based on close relationships with businesses and developing leading edge training programmes using the latest equipment, e.g. in cybersecurity, 3D printing and sustainable agriculture, so as to develop a virtuous cycle between VET and innovation[30]. For example, the Ikaslab project has involved creating

([25])European Commission (2020) Innovation and Digitalisation. A Report of the ET 2020 Working Group on VET. https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8365&furtherPubs=yes

([26])Unpublished CEDEFOP report

([27]) Hazelkorn, E. and Edwards, J., (2019) Skills and Smart Specialisation: The role of Vocational Education and Training in Smart Specialisation Strategies, EUR 29875 EN, Publications Office of the European Union, Luxembourg, 2019, ISBN 978-92-76-11889-3 (online),978-92-76-11890-9 (print), doi:10.2760/828852 (online),10.2760/34689 (print), JRC118229.

([28]) See, for example https://iai.digital/2021/the-cambridge-phenomenon-an-innovation-system-built-on-public-private-partnership/

([29])European Commission (2019) Mapping of Centres of Vocational Excellence. Section 8.2. Luxembourg: Publications Office of the European Union, 2019. https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8250

([30])https://www.cedefop.europa.eu/en/news/spain-basque-country-vet-innovation-offers-good-practices-future-employment

laboratories in Vocational Training Centres that are equipped with 3D printing equipment first to support practice and experimentation with the technology amongst learners but then to promote the use of 3D printing in companies in the field[31]. In addition, Tknika has developed a collaborative, challenge-based learning model (ETHAZI) that supports learners to develop the types of transversal (as well as technical) skills needed for innovation, e.g. team-work and problem-solving[32].

Implications for SELFIE WBL:

The CoVE concept – and practices - could provide a starting point for developing a model of innovation to link VET schools and employers that could underpin SELFIE.

4.3.4 Different forms of VET: IVET and CVET

Another aspect to consider are the potential differences between skills development in the initial phase (Initial VET) and as part of adult learning (Continuing VET), including upskilling and reskilling. Skills acquisition whilst in work 'contributes to the technological capabilities of firms and is positively related to innovation'[33] and, as noted above, lack of certain types of existing workforce skills is believed to play a role in the failure to reap the productivity improvements that have been expected from innovations. Indeed, one might argue that a 'SELFIE for business innovation' would have the potential for greatest impact if applied within CVET more than IVET.

However, CVET is a much more complex terrain compared to IVET. IVET is typically part of the compulsory phase of education and is dominated by publicly funded VET providers providing programmes leading to full nationally recognized qualifications. In contrast, there is a much greater variety of stakeholders in CVET including not just public provision but also private providers who offer a wide variety of short and long courses with employers also playing a key role in purchasing VET for their employees. There is also great variation in the certificates and credentials on offer, especially with the rise of digitally enabled micro-credentials.

Implications for SELFIE WBL:

In view of the growing significance of upskilling and reskilling, consideration will have to be given to the role of both IVET and CVET in innovation. SELFIE WBL would need to somehow allow for variation between these VET sub-sectors and could be extended to CVET.

([31])https://tknika.eus/en/cont/proyectos/4577/#

([32])https://tknika.eus/en/cont/proyectos/ethazi-3/#

([33])P . 13 OECD (2011) Skills for Innovation and Research. https://www.oecd.org/sti/inno/skillsforinnovationandresearch.htm

5 Key findings from the interviews

This chapter presents the key findings generated by the interviews. The interview sample, though small, was designed to reflect the range of stakeholders involved in innovation and as users of SELFIE for WBL.

5.1 Innovation needs of companies

The **innovation needs of companies are likely to vary substantially**, differing according to, e.g. sector, geographical area, company size and company culture. Specific needs will also vary from access to relevant skills and human resources, to collaboration with innovation stakeholders and availability of funding.

While innovation skills could of course encompass the capacity to understand and use the latest technology (with a huge need to upskill the older workforce in particular), interviewees agreed that **there is a range of soft, transversal skills that are required by companies seeking to innovate**. First of all, innovation requires constant learning. A culture of lifelong learning is therefore a precondition for any organisation that seeks to innovate. Companies need to support and motivate employees in this regard, but also create opportunities for constant learning and allocate sufficient time to it. Secondly, innovation requires a specific attitude, a mind-set encompassing creativity, not being afraid of making mistakes, the ability to see beyond one's specific field and to look for potential cross-sectoral opportunities. Companies would seek employees with such an attitude, but companies also have the task to create a culture favourable to this type of thinking.

Collaboration with innovation stakeholders is also essential. Cooperation between start-ups, large companies, universities, research centres and VET providers can unlock innovation potential. While universities have the best conditions for applied research and experimental development, start-ups have the potential to find commercial use of university results, supported by large companies as investors.

