Blueprint “New Skills Agenda Steel”: Industry-driven sustainable European Steel Skills Agenda and Strategy (ESSA)

Sector Skill Framework

Deliverable D4.5

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Content:

Executive Summary

Based on the findings and reflections produced under WP4, we list below a summary of the recommendations devised to navigate the national VET systems, tackle emerging skills gaps and leverage the opportunities offered by the EU frameworks and tools. The recommendations are sorted into recommendations to the steel industry and recommendations to the Blueprint.

Recommendations to the steel industry:

a. *Lobby at the regional level*. Our comparative study of VET governance in the case study countries points to the regional level as the most appropriate level for companies to lobby at.

b. *Sectoral specialisation through CVET*. From a sectoral perspective, CVET provision appears more appropriate to promptly tackle specific skills gaps compared with IVET provisions.

c. *Engage with schools to promote dual training and placements*. Steel companies should be highly aware of the opportunities of offering placements or partnering in dual training schemes to better promote the industry, attract young talents, and offer an earlier specialisation at IVET level.

d. *Engage with national programmes for mapping occupations and skills foresight*. Many European countries have in place skills foresight programmes, mechanisms to review and update the contents of vocational qualifications, and/or national catalogues of occupations. Steel companies and sectoral representatives need to be aware of such programmes and of the benefits of engaging with them.

e. *Engage with European programmes, tools and activities for mobility*. Steel companies should take advantage of mobility opportunities managed by the EU, external VET providers/schools and/or employer mobility schemes (e.g. EURES).

f. *Consider the opportunities and limits of modular provision*. Where modularity allows for shortening vocational paths through recognition of prior learning or adding extra modules to core contents, these opportunities should be known and well understood by companies to make the best use of them.

g. *Encourage workers to make use of national schemes for validation of prior learning*. This offers opportunities for shortening vocational paths, especially in the case of steelworkers that have been long in the industry but do not possess an adequate qualification, or need to retrain.

h. *Align internal provision with national/international frameworks/benchmarks.* When designing their own training programmes, steel companies could consider using European frameworks such as DigComp and e-CF as a benchmarking reference. Companies might also consider designing their provision based on national standards.

i. *Make use of EQAVET framework for monitoring quality of provision.* When designing their own training offer, companies might follow the four stages devised by EQAVET quality criteria and make use of the appropriate indicative descriptors devised for VET providers.

j. *Nourish an innovation culture at all levels*. Whether relying on their own resources or on external providers, the training offered to workers can go beyond responding to *ad hoc* needs and foster a culture of change and innovation.

k. *Integrate with online training platforms (e.g., ESSA steelHub).* The steelHub that is currently being developed by the ESSA partnership will offer a steel-specific MOOC system to which companies can connect to expand and/or benchmark their training offer.

l. *Develop sectoral tools to compare national qualifications.* Within WP4 a Sector Skill-Set Matrix (see D4.3 and D4.4) is currently being developed that connects vocational qualifications with industry core occupations and highlights their transversal skills component[1].

Recommendations to the Blueprint:

1. *Acknowledge and address country differences*. The VET systems in each country differ in particular ways. The Blueprint needs to acknowledge such differences and produce more tailored recommendations to the different steel regions.

2. *Address identified skills needs*. The skills and knowledge identified in this deliverable represent the most common needs in the ESSA case study countries as emerged from WP4 fieldwork and provide a general indication of the direction that the industry is taking. The Blueprint should incorporate a viable strategy to tackle and close such common gaps.

3. *Academic drift to be reflected in the strategy*. The trajectories that VET in the case study countries has shown in the last two decades (academic drift vs. vocational drift) need to be recognised and reflected in the Blueprint strategy to ensure synergy between VET direction and Blueprint recommendations.

4. *Engagement of all social partners*. The Blueprint should stress the strategic role of social partners in identifying and closing skills gaps and devise strategies to strengthen cooperation within the sector.

5. *Contribute to national reviews of vocational qualifications*. The ESSA Technology and Skill Foresight Observatory (ETF) will systematically produce up-to-date sectoral data

[1] The development of a sector skills matrix is fraught with difficulties (see D4.3 and D4.4), but the principle of attempting to better understand the relationship between occupational qualification programmes and industry skill needs has some merit.

that could be particularly useful in the context of national reviews of vocational qualifications.

