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A Continent in Search of Skills?

Aiding the Twin Transition Through Skill Formation Policy

Niccolo Durazzi, Patrick Emmenegger and Alina Felder-Stindt

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Executive summary

The twin transition demands a robust policy infrastructure. Central to this infrastructure is the development and availability of appropriate human capital. EU institutions have been actively working to ensure that Europe can provide the skills required for the twin transition, promoting various initiatives aimed at integrating European education and training systems. However, these efforts have been constrained by the EU's limited role in education and training policies, as the treaties primarily assign the EU a supportive role rather than allowing it to replace national policies. EU action has faced particular challenges in the realm of vocational education and training (VET), where national stakeholders have often resisted 'Europeanisation' efforts, defending national VET systems. This working paper suggests that these limitations can be transformed into advantages. We argue that the inherent treaty-based constraints on establishing a 'European' education and training system present an opportunity for EU policymakers to adopt a more place-based approach, which would not only be more effective within the institutional limits but also it would better address skill needs at the local level. Our analysis reveals significant cross-country heterogeneity in the demand for green and digital skills. Therefore, EU initiatives should prioritize supporting Member States in meeting the specific skill needs of their national and regional labour markets. In VET, this entails shifting focus from creating a unified European VET system to: (a) further supporting successful initiatives within national VET models, and (b) facilitating the recognition of VET qualifications and enhancing the mobility of VET workers within Europe, even when qualifications are awarded by different national systems. In higher education, this approach involves targeted expansion, aligned with the dominant sectoral specializations of Member States. For example, expanding STEM skills in countries leading in green technology production represents a more effective strategy in higher education policy.

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1. Introduction

The twin transition, characterized by the simultaneous greening and digitalization of economies and societies, presents a significant challenge and opportunity for Europe. Central to navigating this transition is the development of a robust policy infrastructure that ensures the availability of the necessary human capital. Recognizing this, EU institutions have initiated various efforts to equip Europe with the skills required to meet these emerging demands. These initiatives aim to harmonize and integrate European education and training systems, thereby supporting the twin transition. However, the EU's role in education and training is inherently limited by the treaties which assign the Union a supportive rather than directive role in these areas. This limitation has been particularly evident in vocational education and training (VET), where national stakeholders have often resisted efforts to 'Europeanise' their systems, choosing instead to safeguard their national models. This working paper argues that the constraints imposed by the treaties can be transformed into strengths. By embracing a more place-based approach to education and training policy, EU policymakers can effectively navigate these institutional limitations while better addressing the diverse skill needs across Member States. Our analysis shows significant variation in the demand for green and digital skills across Europe, suggesting that a one-size-fits-all approach is neither feasible nor desirable. Instead, the EU should focus on enabling Member States to meet the specific skill needs of their national and regional labour markets. In the realm of VET, this means shifting away from the aspiration of a unified European system and instead concentrating on supporting successful initiatives within national models and enhancing the recognition and mobility of VET qualifications across Europe. Similarly, in higher education, we recommend a strategy of what we term targeted expansion of higher education aligned with the sectoral specializations of individual Member States – such as promoting STEM skills in countries leading in green technology.

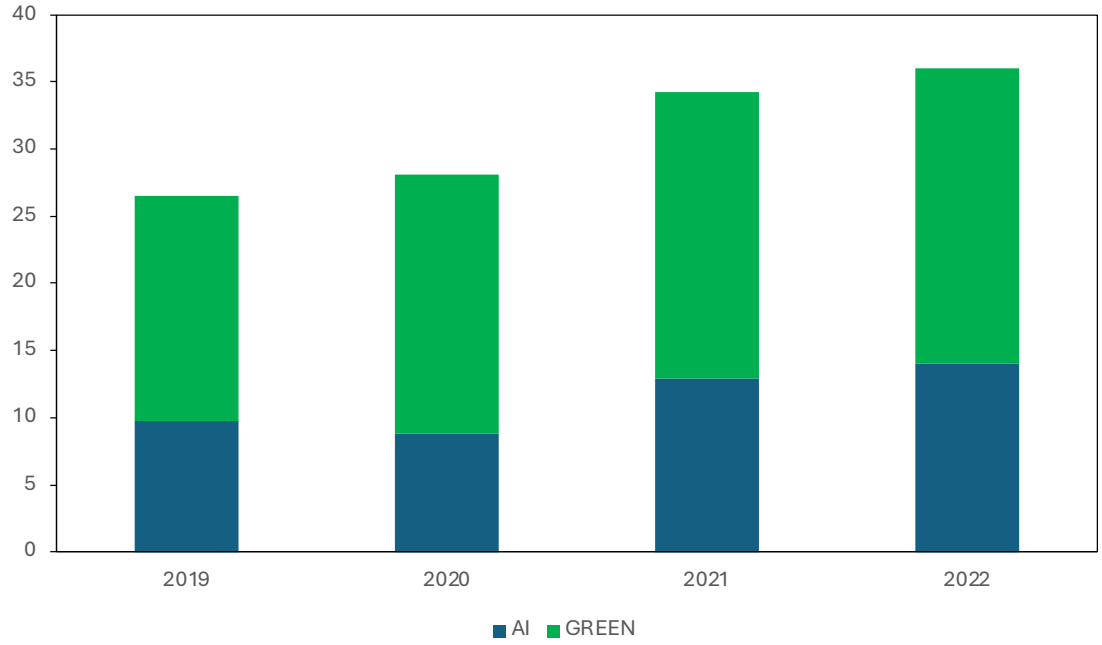
2. Demand and supply of digital and green skills