Access to funding streams allowing development of such partnerships and investments in research and development is also an important innovation enabler. Without adequate funding, key stakeholders might not have the means to put in place projects, strategies and collaborations needed to unlock their full potential. Interviewees also pointed to important differences between SMEs and larger companies, with SMEs likely to have less time and resources to invest in innovation.

The **local and regional dimensions** can play an enabling role by creating an environment conducive to innovation. This can happen through policies fostering the presence of essential stakeholders or through the allocation of funding for innovation.

Implications for SELFIE WBL

- Key stakeholders have **very different needs in relation to innovation**, SELFIE will need to be able to accommodate these differences and allowing a degree of customisation

- Innovation does not rely only on technical skills, but on a wide range of **transversal and soft skills, mind-set, values and attitude**. These skills would need to be identified and mapped.

- Innovation requires **collaboration of different stakeholders**. On the one hand, this would mean that SELFIE would need to be structured so to allow for different stakeholders to be part of the self-assessment process. On the other hand, it would imply a focus of the tool on the capacity of VET providers and other actors of involving a range of stakeholders.

- Innovation requires **ability to identify and access** specific funding streams **to support research and partnership development.**

- Local and regional dimensions can be enabling factors of innovation and should also be areas covered by SELFIE.

5.2 The role of VET

Overall, there was a general consensus among stakeholders interviewed that VET could and should play a key role in fostering innovation.

As discussed above, companies need to find employees that not only have the technical skills required, but that also have specific mind-sets toward work, innovation and learning. VET has the task to prepare young people to work towards innovation, providing them with **transversal skills and knowledge** and supporting them to embrace a culture of lifelong learning. VET can prepare young people to think cross-discipline, equipping them with the ability to identify problems and gaps and find innovative solutions. VET providers are the natural setting for bending the boundaries between sectors and disciplines, allowing multidisciplinary cross-fertilisation and the development of a creative approach to problem solving.

VET also has the potential to support the **development of curricula that are future-oriented**, anticipating trends and ensuring young people are equipped with the technical skills that innovative companies need. For this to happen, there must be a systematic approach to curricula development involving a number of key stakeholders (i.e., VET providers, social partners, companies, public authorities). VET providers normally do not work in isolation but work collaboratively and the most proactive of them are embedded in their local economic and industrial ecosystems, building synergies and actively seeking collaborators. Leveraging on this aggregating function, VET could become a catalyst for innovation, bringing together those stakeholders that have the potential, but often lack the opportunity, to collaborate. Assuming this role would allow on the one side VET providers to ensure their curricula are in line with current and future needs and on the other side companies and research facilities to have access to skills, know-how and resources.

Siemens AG - Scoping for new trends

As a tech company, Siemens generates innovation and VET has the task to prepare their young learners to be part of this generative process. Hence, VET is seen as, not only, participating in innovation but as generating innovation as well.

Since 2019, Siemens AG implemented a new process to ensure that new trends are captured, identified and incorporated in their VET curricula.

Every two years, Siemens AG scopes for new trends both internally, collecting inputs from different units and branches and externally in a dialogue with stakeholders as research institutes, employers' organisations, social partners and universities. They also take opportunities as conferences, fairs, expos, to get a sense of new trends.

All the input so collected is then considered and relevant trends incorporated in their curricula. In case of major trends, or megatrends, that are considered to have the potential to shape the business going forward, these trends are incorporated horizontally in all their training curricula, so that all students and employees are aware of them and ready to deal with them in their work.

It is important to note that several interviewees highlighted an important difference between the current role of private sector and public sector vocational education/training sectors. At present, private VET centres appear to be working more on the innovation side while schools have difficulties in this area as a result of a lack of specialised staff and state of the art infrastructure (e.g. digital technologies).

Implications for SELFIE WBL:

- VET can and should provide young people with the range of transversal skills, attitudes, values and mind-set required for 'being innovative'

- VET providers can provide opportunities for cross-fertilisation between disciplines and sectors

- VET should develop and use curricula that are future-oriented based on dialogues and collaboration with key stakeholders

- VET providers should have the required infrastructure and processes to bring together and collaborate with key stakeholders

5.3 A SELFIE WBL for innovation?

The SELFIE WBL tool has the potential to support VET providers, companies and other stakeholders to develop the conditions typical to an environment favourable to innovation. The tool, used to assess how these stakeholders are doing against a number of key indicators, could allow self-reflection and inspire change. However, there are a number of elements that would need to be considered.