6. *Support train the trainers*. The Blueprint should stress the importance of "train the trainers" schemes and identify opportunities both within companies and the national VET systems.

7. *Integrate EQAVET principles in the steelHub*. As an online training platform, the steelHub could benefit of integrating Quality Assurance measures based on EQAVET descriptors and indicators.

8. *Promote a better understanding of the opportunities and limits of modularisation*. The Blueprint should address the topic of modular VET provision and promote amongst the stakeholders a better understanding of the state of play of modularity in the case study countries and of the opportunities and limitations deriving from this.

9. *Synergise with ESCO*. The Blueprint could suggest making use of ESSA results through incorporating a steel sector case study made of a limited number of occupations. This could allow to assess emerging and future skills required within the sector and compare these with the more general skill-sets that make up the ESCO database.

1. Introduction and rationale

This report summarizes the research carried out in the context of WP4 of the ESSA project, *VET Requirements and Regulations/National VET Systems (relevant requirements and regulations for the Blueprint)*, and it aims to offer a list of actionable insights and recommendations based on the findings presented in Deliverables 4.1, 4.2, 4.3 (the reports) and 4.4 (the matrix).

The research conducted under WP4 aimed to:

a) understand the functioning and regulation of the vocational education and training (VET) systems of 5 European countries (DE, ES, IT, PL, UK), particularly concerning the provision that serves the steel industry. The five case study countries have been selected based on features such as their institutional arrangements, skill formation systems, type of provision, degree of coordination etc. An extensive review of the five VET systems, their comparative advantages and limits is offered in D4.1 - *Identification of National VET Qualification and Skills Frameworks for Steel*. The report also addresses the view of steel companies and VET experts in relation to emerging skills needs and current challenges faced by the industry;

b) review the most relevant EU frameworks and tools aimed at harmonizing and increasing transparency of national VET systems. A detailed description of such frameworks and tools (e.g., EQF, EQAVET, ECVET[2], DigComp), their state of implementation in the ESSA case study countries and relevance for the industry is available in D4.2 - *Analysis of cross-European VET frameworks and standards for sector skills recognition*;

c) design a prototype of a sectoral skills matrix to match industry-relevant occupational profiles with formal qualifications offered in the case study countries. D4.3 - *Sector Skill-Set Matrix* – offers a detailed description of the layout and rationale of the matrix, as well as the functions that it could serve. D4.4 is the spreadsheet version of the prototype of the matrix (uploaded to steelHub). It collects and matches a sample of occupational profiles and vocational qualifications from four of the five case study countries and attempts a systematic comparison and evaluation of transversal skills provision in the different national programmes to point out the extent to which such skills, recognised as crucial by the literature as well as by our fieldwork, are integrated into national IVET programmes.

Based on the findings and reflections produced in the Deliverables listed above, this report aims to offer a brief and clear overview of the state of play of vocational education and training in the ESSA case study countries, as well as more generalisable insights and recommendations on how to effectively navigate the opportunities offered by the different VET systems (exemplified by the 5 case study countries) and overcome their limitations.

The remainder of the report is organized into three sections. The first provides a brief overview, based on desk research and fieldwork, of the challenges that the European steel industry is currently facing. The second section outlines the most relevant features of the ESSA case study countries' VET systems and presents a summary of the key findings of the research reported in Deliverables 4.1, 4.2, 4.3 and 4.4 (particularly concerning common trends and generalisable insights). Finally, the third section offers a list of actionable insights and recommendations to

[2] ECVET has recently been withdrawn, but the principles of labour mobility remain (see, for example, EURES).

the steel industry on how to navigate and leverage vocational education and training to tackle current challenges and enhance long-term sustainability and competitiveness

2. Industry challenges and transformation of work

Figure 1 – Current challenges faced by the industry

Eurofer[3] has pointed to three major challenges that the sector is currently facing: the recovery from the Covid-19 crisis, the low-carbon transition and global trade. In addition, the industry is actively engaged in shifting towards a 4.0 production paradigm and in transforming the public opinion on itself, a challenge which links directly with the need for attracting young talents to overcome skills gaps (an issue that is expected to be intensified by future retirements) (see also Stroud et al. 2023).