Measuring in a credible way the demand and supply of digital and green skills is a difficult task. As many other parts of the twin transition, its skill base is unfolding as we write, and a moving target is notoriously hard to pin down. Yet, the significant interest that the twin transition has triggered among academic and policy-oriented researchers in recent years led to the creation of some datasets that allow us to gauge the demand for skills that *at the moment* constitute the backbone of the human capital needed for the twin transition. In this section, we rely in particular on Bruegel's *Twin transition skills dashboard* (Gotti, Güner, & Stephany, 2024). This approach is based on web-scraping job adverts posted online across the European Union (EU) since 2019. The data scraped from the web has then been systematised to capture a variety of features that help us paint a picture of the demand for twin transition-related jobs, and therefore *skills*, across Europe. We focus on three main characteristics derived from job adverts: (i) the

size of the digital and green sector, as proxied by the share of green- and digital- related job adverts across Europe; (ii) the *skills* that are most commonly listed in digital and green job adverts (i.e. what skills and knowledge recruiters want candidates to possess); and (iii) the *occupations* that digital and green job adverts are associated with (e.g. whether they are managerial or manual jobs), which we take as a proxy for the level and complexity of skills required to perform the job.

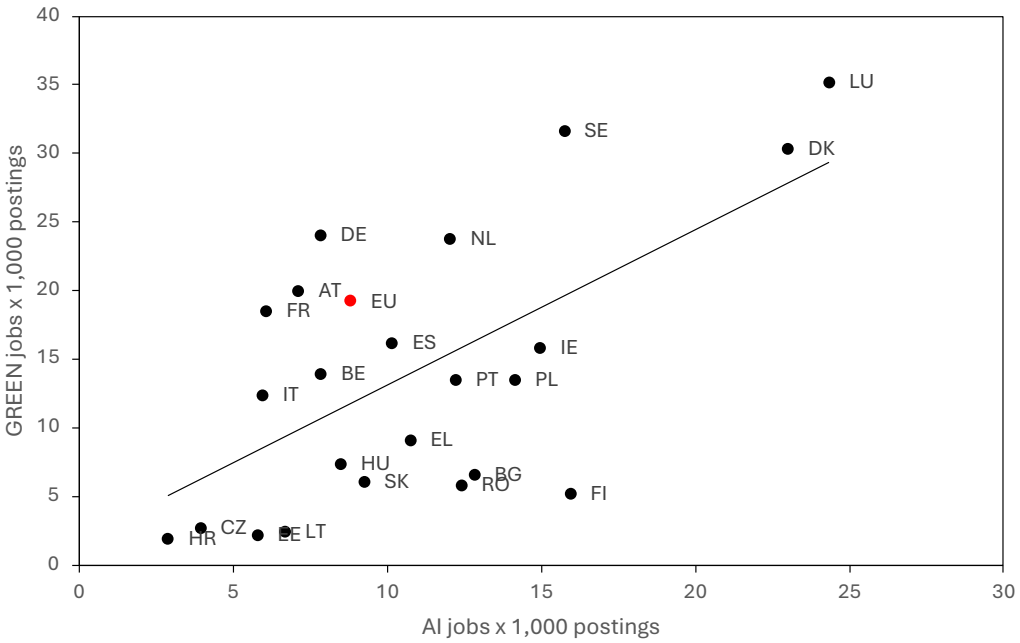
In terms of size, Figure 1 shows a clear upward trend in the demand for digital- and green-related jobs over time. The time series of the Bruegel data is limited to four years, but even within such a short timeframe, we observe a steady increase in demand for both digital and green jobs in the EU. In 2019, just above 25 per 1,000 job adverts were green or digital, while the figure grew to above 35 per 1,000 job adverts in 2022, with green jobs accounting for roughly two thirds of the total and increasing at a faster pace than their digital counterparts. Figure 2 shifts the focus from EU- to country-level data. It shows that green and digital jobs are positively correlated (.63), suggesting a mutually reinforcing relationship between green and digital and supporting the notion of a 'twin' transition, as opposed to 'two' transitions. At the same time, some countries seem to display a more circumscribed specialisation in only one leg of the twin transition. Such cases are, for example, Finland and Germany. The former shows above-EU-average demand for digital jobs but well below-average demand for green jobs. The reverse holds true for Germany. This is in line with existing accounts by scholars of comparative capitalism that noted how some countries' growth models have been relying more strongly on single sectors, compared to other countries that have branched out into multiple sectors overtime (Thelen, 2019). Germany's doubling-down in the realm of manufacturing (Diessner, Durazzi, & Hope, 2022), which included seizing new export markets in green manufacturing (Nahm, 2022), or Finland's strong drive into ICT markets in a context of de-industrialisation (Ornston, 2013) are examples of such economic strategies targeting primarily a single sector of specialisation.

Figure 1: The growth of digital and green jobs in the EU over time as postings per 1,000 job adverts



Source: own elaboration based on Gotti et al. (2024).