The current tool focuses on digitalisation and it is based on standard goals in terms of digital skills, equipment and processes. This standards baseline would need to be developed for innovation as well, taking into consideration elements such as:

- Appropriate curricula capturing trends and the acquisition of transversal skills (e.g., creative thinking, cross-sectoral approaches, failure acceptance, attitude to lifelong learning, etc.);
- Availability of laboratories, tools, technology in line with the specific skills that are required;
- Capacity to bring together different stakeholders at different levels (local and regional, but also national and international), including the ability to build collaborations and develop synergies fostering the development of innovation skills;
- Having in place processes to identify trends and future needs;
- Access to funding for innovation related needs (laboratories, but also partnerships development, R&D, etc.);
- 'Innovation ready' in-company trainers and VET teachers supported through Continuous Development Programmes and able to cooperate to ensure cross-fertilisation between the work and teaching environments;
- The local and regional dimensions and whether these are conductive for innovation to happen.

While defining standard goals for innovation would be required, this would not be sufficient as it should allow a certain degree of customisation to meet the different and evolving needs of stakeholders in the ecosystem the tool user would operate in. So, it is **important that the tool is customizable by different stakeholders**, becoming the basis for a dialogue between them. Interviewees suggested that this is particularly important for companies, which are more heterogeneous than schools in terms of their range of sizes and sectors.

Once created, **this tool should be correctly communicated and 'marketed'**. It would be important that VET providers and companies do not perceive such a tool as an assessment or evaluation instrument, but as a support system that can inspire good practices. Also, it would need to consider the specificities of national systems, in particular the variation in the nature and degree of communication between VET schools and companies.

The current tool is geared towards VET providers that can then involve companies in the process by answering part of the questionnaire. This approach could be widened to allow companies or other key stakeholders to initiate the process and would allow a stronger sense of ownership and further engagement of other parties.

In this context, interviewees also provided some concrete suggestions regarding how the current SELFIE WBL could be further geared to support innovation. They emphasised:

The language of the current questionnaire is largely tailored towards teachers, while not adequately addressing the fact that in-company trainers are typically not professional educators. As such, some expressions in the current SELFIE WBL questionnaire may be too technical/pedagogical for in-company respondents (e.g., the use of ''blended learning''). Such terms throughout would thus either need to be rephrased or incorporate a brief description to facilitate navigation.

The **difference between the innovation/digitalisation available in companies and schools, with schools often lagging behind**. More specifically, an interviewee pointed out that often the only way that schools can access state of the art digitalisation/innovation is by sending their students to companies. As such, SELFIE WBL has an important role to play in finding out from in-company trainers whether trainees are exposed to the latest technologies/innovations during their work-based learning experience.

The **promotion of SELFIE WBL as an innovation support tool** would be crucial, to ensure that key stakeholders would be aware of its potential and the benefits of engaging with the tool for this purpose. In particular, interviewees suggested leveraging the School Education Gateway and key Erasmus+ programme activities to spread the word and educate key stakeholders about the purpose and potential of the tool. At EU-level, interviewees further encouraged involving DGs working on relevant sectoral development and at country-level and highlighted the importance of working with national agencies related to EU programmes, e.g. national offices for Erasmus + in promoting the tool.

Implications for SELFIE WBL:

- SELFIE WBL could serve as a tool for fostering innovation by becoming a tool to engage key stakeholders on a collective reflection regarding tools and processes to actually be innovative

- Standard goals for innovation should be developed encompassing specific elements

- Stakeholders should be able to further build on these standard goals to meet their specific needs in a customisable tool

- Good communication of the tool would be key to its adoption

- Allowing stakeholders other than VET providers to initiate the assessment process would widen up the use of the tool.

6 Conclusions

This final section of the report draws together the findings from the interviews and the insights from the literature to provide a set of conclusions that would need to be at the forefront in any future steps regarding the role of SELFIE WBL in better connecting business and regional innovation with VET schools. As well as identifying the factors that would need to take into account developments in the field and highlights the key areas for further research.

6.1 Meeting a need

There is no doubt there is currently a 'gap in the market' for a self-reflection tool to improve the connections between companies, regional stakeholders and VET providers in the area of innovation, a gap that SELFIE WBL has the potential to fill. VET providers currently span an enormous range in terms of how actively they support business innovation and there is no common set of tools to enable stakeholders to judge their current role in this respect. At the same time, extending SELFIE WBL into the innovation domain would mean building out from the existing tool and there are some key points of difference between the arenas of digitalisation and innovation that would need to be considered. In addition, it will be important to watch out for any potential negative unintended 'backwash' effects on perceptions of the current SELFIE, such as its use as a bottom-up self-reflection tool, which could adversely impact usage of the tool in general.

Any tool would need to take into account the factors described in the next sections.

6.2 Understanding innovation, skills and VET's role

As has been shown, the concept of innovation is complex and disputed – and there is a vast literature on the subject. When it comes to skills, there is a lack of clear proven connections between particular skills and innovation. Whilst it seems there is a group of skills that are linked to innovation, actual evidence for how they are connected is still being established. It is important that a better understanding of skills for innovation is developed which identifies what are they and their respective roles. Similarly, there is not a relevant amount of research on the VET's role in innovation. This is also accompanied by variation in what stakeholders think VET's role in innovation ought to be (the normative aspect) and enormous variation 'on the ground' in the extent to which VET providers even consider their role in this respect.