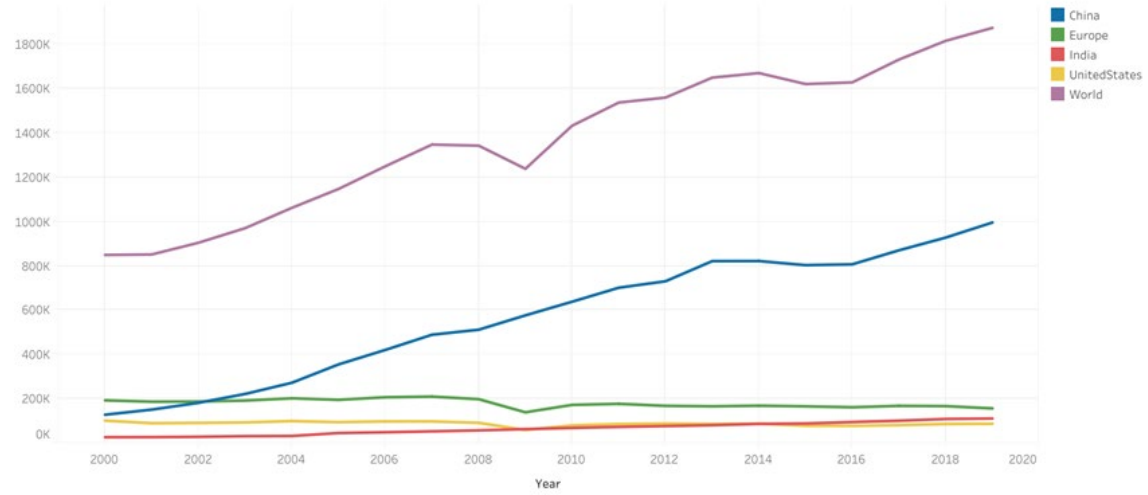
The steel industry, closely linked with sectors like automotive and construction, has inevitably been affected by the economic trends in the EU. Economic growth predictions for the years 2020-2021 were dramatically changed by the impact of the Covid-19 global pandemic, which "has hit the EU economy and industry at a time when a significant slowdown had already been brewing" (Eurofer 2020a, p.7).

Between 2018 and 2019, the global share of European steel has further decreased from 17.2% to 16%, while the Asian share has increased by 1.4 points, consolidating a trend that started in

[3] Questionnaire response.

early 2000 (Figure 2). In 2019, Asia accounted for almost 72% of the global steel production (Eurofer 2020b). Overall, crude steel production in the EU in 2019 dropped by 6% compared to 2018. Such a decrease reflects a continued deterioration in demand from steel-using sectors, coupled with competition in the domestic EU market and export markets (Eurofer 2020a).

Figure 2 - Global production of crude steel (in thousand tonnes) 2000-2019



Source: worldsteel data, own elaboration

Decarbonisation is expected to become a major driver of change in the coming years, accelerated by the European Green Deal that aims to pursue "a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases in 2050 and where economic growth is decoupled from resource use". This goes along with a commitment to support clean steel breakthrough technologies leading to zero-carbon steelmaking by 2030.

Concerning the net-zero target, "Eurofer believes that the European steel industry could achieve carbon emissions cuts of 95% by 2050. This will nevertheless result in an increase in the total cost of production of 35-100% per tonne […] with a requirement for 400 TWh of CO_2-free electricity, seven times the current consumption of the sector" (Syndex 2021, p.3-4).