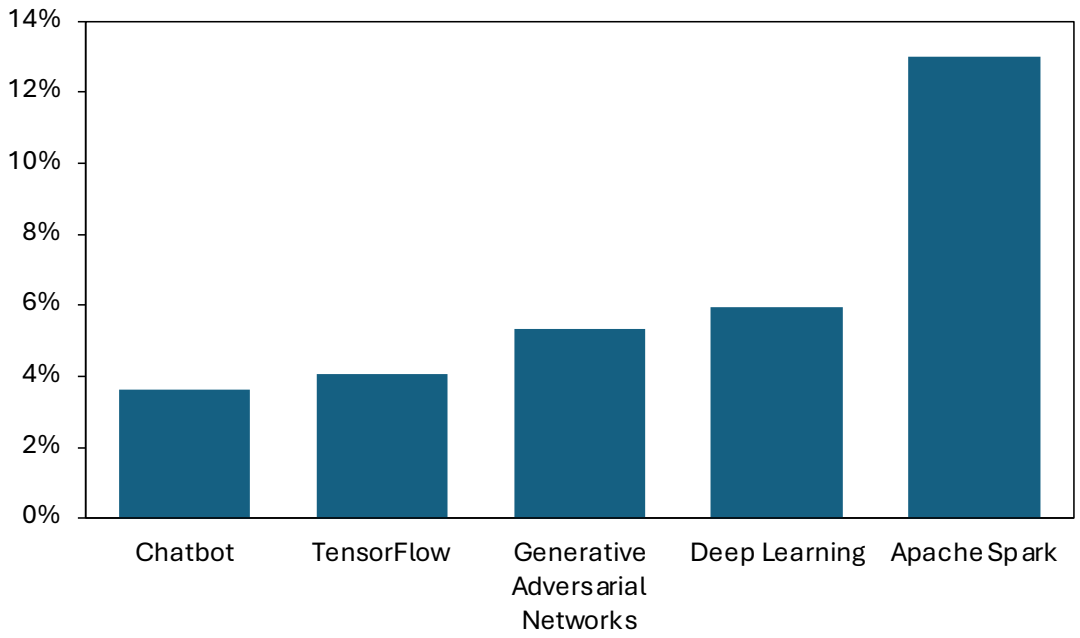
Figure 2: Digital and green jobs in EU countries per 1,000 postings in 2020



Source: own elaboration based on Gotti et al. (2024).

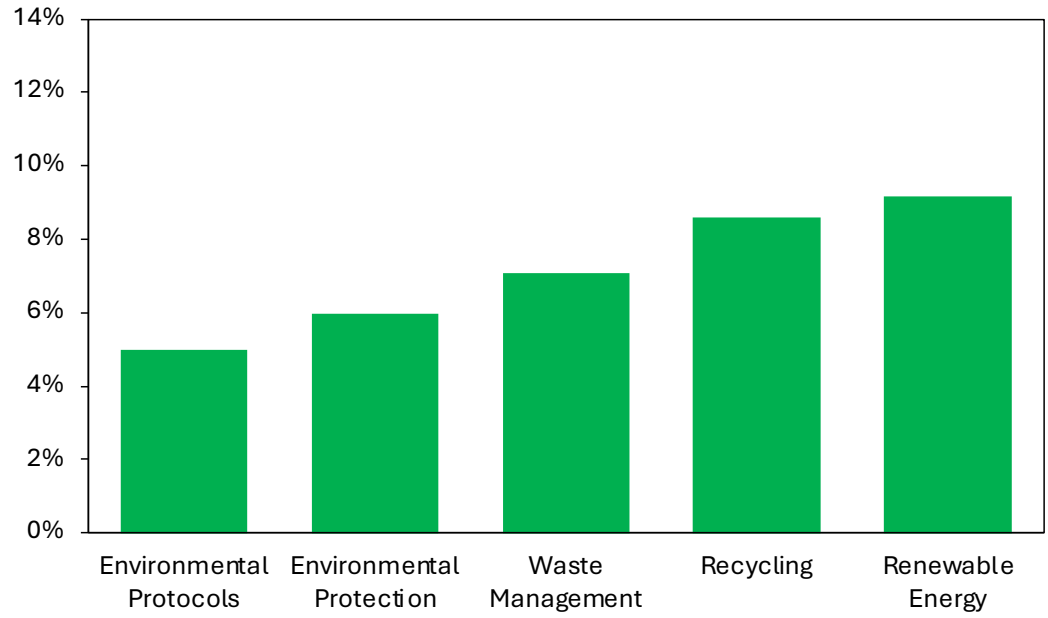
Figures 3 and 4 turn to the actual skills that are required across digital and green job ads, showing the five most popular ads across the EU. Here we note rather striking differences. Firms that advertise digital jobs look for workers who have knowledge of particular machine learning software to process big data (e.g. Apache Spark) or simulate human-to-human conversations (e.g. Chatbot). These are skills that point at highly specialised professional profiles, with high levels of formal education and training – a point which we shall return to later. The skills required in green jobs are instead more varied. Most of them (e.g. renewable energy; waste management) suggest the need for both highly specialised professional profiles – such as environmental engineers – as well as jobs that tend to be found in the 'middle' of the skill distribution, such as vocationally-trained workers performing jobs with a more practical orientation – such as the installation of solar panels, to stay within the remit of the renewable energy example.