Establishing a common understanding of these aspects is likely to be a prerequisite for successful application of SELFIE WBL to the innovation topic just as a shared understanding of the concept of digitalisation has been one factor underpinning SELFIE's success to date. It goes without saying that these would be key areas for further research. And it should also be noted that achieving consensus could be challenging: digitalisation looks quite uncontroversial in comparison to innovation and even here there are on-going debates about the proper role of digital tools in VET.

6.3 Developing a normative model of VET's role in innovation

Closely related to the foregoing point is the conclusion that it will be important to develop a normative model of VET's role in innovation. Every self-reflection tool is underpinned by one form of normative model or another, otherwise it would be impossible to define its parameters, individual indicator statements etc. It may be challenging to develop such a model for innovation given its complexity. One thing it would need to identify would be those aspects of VET that support innovation, e.g. cross-fertilisation across subject disciplines. A starting point might be provided by the maturity model for CoVEs developed by the European Commission plus further research into the experiences of leading CoVEs. Another aspect to consider would be how to operationalise the broad range of generic (soft or transversal) skills implicated in most innovation (which is incremental and small scale). It is also important to develop some methodological approaches that can facilitate the generation of such a model for example the use of experimental innovative projects where the VET school and a company collaborate to put in place learning material and scenarios, identify the skills,

values, knowledge that would be taught in each context and then use this as a basis to identify the dimensions and the questions that should be included in a SELFIE for innovation building in flexibility around stakeholder needs.

The stakeholder aspect raises a number of issues in connecting company and regional innovation with VET schools. On the one hand, innovation can involve a very wide range of stakeholders, whilst on the other hand not every company is involved in innovation – or may perceive itself to be involved in innovation. In addition, there are widely differing needs around innovation such that any tool would need to untangle the different forms of innovation (e.g. technology diffusion from applied research) as well as having regard to sectoral and geographical differences. Ideally, the tool would also need to be flexible enough to be useable not just in initial VET but in continuing VET too. This suggests that a SELFIE tool focused on innovation may have to cope with a more diverse set of target groups than the current tool and – more even than with the existing SELFIE WBL – possibly have greater scope for customisation.

6.4 Bridging the school-company gap

It will also be important that the tool bridges the school-company gap. The current SELFIE WBL has placed the school in the driving seat for the use of the tool, but a focus on innovation would mean having a stronger focus on the company side. This could mean that stakeholders other than schools should be enabled to initiate the reflection process in order to broaden ownership and enhance take-up. Apart from this, it seems that we need a methodology to do this.

6.5 Growing the potential user base

In view of the lack of clarity and awareness around how skills and thus VET providers can help companies to innovate, a 'SELFIE for company innovation' would probably have to be supported by a significant effort to promote the role of VET providers alongside or in advance of promotion of the SELFIE tool itself, in order to encourage take-up. There is likely to be an obstacle of understanding around innovation that needs to be tackled – generally and specifically on the role of VET, which in many countries has not been perceived as having a leading role in business development (linked to the poor image and attractiveness issue highlighted in European policy for many years now). On the company side, most innovation is small scale and incremental and many companies themselves might not see themselves as 'innovative'; as a result the definition of innovation used needs to be as open and inclusive as possible and companies may need encouragement to engage with the tool.

6.6 Balancing top-down and bottom-up interests

As noted in section 1.3, SELFIE WBL has strong bottom-up ownership as a school-level diagnostic tool but at the same time its role as a support to 'top-down' policy monitoring has been developing. A SELFIE tool focused on innovation could be a useful tool at sectoral and regional levels to support the integration of skills development into innovation systems and consideration would need to be given to how to balance top-down and bottom-up interests especially if there is greater desire amongst regional/national authorities to use a SELFIE for innovation for policy monitoring purposes.

6.7 Next steps: an outline action plan

This study has made an initial first step in exploring how SELFIE for WBL might encompass the topic of innovation. Based on the preceding conclusions, it is clear there are some further steps that would need to be undertaken next to provide a solid foundation for future developments.

Mapping of stakeholders

- This would be critical to understand (a) who is (or could be) involved at the VET-innovation nexus and (b) where there is demand for a SELFIE WBL applied to innovation (a kind of 'market research').

Mapping could take place at European, national, regional and sectoral levels and could involve interviews with potential stakeholders to understand their perspectives on VET and innovation, building on the interviews already conducted for this study.

Research into skills for innovation

- It will be important to establish a more solid understanding of how core/transversal skills relate to innovation since this provides the link into VET from both a company and regional development perspective. Whilst it is understood in general which types of core skills support innovation, the precise nature of the connections is less clearly appreciated. Considerable work at European level has gone into developing the understanding of digital and green skills (e.g. leading to GreenComp) and a similar effort is required in respect of innovation as a key foundation stone for a SELFIE WBL for innovation.