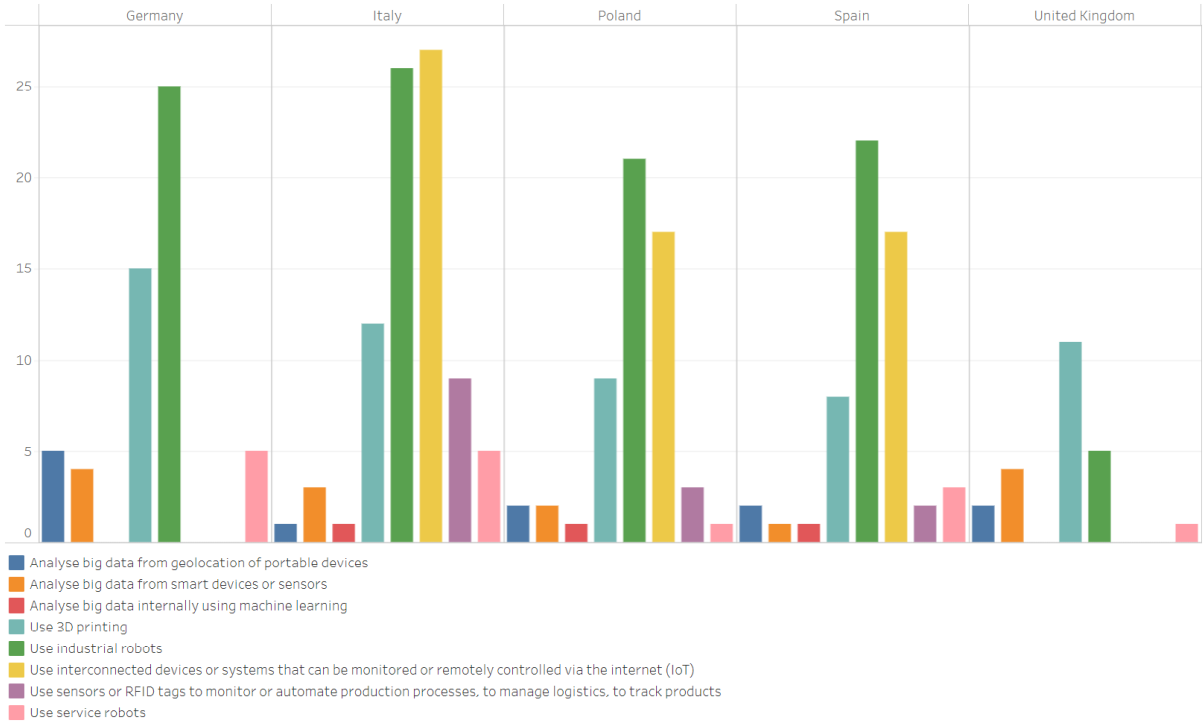
Overall, it appears that blast furnaces and DRI (Direct Reduced Iron) furnaces will remain the main routes for European steel producers, and that EAF-based steel will only reach a share of 40% of production by 2050. At the same time, the main European companies are now engaged in the development of a DRI-Hydrogen solution including, for most of them, a transition from blast furnaces to EAF over the next 20 years (Syndex 2021).

Estep's Strategic Research Agenda (2017) maintains that the future of the industry will be driven by five needs: sustainability, quality, lead time, profitability and health and safety. To reach these goals, the Agenda envisages a *Smart Steel Factory* enabled by the integration of key technologies such as Internet of Things, Cloud Computing, Big Data and so on.

In general, automation has been recognised as intrinsic to the steel industry, something that has been constantly applied over the last decades to improve process optimisation and products quality. However, the state of play of Industry 4.0 enabling technologies appears uneven across

Europe and it is difficult to sketch out a clear picture at the sectoral/national level. While the use of industrial robots appears as the most common trait within the manufacture of basic metals and fabricated metal products, its degree of adoption is at different stages. Also, there appears to be even more difference in the adoption of other pieces of technology such as RFIDs and machine learning.

Figure 3 – Technological advancement in basic metals production in the case study countries[4]



Source: Eurostat data, own elaboration

While technologies advance at a different pace, it can be assumed that the transition to smart steelmaking, once completed, will be irreversible. From this stems the need for a workforce that develops in parallel with the technological shift: "this trend towards digitisation will necessarily require a significant degree of skills improvement to handle the technical aspects of industry 4.0 applications and tools in a digitised industrial environment. Currently, this set of skills is in relatively short supply in Europe overall, and attracting candidates with the requisite abilities and aptitudes to the steel sector is an ongoing challenge"[5] .