Figure 3: Top 5 AI skills required in the EU (2020)



Source: own elaboration based on Gotti et al. (2024).

Figure 4: Top 5 GREEN skills required in the EU (2020)



Source: own elaboration based on Gotti et al. (2024).

Such an interpretation of the top skills required across digital and green jobs is corroborated by the breakdown of digital and green jobs by occupational category, which we report in Figure 5. Using the ISCO-08 major groups,[4] we note again striking differences between digital and green jobs. Digital jobs fall overwhelmingly in the major group 2, i.e. that of 'Professionals' (nearly 70%). Professionals are defined as those workers who

> 'increase the existing stock of knowledge; apply scientific [...] concepts and theories; teach about the foregoing in a systematic manner; or engage in any combination of these activities. Competent performance in most occupations in this major group requires skills at the fourth ISCO skill level [i.e. the highest level, usually associated with formal educational attainment at tertiary level]' (ILO 2012, p. 109).

Coders or data engineers fit squarely into this definition. If we look at the occupational breakdown of green jobs, instead, we find a very different picture. Highly skilled occupations top these jobs too, but their share is much more limited compared to digital jobs. The Professionals category is the top one across green jobs too, but its share at 33% is less than half compared to the same occupation in digital jobs. The second most represented occupational category is that of 'Technicians and Associate Professionals' (major group 3), who are also

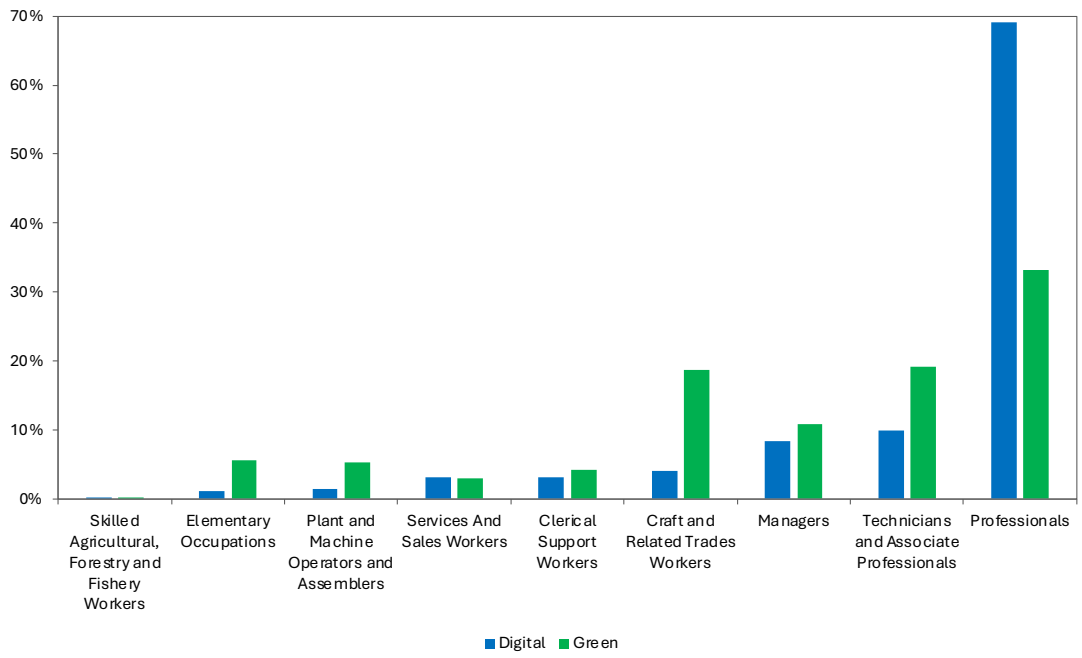
[4] ISCO-08 seeks to capture "a set of tasks and duties performed, or meant to be performed, by one person" and allows for the comparison jobs across countries.

highly skilled workers but perform roles with greater emphasis on technical skills of the type that both higher education and advanced vocational training programmes may be able to provide. A significant proportion of green jobs (almost 20% of them) then falls instead into a radically different occupational category, namely that of major group 7 'Craft and Related Trades Workers', which are defined as workers who

> 'apply specific technical and practical knowledge and skills in the fields to construct and maintain buildings; form metal; erect metal structures; set machine tools or make, fit, maintain and repair machinery, equipment or tools; carry out printing work; and produce or process foodstuffs, textiles and wooden, metal and other articles, including handicraft goods. Competent performance in most occupations in this major group requires skills at the second ISCO skill level [i.e. intermediate skill level, commonly associated with upper-secondary vocational education and training]' (ILO 2012, p. 277).

The strong presence of both professional and craft workers among green jobs suggests that the green transition, compared to its digital twin, produces a bifurcated demand for skills in which highly specialised technical workers (e.g. environmental engineers) are high in demand alongside middle-skilled vocationally-trained workers.