Research into types of innovation where VET might support development

- It will be important to understand in more detail the types of innovation where VET could make a contribution to development, such as pure science-based innovation, applied research, innovation diffusion. This is a highly under-researched area and case studies would help to shed light on this topic. A starting point for case studies could be the Centres of Vocational Excellence identified in the EC mapping exercise plus the CoVEs currently funded through Erasmus+. Whilst some information has been gathered on these CoVEs, it covers a broad area of VET excellence and more detailed probing around the topic of innovation would be valuable.

Stakeholder engagement to develop a normative model of VET and innovation

- Research and discussions into the current 'state of the art' on VET and innovation can only go so far: at some point it will be necessary to establish a normative model which sets out what VET should be trying to achieve in this field. This requires choices to be made, e.g. around whether a SELFIE WBL for innovation should focus on company innovation, regional innovation or both; on the types of innovation to address. This is likely to require extensive consultation that engages with stakeholders through workshops at multiple levels and involves European-level events and workshops in EU Member States to bring together national and regional players.

Experimental innovative projects to support the development of a normative model

- Along with stakeholder engagement, normative model development could be supported by some experimental projects which bring together VET schools and companies to put in place learning materials and scenarios related to innovation and to identify the skills, values and knowledge that would be taught in each context. This could then be used to identify the dimensions and the questions that should be included in a SELFIE for innovation.

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List of abbreviations and definitions

CoVE	Centre of Vocational Excellence
IVET	Initial Vocational Education and Training
CVET	Continuing Vocational Education and Training
R&D	Research & Development
SELFIE	Self-reflection on Effective Learning by Fostering the use of Innovative Educational technologies
SELFIE WBL	SELFIE for Work-based Learning
SMEs	Small and Medium-sized Enterprises
STEM	Science, Technology, Engineering and Mathematics.
VET	Vocational Education and Training

Annexes

Annex 1. Concept Note

1.0 Aims of the project

The project is an initial scoping exercise whose purpose is to make a first assessment of the potential for SELFIE WBL to play a role in supporting the relationship between VET providers and companies in terms of business innovation.

2.0 Purpose of this note

The purpose of this note is to provide some initial ideas on innovation as input to the preparation of the questionnaire. It is based on a first rapid literature scan.

3.0 Innovation in companies

3.1 Nature of 'innovation'

In terms of definitions OECD/Eurostat use the following in the latest edition (2018) of the Oslo Manual:

> *A **business innovation** is a new or improved product [good, service or combination] or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm.*[34]

This definition thus differentiates between, on the one hand, product and process innovations and, on the other hand, innovations that are external to the firm (and introduced on the market) and innovations that are internal to the firm. There is also a difference between innovation as an outcome (an innovation) and the activities by which innovations come about (innovation activities). Furthermore, as the OECD previously noted:

> *Innovation is a broad concept which encompasses a wide range of activities and processes: markets, entrepreneurship, networks and competition, but also skills and organisations, creativity and knowledge transfers*[35].

Another dimension of variation is that how firms undertake their innovation activities varies greatly:

> *Some firms manage their innovation activities through well-defined innovation projects or programmes with dedicated budgets, for which an innovation represents an intermediate or final milestone. Other firms primarily integrate their innovation activities into regular business operations and work to make continuous improvements to their products and business processes, while other firms primarily engage in innovation activities on an ad hoc basis.*[36]

3.2 Prevalence of innovation

[34] OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.9, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

[35] OECD (2009) Innovation in Firms: A Microeconomic Perspective. https://www.oecd.org/sti/inno/innovationinfirmsamicroeconomicperspective.htm

[36] OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.7, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

Companies naturally vary in how innovative they are. Eurostat/OECD statistics[37] indicate that in the EU around one half of enterprises employing 10 people or more reported innovation activity[38] in the three-year period 2016 – 2018, with strong country variations (from 15% in Romania to 73% in Estonia). Companies vary in terms of whether these innovation activities lead to innovations that are 'new-to-market' or internal process innovations that are 'internal' to the company (such as new methods for production, information processing, marketing, distribution etc.). 'New-to-market' innovations comprise the smaller of these two types of innovations, involving 13% of companies with at least 10 employees (2016-18) and ranging from 3% in Romania to 25% in Finland.

3.3 Role of skills in innovation[39]

From the VET perspective, the question of how it might support company innovation naturally centres on skills. There is a substantial and growing literature on this topic. Whilst it is known that skills have a crucial role in innovation, it has been found to be difficult to make explicit links between specific skills and innovation; and a large range of skills and competences are typically implicated. Both technical skills and transversal skills such as communication and teamwork are likely required. The ability to collaborate across firms and to work in multi-disciplinary firms are often important for innovation. The precise mix of skills involved in innovation are likely to vary by type and stage of innovation and by the structure within a business sector.