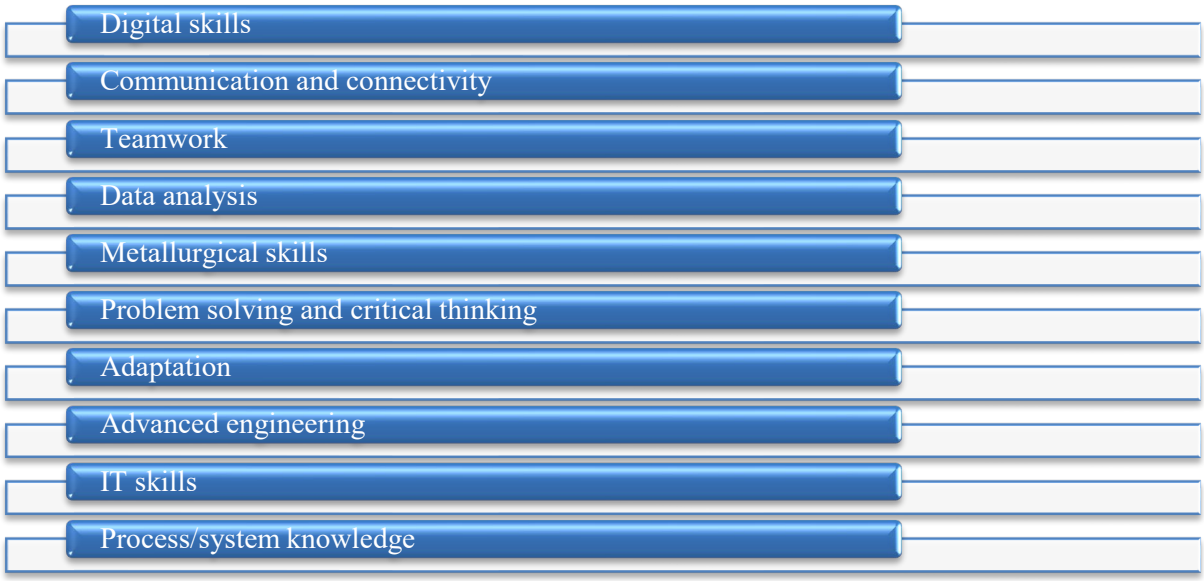
Several authors have addressed the issue of developing a workforce that is adequate to Industry 4.0, applying different labels to it, such as *Human Capital 4.0* (Flores et al., 2020), *Operator 4.0* (Romero et al., 2016), *Workforce 4.0* (Estep, 2017), *Berufsbildung 4.0* (Germany's concept for vocational training to meet Industry 4.0 challenges[6]).

[4] A value of 0 in the figure might indicate a missing value or a level of implementation equal to zero.
[5] Questionnaire response, Eurofer.
[6] https://www.bmbf.de/de/berufsbildung-4-0-3246.html

Within the steel sector, Estep's Strategic Research Agenda (2017) maintains that safety will benefit from the minimal and remote interactions in harsh environments utilising intelligent systems and robots (both autonomous and piloted by humans), while local and global monitoring of plants and workplaces will guarantee health to workers and surrounding communities. In addition, the Agenda expects that operator skills will be oriented more towards maintenance and monitoring, rather than manual operations. Furthermore, projections on workforce trends estimate that about 20% of the current workforce will retire in the next ten years (Ibidem). Such transition is considered at the same time a challenge and an opportunity: a challenge from a skills and competencies perspective, but also an opportunity to take advantage of the change in the workforce composition as an endogenous driver of transformation. In strategic terms, "to ensure the ongoing competitiveness of a safer, cleaner and more technologically developed steel industry, a highly skilled workforce is required. In fact, highly skilled people are the vital resource for the industrial added value in Europe today and tomorrow" (Estep 2017, p. 43).

Our fieldwork has allowed us to identify a list of common skills needs that resurfaced in the ESSA five case study countries, which can offer an illustration of what industry representatives think VET programmes need to tackle (Figure 4).

Figure 4 – Ten most cited skills and needs in the ESSA case study countries



While some VET systems are already paying more attention to transversal skills (see, for instance, D4.1 on the occupations screening carried out in Germany and the recent review of vocational qualification in Italy), the extent to which these are incorporated in the programmes varies (see qualifications identified in D4.4).

The next section presents a summary of the main findings of the comparative research carried out on VET systems functioning and provision under Work Package 4.