Figure 5: Digital and green jobs by occupational category

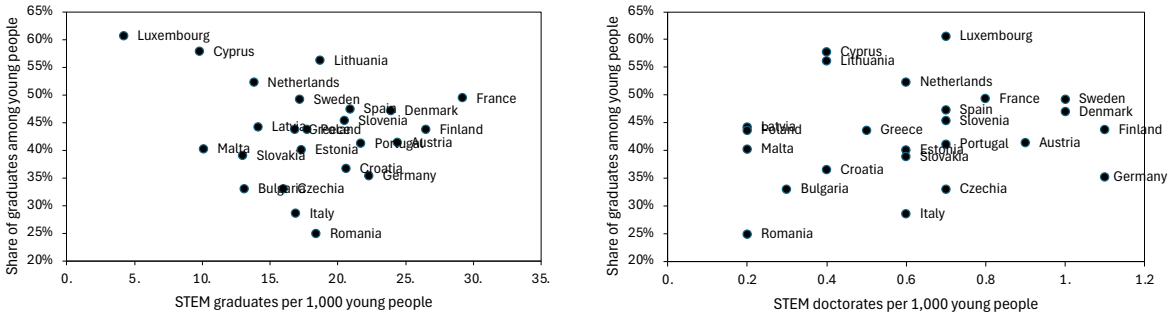


Source: own elaboration based on Gotti et al. (2024).

How well-equipped are national education and training systems to meet the demand for skills in the context of the twin transition? We turn to the question of the 'supply' of skills in the

remainder of this section. Given the centrality of occupational profiles at the highest skill level across digital and (to a lesser extent) green jobs, the first basic requirement for a country's education and training system is to produce a significant number of graduates. In this respect, the picture is mixed across Europe. Some countries – e.g. Italy and Romania – have a share of graduates among the 25–34-year olds that is below 30%, while other countries – e.g. the Netherlands as well as a number of smaller European countries – stand at above 50% (see Figure 6 below). Yet, given the contours of skill demand outlined in the first part of this section, it is plausible to expect that in many instances the twin transition requires technically specialised professional profiles that may not be satisfied by 'any' university graduates. In the case of the green transition, the type of tertiary graduates that are expected to be most in demand are STEM and in particular engineering graduates (Durazzi, Emmenegger, & Felder, 2024). The digital transition requires graduates with advanced quantitative and programming skills that are less tied to specific degrees but that are still more likely to be found among STEM and social science graduates compared to, say, graduates in arts and humanities. To gauge the ability of national higher education systems to supply highly specialised professionals, Figure 6 therefore plots the overall supply of higher education graduates against the supply of STEM graduates (left panel) and STEM doctoral-level graduates (right panel). Figure 6 shows that some countries – such as Finland and Germany – produce above-average STEM graduates (and top the STEM doctoral graduates measure) with just average or (in the case of Germany) below average overall graduation rates. This suggests that countries may be able to satisfy a crucial demand for highly specialised skills in the context of the twin transition without necessarily moving in the direction of near-universal higher education. Rather, countries may satisfy a crucial source of skill demand through a strategy that we have defined elsewhere as targeted expansion of higher education (Durazzi, Emmenegger, & Felder, 2024) whereby the government actively promotes the expansion of STEM skills, rather than the expansion of higher education tout-court.

Figure 6: Young university graduates and young STEM specialists across Europe

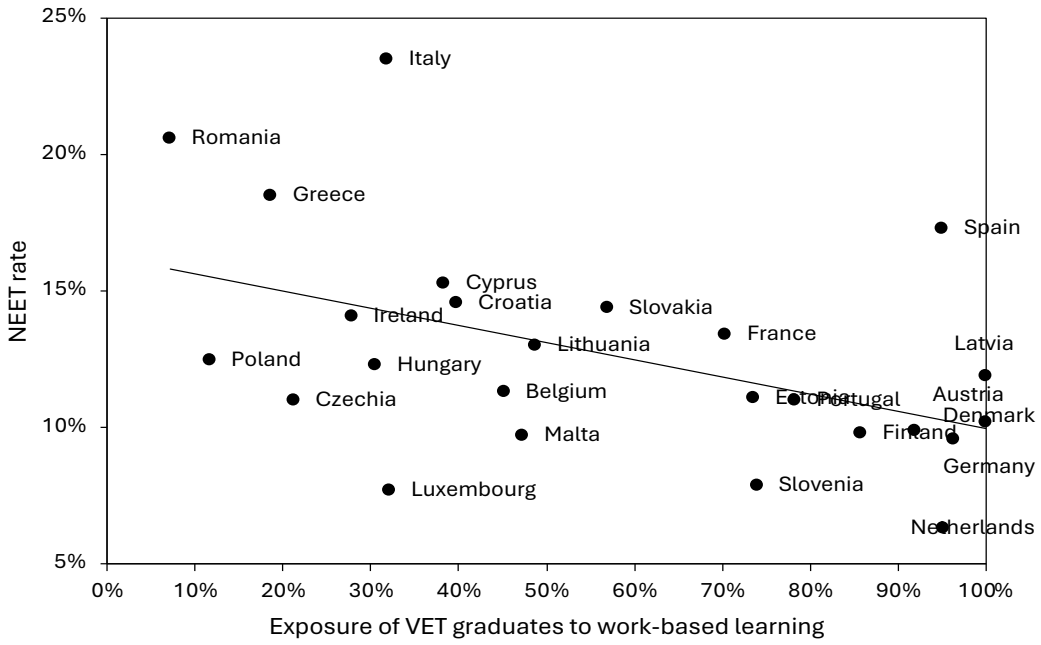


Source: own elaboration based on Eurostat data.
Note: All countries for which *comparable* data is available according to Eurostat are included