At the industry level there has been found to be some relationship between levels of business enterprise R&D personnel and in-house product innovation, although these represent higher skill levels in which many VET providers are not (yet) involved. At firm level, the possibility for analysis has been more limited but seems to point towards both technical and business/management skills being relevant for innovation.

On the company side, evidence suggests that an important factor in innovation is how relevant skills are utilized. Hence there is a link between human resource management and innovation. There has been increasing interest in how to release innovation potential through ideas such as increasing employee autonomy and how to create high performance working and learning organizations.

4.0 The role of VET in company innovation

Compared to the knowledge base on innovation, we know relatively little about the role of VET in company innovation. In the academic literature, there has been little focus on this topic, whereas in higher education there is a body of work dealing with the role of universities in stimulating innovation, e.g. through 'knowledge triangles'.

4.1 VET and innovation types

Nonetheless, useful insights include the distinction that can be made between science-based innovations, innovations based on applied research and innovations related to the diffusion of technology. Curtain has argued that the scope for VET to be involved with 'pure' science-based research that might lead to radical innovations is likely to be small since this terrain is where higher education excels[40]. However, there is scope for VET to play a role in technology diffusion, especially to SMEs. The role of such diffusion is not to be under-estimated since the dissemination and adaptation of new technologies from knowledge-intensive to mainstream industries are central to the spread of innovation. Industries like food-processing, timber and textiles have low R&D but make use of knowledge-intensive inputs. Curtain concludes:

[37] Data in this paragraph based on https://ec.europa.eu/eurostat/web/products-eurostat-news/-/ddn-20210115-2

[38] As defined by the OECD, innovation activities include all developmental, financial and commercial activities undertaken by a firm that are intended to result in an innovation for the firm. OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.5, in *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

[39] This section is based on: OECD (2011) Skills for Innovation and Research. https://www.oecd.org/sti/inno/skillsforinnovationandresearch.htm

[40] Curtain, R. (2004). Vocational Education and Training, Innovation and Globalisation. Adelaide: National Centre for Vocational Education Research

'From the perspective of innovation as a series of small changes diffused widely, vocational education and training has much more definable role.'

As noted above, most innovation is internal to firms and is therefore likely to involve the adoption, adaptation and application of new or improved processes from outside, so this observation suggests that there is quite some scope for VET to support innovation.

VET may also have a role to play in applied research. Beddie and Simon note the potential to involve VET learners in applied research projects, which will enhance learning and lead to a more innovative workforce[41]. Involvement in applied research might be more applicable to higher-level VET rather than VET in general.

4.2 VET's different roles

It might be useful to think of VET's role in respect of innovation in two senses: a somewhat passive, weak role and a more proactive and direct role. VET could be seen as having a passive role by virtue of its ability to develop in learners the types of transversal skills needed for innovation (notwithstanding the lack of a proven relationships between innovation and particular skills noted above). VET is well placed to develop the types of skills needed for innovation (team-work, problem-solving, critical thinking etc.), especially if it embraces more innovative teaching and learning methodologies, e.g. project-based learning[42]. However, the extent to which transversal skills are explicitly well catered for by VET is a moot point: detailed analysis of VET qualifications indicates that typically they are focused on technical skills and that transversal competences are poorly served[43].

Alongside this rather passive role, VET also has the potential to more actively and directly support innovation in companies. This role has been the subject of more interest in recent years. Recent research, in response to developments in EU policy has identified the role that VET might play in 'innovation eco-systems' and in regional development or smart specialisation strategies. Hazelkorn and Edwards have found that VET 'has a strong capacity to deliver and play a major role in smart specialisation strategies', e.g. supporting diffusion of innovation, providing relevant skills for industrial development and supporting local/regional innovation ecosystems. [44] They also note that work needs to be done to 'bring VET to the attention of policy makers and practitioners in the field of innovation and smart specialisation, as well as the field of local and regional development more broadly'. There is an interesting contrast here with the role of higher education in innovation, which has been the subject of academic research for some time, reflecting the practical engagement of universities in supporting the conversion of science-based innovations into products that can be taken to market, e.g. through the development of science parks and other ventures which bring together innovation, education and research into 'knowledge triangles'.

VET's role in innovation also features in the concept of Centres of Vocational Excellence (CoVE). The EC's CoVE mapping exercise identified a number of distinct features that VET can or could bring to bear on the topic of innovation:

- Close and practical business links
- Connections to all sectors of business, not just hi-tech, which tend to be the focus of innovation strategies
- Its expertise in low and intermediate level skills development, often overlooked in innovation strategies which tend to focus on high level (research and STEM) skills[45].