3. Key findings

The ESSA case study countries have been selected based on their relevance in the European industrial landscape and the characteristics of their VET system, which reflect differences in their broader institutional architecture. Table 1 below offers a comparative overview of some of the main features of the case study countries, moving from their economic model (informed by the Varieties of Capitalism literature)[7] to the type of skill formation systems[8] and VET distinguishing features. Reviewing and comparing VET systems that are embedded in different institutional environments and based on different approaches to education and training has helped to identify common patterns of transformation of VET at the European level[9]. Nevertheless, path-dependency still appears to influence deeply the transformations occurring at the national level and common pressures (e.g. market competition, technological change) and regulation (e.g. EU frameworks) might produce formally similar outcomes but different practical consequences.

[7] See Hall and Soskice 2001; Amable 2009; Nölke and Vliegenthart 2009
[8] Busemeyer and Trampusch 2011
[9] See Deliverable 4.1 for a detailed review of the case study countries' VET systems and their steel-relevant training offer.

Table 1 – Categorization of the case studies

Country	Economic model[10]	Skills formation[11]	Standardisation in IVET curricula	Distinction between IVET and CVET	Learning arrangements
DE	Coordinated Market Economy	Collective	High	Clear	Apprenticeship-based
ES	Mediterranean Capitalism	Collective	High	Clear	School-based
IT	Mediterranean Capitalism	Statist → (collective)	High	Clear	School-based
PL	Dependent Market Economy	Statist → (collective)	High	Clear	School-based
UK	Liberal Market Economy	Liberal	Low	Blurred	Mixed

Source: Deliverable 4.1

A recent study by Cedefop (2020a) on VET systems' trajectories offers some insight on the ESSA case study countries:

- In Germany, the VET share of enrolment at upper-secondary level decreased steadily between 1995 and 2015 from more than two-thirds to less than half of all enrolments (however it should be noted that the overall enrolment in VET has increased). This seems to point to what Cedefop (Ibidem) defines as an "academic drift"[12] in Germany, particularly as regards the upper-secondary level (which was traditionally the backbone of VET provision in the country).

- Italy has also experienced an academic drift in the last two decades, coupled with a broadening and hybridization[13] of the provision and an extension at post-secondary level (e.g., IFTS and ITS courses, see D4.1). Despite this shift towards general education, some of the evidence still points to a certain distinction between general and vocational programmes.

[10] As the comparative capitalism (CC) literature shows, economic models have implications in terms of skills formation. Market-based economic systems tend to incentivise learners to acquire more general (in the sense of portable) skills to cope with unpredictable market turns, whereas more coordinated systems tend to favour the acquisition of more specialised skills (see D4.1 for more detail).

[11] Skills formation systems classify the different level of engagement of the State and companies in vocational education and training. While in statist systems there is a high public commitment but low firms' involvement, in collective systems the responsibility for training is shared. Finally, in liberal systems the involvement of both the State and firms is relatively lower.

[12] Cedefop (2020a) defines any increase of the significance of VET (in relation to general/academic education at the same skill level) as a vocational drift, and any decrease as an academic drift. It also describes trends towards more distinctive VET as 'strengthening' of VET principles and the trends towards pluralistic VET as 'diversification' of VET principles and approaches.

[13] Cedefop (2020a) defines hybridisation as the trend within school-based VET towards broader vocational domains, a richer mixture of theoretical and general subject matter, and qualifications providing access to higher education at the expense of more specific practical VET.