Yet, we have also noted earlier that high-level skills are predominant, but they do not account for the entire demand for skills in the context of the twin transition. Of particular importance for the green leg of the twin transition is the availability of well-embedded vocational training systems that are able to supply high-quality intermediate skills to the labour market. There is a two-fold challenge that vocational training systems are (theoretically) well-placed to address in the context of the twin transition. Firstly, they need to provide high-quality skills and be able to cope with skill requirements that are likely to change more frequently and more radically compared to the past, given that the twin transition is underpinned by fast changing technological advancements (Schmidt & Sewerin, 2017). Secondly, in the context of skill shortages induced by demographic changes and given the strong demand for skills at various levels that comes with the twin transition, European countries cannot afford to forego any human capital. Vocational training systems have a crucial role in this respect as they have traditionally been the segment of the education systems that have kept engaged those young people – often from disadvantaged socio-economic backgrounds – that are most at-risk of dropping out of the school system leading to both economic and social losses. Yet, if training systems are to (a) be responsive to fast-changing skills needs and (b) keep all young people engaged, including those from disadvantaged background, they need to be of high-quality. A crucial feature in this respect lies in the involvement of firms in the design and provision of training in cooperation with public authorities. This system of 'polycentric governance' at the crossroads of private and public sector has been already found to support the adaptation of traditional training curricula to the needs of the green economy (Carstensen and Ibsen, 2024). At the same time, training systems with a heavy practical component provided directly by firms have been time and again identified as offering an incentive set for academic low achievers to remain engaged with the education system (Soskice, 1994) and therefore limiting the risk of human capital 'loss'. Indeed, this relationship seems to still hold true today. Figure 7 plots the exposure of vocational education and training (VET) graduates to work-based learning against

the rate of NEETs and shows a negative relationship. While no doubt this relationship is influenced by other factors too (e.g. the general status of the economy and the labour market), a greater involvement of firms in the design and delivery of training seems a desirable avenue to meet fast-changing skill needs while minimising the risk of human capital loss in an era of skill shortage.

Figure 7: Involvement of firms in VET and human capital mobilisation



Source: own elaboration based on Eurostat data.

To what extent has EU-level policy supported national education and training systems in meeting the demand for skills in the context of the twin transition? We turn to this question in the next section.

3. A review of EU-level policy initiatives to create digital and green skills

Joint efforts among the European Union's Member States to adapt their skill formation systems to wider socio-economic transformations are not new. Knowledge has been identified as a precondition for economic competitiveness and thus has been at the fore of the EU's overall strategies at least since the 2000s. However, the recent manifold EU-level initiatives in the areas of higher education and VET point to unprecedented attention at the supranational level to policies facilitating the transition towards a 'Europe of Knowledge'. It is not only universities which feature prominently in EU action such as the European Universities Initiative, but the EU's Skills Strategy, the Alliance for Apprenticeships, and the European Year of Skills illustrate that VET features prominently among EU-level priorities as well. Regardless of whether the

focus is on higher education or VET, however, a common characteristic of recent EU initiatives in the field of education and training seems to be the attempt to move toward *European* education and training systems, which practically meant promoting skills policy with limited appreciation of the vastly different labour markets and economic models that exist across Member States and that, therefore, produce different demands for skills (as section 2 exemplified).

While VET was acknowledged as an area for Community action already in the Treaty of Rome (Corbett, 2003), the EU is however only allowed to *support* Member States' policy action in education and training. Consequently, EU education and training policy ought to add to national policies and not replace them. Accordingly, Articles 165 and 166 of the Treaty on the Functioning of the European Union (TFEU) emphasize the contribution of EU support for the quality of and access to education and training, on the one hand, and the responsibility of Member States for educational and training content and systems, on the other hand.

European cooperation for skills development and exchange takes three different forms: (i) intergovernmental coordination, (ii) community programmes and (iii) organizational cooperation (Felder-Stindt, forthcoming). Intergovernmental coordination manifests itself in the mutual recognition of diplomas and in the exchange of information and experience. Recognition is facilitated through the Bologna and Copenhagen processes, the European Qualifications Framework (EQF) and the European Credit Transfer System (ECTS). The primary outlets for best practice exchange for practitioners from the various education sectors are the working groups under the Open Method of Coordination in the European Education Area (EEA) strategic framework. Community programmes provide funding instruments which are supposed to increase the mobility of learners and teachers and the cooperation between educational institutions. The formation of practitioner networks supports intergovernmental coordination and the implementation of EU funding. European cooperation is further supported through dedicated EU institutions such as the European Centre for the Development of Vocational Training (CEDEFOP) and the European Training Foundation (ETF) and through regular reporting such as the Education and Training Monitor.