One of Europe's leading CoVEs is Tknika in the Basque Country of Spain, which has developed a modus operandi based on close relationships with businesses and developing leading edge training programmes using the latest equipment, e.g. in cybersecurity, 3D printing and sustainable agriculture, so as to develop a

[41] Beddie, F. M., & Simon, L. (2017). VET applied research: driving VET's role in the innovation system. Adelaide: National Centre for Vocational Education Research

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[45] European Commission (2019) Mapping of Centres of Vocational Excellence. Section 8.2. Luxembourg: Publications Office of the European Union, 2019. https://ec.europa.eu/social/main.jsp?catId=738&langId=en&pubId=8250

virtuous cycle between VET and innovation[46]. For example, the Ikaslab project has involved creating laboratories in Vocational Training Centres that are equipped with 3D printing equipment first to support practice and experimentation with the technology amongst learners but then to promote the use of 3D printing in companies in the field[47]. In addition, Tknika has developed a collaborative, challenge-based learning model (ETHAZI) that supports learners to develop the types of transversal (as well as technical) skills needed for innovation, e.g. team-work and problem-solving[48].

Another aspect to consider are the potential differences between skills development in the initial phase (IVET) and as part of adult learning (CVET), including upskilling and reskilling. Skills acquisition whilst in work 'contributes to the technological capabilities of firms and is positively related to innovation'[49]

[46] https://www.cedefop.europa.eu/en/news/spain-basque-country-vet-innovation-offers-good-practices-future-employment
[47] https://tknika.eus/en/cont/proyectos/4577/#
[48] https://tknika.eus/en/cont/proyectos/ethazi-3/#
[49] p. 13 OECD (2011) Skills for Innovation and Research. https://www.oecd.org/sti/inno/skillsforinnovationandresearch.htm

Annex 2. Key Research Questions

1. **What are the key challenges and needs of companies regarding skills development to support innovation?**
    - What role can VET providers play in addressing these challenges and supporting companies in meeting their innovation needs?
    - Are VET providers able to keep up with innovation and provide students with the right skills to be employed in innovative companies?
        - How could this be ensured?

2. **What role does the SELFIE WBL tool currently play in connecting companies and VET providers to support innovation?**
    - Does SELFIE WBL cover areas and items relevant to innovation in companies?
    - Does SELFIE WBL allow, on the one hand, companies to highlight their innovation needs and, on the other hand, VET providers to meet these needs?

3. **How could the SELFIE WBL tool be developed to play a stronger role in connecting companies and VET providers to support innovation?**
    - Could it be used to establish/reinforce the dialogue between innovative companies and VET providers?
    - What changes to the current tool would be required?
    - Are there additional areas that would need to be covered?
    - Looking at the following items, what additional questions/elements should be considered in the questionnaire:
        - Leadership – e.g. existence of innovation plans, strategies
        2. Collaboration and Networking – e.g. companies working with VET schools on innovation projects
        3. Infrastructure and Equipment – e.g. availability of innovative technologies for skills development, VET school innovation/entrepreneurship hubs
        4. Continuing Professional Development – e.g. preparedness of staff for innovation
        5. Pedagogy – e.g. how far pedagogy supports innovation
        6. Assessment practices – e.g. how far assessment supports innovation
        - Student (Digital) Competence – e.g. inclusion of competences for innovation

Annex 3. Research Protocol – Interviews with key stakeholders

SELFIE FOR WORK-BASED LEARNING

SCOPING RESEARCH

Topic guide for interviews with key stakeholders

Background:

Scope and aim of research

This interview forms part of a small-scale scoping study commissioned by the JRC. The purpose of the study is to make a first assessment of **the potential for SELFIE for work-based learning to play a role in supporting the relationship between i) VET providers and ii) companies when it comes to business innovation**.

SELFIE for work-based learning (WBL) is a free online tool that supports Vocational Education and Training (VET) schools and companies to assess their level of digitalisation when it comes to teaching, learning and training. SELFIE for WBL is an extension of the general education SELFIE tool. This extension of SELFIE considers digitalisation in line with the specific requirements of WBL and integrates the perspectives of VET school leaders, VET school teachers, VET learners and in-company trainers in its assessment across a number of categories including infrastructure and equipment; professional development; classroom implementation, leadership, assessment practices and others.

The research conducted as part of this scoping research involves a mix of desk research (secondary data collection) and interviews (primary research) with VET providers, companies and social partners. **The final objective of the scoping exercise is to develop a scoping report**, primarily building on the findings from the interviews, identifying potential actions to be taken or items to be further discussed or analysed, in order to better support company innovation through the SELFIE tool in the future.