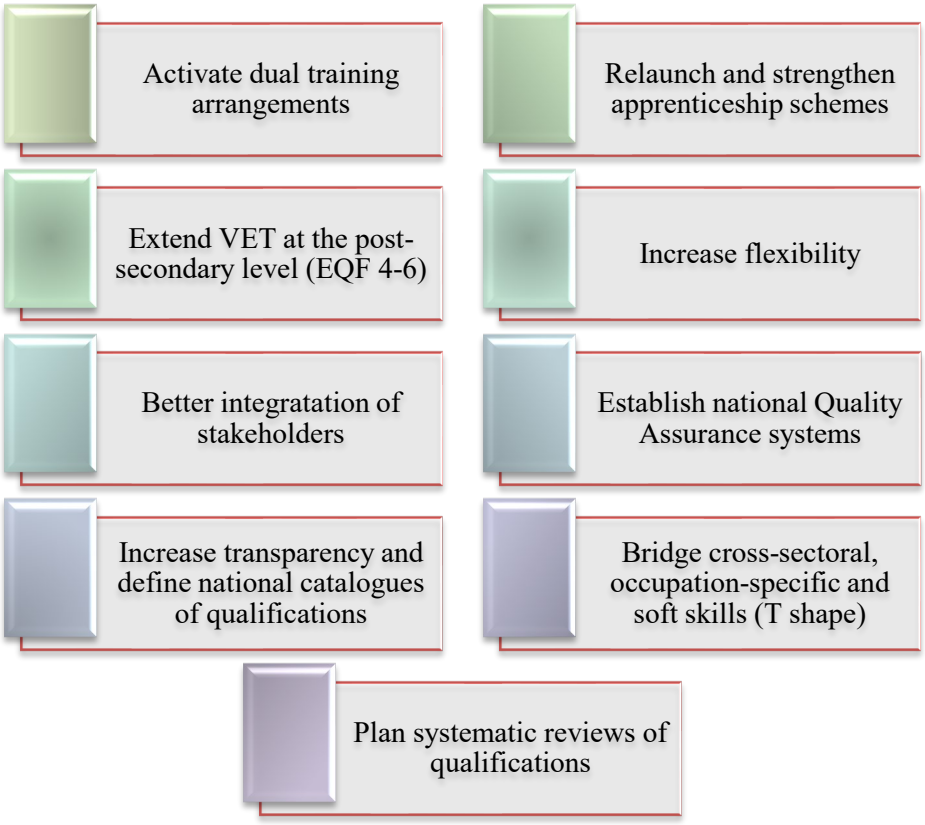
- Poland appears to have performed an U-turn in recent years. The system has experienced a progressive and continuous academic drift starting from the early Nineties, with the transition to a market economy. However, in recent years, employers' attitudes towards VET appears to have changed and there seems to be a greater inclination to support the system. The reforms started in 2016 point to a change in the trajectory, with a stronger emphasis on dual training and collaboration between VET providers and businesses. In this sense, the Polish VET system might experience in the coming years a counter-drift towards vocationalism.

- Spain has made some efforts to strengthen the VET system in a context that was historically characterised by a preference for general education. Cedefop considers such trends as an evidence of vocational drift, along with reforms, such as the introduction of dual VET, aimed at strengthening the ties between VET providers and employers and encouraging a greater involvement of students in the labour market.

- As regards the UK, despite a remarkable increase in the number of apprenticeships offered, this does not mean that the UK is shifting towards a more distinctive VET system. Rather, Cedefop underlines that the trend appears to be consistent with a continuous diversification and academization of VET.

Cedefop (2018) observed a certain degree of convergence in VET reforms across the EU over the last two decades. The most common reform packages have consisted of strengthening the ties between VET and the labour market, relaunching apprenticeships as a way to anchor training to actual jobs, broadening courses contents to equip learners with more transversal skills, and extending and strengthening VET provision at post-secondary and tertiary level. These trends resurface to some degree in recent VET system reforms in our case study countries, although there are country-specific differences, mainly depending on the 'starting position' of the respective VET systems (e.g. in relation to modularity and the understanding of IVET). Persistent differences between systems reduces the likelihood that complete harmonisation is possible in relation to the addressing of skill needs. Particularly, differences between the UK and elsewhere in Europe, but also differences between other case study countries are notable. Such differences result in quite different patterns of skill formation and the way skills needs might be addressed.

Figure 5 – Most common VET reforms and trends in the case study countries



The following points summarise the common trends that have been identified by our research:

- Skills mismatches are being addressed in all the case study countries through a more direct engagement of social partners (especially employers[14]) in VET provision and in the existing feedback mechanisms[15] (see D4.1). This does not apply to Germany in which was already in place a solid and long-lasting cooperation in VET.
- Systematic reviews of vocational qualifications are needed to ensure that contents are up-to-date and vocational profiles are still relevant for the labour market. This is particularly important in light of the accelerating pace of technological change. In Germany, for instance, the screening of occupational curricula for metalworking and electrical qualifications led to the introduction of a specific learning module on digitalisation of work, data protection and information security. It also led to additional content on environmental sustainability, occupational safety and labour law. In Italy, the review of vocational profiles completed in 2019 produced a more nuanced catalogue of national profiles with more adequate technical requirements (e.g., automation, production

[14] In the UK, trade unions are largely excluded although planned reforms of corporate governance arrangements in Wales suggest that trade unions might have a greater role to play in the future, in parts of the UK.
[15] Feedback mechanisms are formal institutional procedures, determining the particular roles of various stakeholders in planned renewal of VET provision (Markowitsch and Hefler 2018).

line programming, renewable energy etc.), and strengthened the transversal skills component. Other countries have also in place regulations for the systematic review of qualifications.