Supranational financial support in the area of skills bears manifold connections to other policy fields including research and innovation policy, labour market policy and youth policy. As such, the European Union offers financial support for reskilling and upskilling through various programmes such as the European Social Fund Plus (ESF+), the Recovery and Resilience Facility (RRF), the European Regional Development Fund, the Just Transition Fund, InvestEU, the Digital Europe Programme, Erasmus+, Horizon Europe, LIFE, the Modernisation Fund, and the Neighbourhood, Development and International Cooperation Instrument – Global Europe. The ESF+ is the primary funding tool for enhancing workforce skills, particularly by aiding institutions and services in assessing and anticipating skill needs and challenges, and by

supporting reskilling and upskilling opportunities provided by both public and private sectors. The Reinforced Youth Guarantee aims to ensure that all young people receive a quality offer of employment, continued education, an apprenticeship, or a traineeship within four months of becoming unemployed or leaving formal education. Reforms and investments in Member States' national recovery and resilience plans under the RRF often focus on skills development, particularly in connection with active labour market policies and youth employment support. Approximately 20% of the social expenditure in these plans is dedicated to employment and skills.

In contrast to the area of higher education, where the EU has succeeded to continuously expand financial and legal instruments, EU action for joint approaches to VET has resonated less strongly at Member State level. Not only has the European Credit System for VET (ECVET) been discontinued,[5] but also cross-border cooperation and mobility of individuals who are enrolled in VET/work in VET provision is more difficult to achieve. While the priority of the EU's first action programme for education from the mid-1970s was the transition from school to work, the programme was "taken up enthusiastically by academics" (Corbett, 2003, p. 324). As a result, the most successful measures of the programme were the supranationally funded joint study programmes and study visits, which ten years later were transformed into the Erasmus programme. While acknowledging that VET mobility is under researched, comparative studies on learner mobility document more obstacles to mobility in VET than in higher education (Kmiotek-Meier et al., 2019). This picture equally applies to intergovernmental coordination which came first for higher education with the Bologna Process and which informed the development of an analogue process for VET, i.e. the Copenhagen Process. Graf and Lohse show that policy transfer proves to be more successful for the area of higher education than for VET due to more favourable demand-side, programmatic, contextual and application conditions (Graf & Lohse, 2021). Even though the recent initiative of the European Alliance for Apprenticeship experienced greater Member State commitment, Rohde-Liebenau and Graf find that European and national-level initiatives have been developed in parallel and without much recognition of the corresponding EU-level policy (Rohde-Liebenau & Graf, 2023). The resistance of certain actor groups towards EU VET policy such as trade unions lies in the nature of EU initiatives for VET being strongly market-oriented (Trampusch, 2008). Interestingly enough, the European Alliance for Apprenticeships was not faced by the usual scepticism. Instead, those VET stakeholders who had been critical of previous initiatives were strongly involved in the drafting process of the alliance and uploaded their preferences (Rohde-Liebenau & Graf, 2023).

[5] Council of the European Union. 2020. 'Council recommendation of 24 November 2020 on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience (2020/C 417/01)'.

EU activities in matters of education and training were always supposed to support wider Community and Union principles such as mobility of labour and the freedom of establishment. Skill policy has become a distinguishable area of Union action with the Lisbon strategy, where knowledge has been coined as a condition for economic competitiveness. More recently, skills have not only been connected to the Single Market and its sustained resilience after COVID-19, but also to the digital and green transitions. The recent EU policy discourse centres on the skill demands for the digital and green transition. Next to referring to the core role of skilled labour to manage the twin transition, the decision on a European Year of Skills[6] emphasizes the central role of social dialogue partners in anticipating skills needs in the labour market. Moreover, recent EU legislation related to the Single Market such as the Regulation on establishing the Strategic Technologies for Europe Platform (STEP)[7] raises labour and skills shortages as a major concern for those sectors which are considered key for the green and digital transitions. The latter regulation calls "to boost the participation of more people in the labour market of the relevant sectors, in particular through investments in learning and life-long learning, the enhancement of relevant skills and the creation of quality jobs and apprenticeships for young and disadvantaged persons who are not in employment, education or training."

Even before the pandemic, an action plan for digital education existed at the EU level. It was renewed for the period 2021-2027 and strongly relates to Europe's Digital Decade. The latter provides the vision for a human-centred, sustainable digital society that empowers citizens and businesses. These goals include ensuring that 80% of adults have basic digital skills by 2030.[8] The European Commission used Covid-19 as a challenge for the education sector to push existing goals and ideas. In April 2023, it published two proposals for Council recommendations: one on the key factors for successful digital education and training, and the other on imparting digital skills in general education and VET. The proposals stem from the structured dialogue on digital education and skills between the European Commission and EU Member States lasting from October 2021 to March 2023. At their meeting in November 2023, the EU education ministers adopted the two recommendations[9] which call on them to ensure universal access to inclusive and high-quality digital education and training and to provide digital skills at all levels of education. EU countries are urged to develop national strategies for digital education and skills, work closely with stakeholders, invest in digital equipment, infrastructure, tools, and content, and promote targeted training to support teachers in using

[6] Decision (EU) 2023/936 of the European Parliament and of the Council of 10 May 2023 on a European Year of Skills.
[7] Regulation (EU) 2024/795 of the European Parliament and of the Council of 29 February 2024 establishing the Strategic Technologies for Europe Platform (STEP).
[8] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030.
[9] Council Recommendation on improving the provision of digital skills and competences in education and training, 23.11.2023, 15740/23.
Council Recommendation on the key enabling factors for successful digital education and training, 23.11.2023, 15741/23.

digital technologies. The European Commission will support the implementation of these recommendations through conducting a survey on digital education in Europe and by facilitating the recognition of digital skills certifications. The development of digital skills is further supported through EU funding. By allocating one-fifth of the funds from the Recovery and Resilience Facility to the digital transformation, the Member States are supported in digitalizing their educational infrastructure.