Understanding 'innovation' within the context of this interview: key considerations

Our working definition of business innovation was developed by the OECD/Eurostat for the latest edition (2018) of the Oslo Manual:

> *A **business innovation** is a new or improved product [good, service or combination] or business process (or combination thereof) that differs significantly from the firm's previous products or business processes and that has been introduced on the market or brought into use by the firm.*[50]

This definition thus differentiates between, on the one hand, product and process innovations and, on the other hand, innovations that are external to the firm (and introduced on the market) and innovations that are internal to the firm. There is also a difference between innovation as an outcome (an innovation) and the activities by which innovations come about (innovation activities). Furthermore, as the OECD previously

[50] OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.9, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

noted:

> *Innovation is a broad concept which encompasses a wide range of activities and processes: markets, entrepreneurship, networks and competition, but also skills and organisations, creativity and knowledge transfers*[51].

Another dimension of variation is that how firms undertake their innovation activities varies greatly:

> *Some firms manage their innovation activities through well-defined innovation projects or programmes with dedicated budgets, for which an innovation represents an intermediate or final milestone. Other firms primarily integrate their innovation activities into regular business operations and work to make continuous improvements to their products and business processes, while other firms primarily engage in innovation activities on an ad hoc basis.*[52]

Note on privacy and data protection:

Taking part in the study is voluntary. Your views, personal data and opinions will be treated as confidential, in line with the EU's General Data Protection Regulation (GDPR).[53] We will not attribute quotes to any consultees. We will be using the evidence from the interviews to guide the reporting stages of our research.

Interview details	
Format	Online
Software	Microsoft Teams
Date interview conducted	[To be filled in]
Researcher(s) responsible	[To be filled in]

[51] OECD (2009) Innovation in Firms: A Microeconomic Perspective. https://www.oecd.org/sti/inno/innovationinfirmsamicroeconomicperspective.htm

[52] OECD (2019), "Concepts and definitions for measuring business innovation", Section 3.7, *Oslo Manual 2018: Guidelines for Collecting, Reporting and Using Data on Innovation, 4th Edition*, OECD Publishing, Paris, https://doi.org/10.1787/9789264304604-6-en.

Questions

1. Respondent profile and expertise

- Please provide a brief overview of your role and the work of your institution/company as relates to the core research themes:
    - VET & work-based learning
    - Digitalisation & innovation
- Do you have personal experience with the SELFIE for WBL tool?
    - If yes:
        - Relevance to their institution/ company's needs
        - Follow-up actions taken post-assessment
        - Inquire about their interest in participating in a short SELFIE promotional video organised by the JRC
    - If no:
        - Probe about relevance for institution/company needs based on scan of SELFIE for WBL questionnaire forwarded by research team

2. Innovation needs of companies

- In your view, what are the most significant challenges and needs of innovative companies in relation to acquiring the skills required?

[e.g. company policies that facilitate efficient organisational changes, skills development, participatory work processes, funding, company culture, development of regional/sectoral networks, digital infrastructure access/use, company-level leadership/ innovation strategies]

- What barriers do you currently see when it comes to companies meeting their innovation needs?

3. The role of VET

- Please elaborate on what you consider to be VET's role in supporting business innovation, considering for instance:
    a. Skills development (note: certain technical and transversal skills such as communication/teamwork/entrepreneurship are typically associated with innovation)
    b. Technology diffusion in companies
    c. Applied research projects
    d. It's role in 'innovation eco-systems' and regional development *(e.g. CoVEs)*
    e. Others?
        - Make sure to also probe about the role of CVET
- Are VET providers able to keep up with innovation and provide students with the right skills required by innovative companies?
    - How could this be ensured?

4. The role of SELFIE for WBL

- Based on your reading of the SELFIE for WBL questionnaire, to what extent do you believe it can support the promotion of company-level innovation in its current state? *How/why not?*
    - Does SELFIE WBL cover areas and items relevant to innovative companies?
    - Does SELFIE WBL allow, on the one hand, innovative companies to highlight their needs and, on the other hand, VET providers to meet these needs?
- Looking at the questionnaire, how can the SELFIE for WBL tool be improved to better connect VET schools to business innovation in the future?
    - Example:
        - Area A: Leadership: Include a section of questions regarding VET providers' engagement with wider 'innovation eco-systems'/regional development initiatives and networks
        - Area B: Collaboration and Networking – e.g. include activities such as companies working with VET schools on innovation projects
        - Areas C: Infrastructure and Equipment, E & F: Pedagogy, H: Student Digital Competence: Include a wider range of

skills/competences/methodologies/equipment more closely linked to innovation (e.g. robotics, 3d printing etc.)

- At present, only digital innovation is considered in the SELFIE for WBL questionnaire (in terms of processes, equipment and skills). What are your thoughts around updating SELFIE for WBL to better connect innovation within companies with VET schools by considering innovation beyond the digital sphere, e.g. assessing skills associated with innovation more widely (transversal skills such as problem-solving, creativity, critical thinking etc.)?
  - How could this be achieved?

Thank and close

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