Already the "Skills for Green Jobs" report by CEDEFOP from 2010 (Cedefop, 2010, p. 8)referred to "how the fundamental weaknesses in the EU's skills base matter more to its capacity for green growth than shortages in specialist 'green tech' know-how". The fundamental weaknesses concern deficits in management skills and technical job-specific skills related to STEM. Reiterating this issue, CEDEFOP's "European Green Deal skills forecast scenario" from 2021 (Cedefop, 2021, p. 11) emphasizes that the up- and re-skilling potential that results from green transition related "shifts within and across sectors and occupational categories". The skills forecast also points to the fact that digital skills enable the green transition as well, which points to difficulty of defining "green occupations". The CEDEFOP approach consists in extracting information from online job advertisements whereas 'greenness' is assessed by the job's skills. The European Commission's Green Deal Industrial Plan[10] aims to boost the EU's manufacturing capabilities to produce the necessary net-zero technologies and products. All sectors essential for the green transition, such as waste management, construction, and energy, rely on intermediate-skill jobs (at ISCED levels 3 and 4), which are typically accessible through VET.

4. Conclusions and policy recommendations

Since the emphatic Lisbon objective in 2000, the EU has launched numerous policy initiatives to promote skills. Many of these initiatives appear to be effective, but our analysis of existing EU policies and supporting measures suggests that the EU's skills needs should be better met in the context of the twin transition. We develop four main recommendations in this respect:

- Although the green transition and the associated new skill requirements are recognized as a key challenge for the EU, efforts are undermined by the lack of a clear definition of green skills. This is not a failure specific to the EU, as there is no generally accepted definition of green skills or green jobs in the literature either (OECD, 2024). However, this lack of clear targets is likely to undermine the effectiveness of EU policy initiatives. We recommend therefore that greater efforts be devoted to refining our understanding of what green skills are and how their demand varies by country and sector. Similar forecasting analyses should be stepped up for digital skills too.

[10] Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. A Green Deal Industrial Plan for the Net-Zero Age. COM/2023/62 final

- Our analysis suggests that VET might play a particularly important role in the provision of green skills for a significant share of occupations in the middle of the skill distribution. Yet, EU's policy initiatives in VET have not been particularly effective. The importance of a European strategy for VET has been recognized (Von der Leyen, 2024), but the EU's limited policy competencies in this field in addition to large institutional differences between Member States will continue to undermine efforts to provide sufficient VET skills to tackle the green transition. Improving VET should remain a policy priority at the EU level but, more importantly, also within Member States. Given the track record to date in fostering integration in VET, and given the notorious difficulties in replicating successful VET institutions outside of their home institutional environment (Finegold & Soskice, n.d.), we recommend that EU efforts move away from the ambition of creating a European VET system but rather veer toward (a) further support of national VET success stories and (b) easing the recognition of VET qualifications and thereby the mobility of VET workers within Europe even if such qualifications are awarded by different national VET systems.
- An important extension of point 2 is that if VET systems are to be truly responsive to the skill needs of the labour market, they must be underpinned by bottom-up processes that allow locally embedded actors to flexibly align EU policy initiatives with local skill needs. EU policy should provide both financial and organisational incentives for the systematic involvement of local stakeholders in the governance of VET systems, without, however, imposing a governance structure.
- Our analysis shows that there are numerous EU policy initiatives that aim to expand higher education. These policy initiatives are typically designed as *horizontal industrial policy,* which aims to improve general conditions and skill provision in all Member States and for all economic sectors. Education and skills policies are often argued to be prime examples of such horizontal industrial policies because they are likely to benefit all economic sectors. However, skill needs may be very different, and this working paper shows that such cross-country heterogeneity in the demand for skills occurs also within green and digital sectors. The literature has conceptualised these differences through the notion of growth regimes, which are modes of governance of the economy. Growth regimes differ not least with regard to the economic sectors that contribute to wealth and job creation with some Member States for instance specialising in advanced manufacturing for export, while others primarily rely on dynamic services for economic growth (Hassel & Palier, 2021). This sectoral specialisation results in different skill needs that can be further differentiated at subnational level given that sectoral specialisations within Member States are often territorially-bounded below the national level (Di Carlo, Ciarini, & Villa, 2024). The EU and its Member States should therefore not move in the direction of near-universal higher education everywhere. While this may be desirable

to meet the skill needs of advanced digital sectors, we have seen how the demand for green skills tends to be rather different and it may be satisfied via *targeted expansion* of higher education. Through the notion of targeted expansion, we seek to emphasise that higher education should also be understood as a form of *vertical industrial policy,* whereby the EU and Member States actively promote the expansion of those skills that are needed given different regions' sectoral specialisation (Durazzi, Emmenegger, & Felder, 2024). The expansion of STEM skills in those countries that are at the forefront of the production of green technology is a major example of how targeted expansion might be a better approach in higher education policy.

Our overarching message is therefore that EU education and training policy should align with its institutional constraints rather than trying to overcome them. By embracing the limitations set by the treaties, the EU has the opportunity to foster a place-based approach to both VET and higher education that is attuned to the specific needs of national and regional labour markets and their sectoral specialisations.

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