- The gap between formal training and work experience was a shortcoming of the VET systems in so-called 'Mediterranean countries'. Also in Poland, the recent economic developments have broken the link between companies and VET providers. Recent reforms in all these countries have introduced dual apprenticeship schemes, with the aim to bridge the gap between formal training and workplace-relevant skills acquired directly on the shop floor. This results in an attempt to shift the whole system towards a more collective type of skills formation (Table 1). In the case study countries, dual options are often available from upper-secondary to tertiary education. However, in some countries such options are still marginal (e.g. Italy and Spain).
- The competence of VET trainers is considered another strategic leverage to relaunch the attractiveness of vocational education and training. In different systems, new programmes and curricula have been introduced (like "ITS" in Italy, "T levels" in England) which require the participation of professionals from the specific sector as trainers and a relevant on-the-job training component. The importance of training the trainers was stressed also in the 2016 reform of the Polish education and training system.
- Permeability and flexibility of the paths have been enhanced through better connecting IVET with CVET and higher education (though these routes are still not particularly popular). This aims to avoid dead ends and to reduce the divide between different programmes, allowing for more flexible and adaptive paths (also in consideration of an increasing need for re-training mechanisms).
- IVET programmes appear to incorporate now more transversal skills (digital, personal, social, green, methodological). A transversal skills component is present in most of the vocational curricula reviewed. However, the range of soft skills covered varies from country to country as it reflects national institutional arrangements as well as the understanding and purpose of VET.
- Most of the European countries have devised an approach to Quality Assurance in VET at the national level and no system differs from the main characteristic of EQAVET. Germany, Spain and the United Kingdom have devised national approaches independently of EQAVET, but compatible with the framework. In Italy and Poland, instead, the national approach was devised utilizing the EQAVET framework.

From an EU perspective, the convergence of national VET systems, although accelerated by mobility and research programmes and by the establishment of frameworks and tools like EQF, the Digital Competence Framework (DigComp), EQAVET and so on is still incomplete. Nevertheless, all the EU countries have made many steps forward in the collective challenge of increasing transparency and mutual recognition through the harmonisation of national VET systems within the EU meta-frameworks (e.g. EURES). The main outcomes of this convergence process can be listed as follows:

a) progressive shift to a learning outcomes approach;
b) progressive establishment of a credit system and shift to a unit-based/modular approach;
c) introduction of guidelines for establishing mechanisms for the recognition, validation and certification of informal and non-formal learnings
d) establishment of national quality assurance systems in line with the EU requirements

e) establishment of cross-national databases and systems for mapping and cross-referencing occupations and qualifications (e.g., ESCO, ISCO, ISCED), thus increasing transparency and comparability.

Table 2 offers a snapshot of the level of implementation of some of the concepts, tools and frameworks that are at the basis of the EU vision on vocational education and training. The colour coding adopted is based on a traffic light system, where yellow means that steps have been taken towards alignment and implementation at the national level, but not to an operational state, and green means that the tool/concept/framework is present and operational (at least to some extent).

Table 2 – Summary of the integration of EU frameworks, tools and concepts in the case study countries[16]

	Germany	Italy	Spain	Poland	United Kingdom
EQF	🟢	🟢	🟡	🟢	🟢
ECVET (discontinued)	🟡	🟡	🟡	🟡	🟡
EQAVET	🟢	🟢	🟢	🟢	🟢
Digcomp	🟢	🟢	🟢	🟢	🟢
Learning Outcomes	🟢	🟢	🟢	🟢	🟢
Modularity	🟡	🟡	🟢	🟢	🟢
Validation of non-Formal and Informal Learning	🟢	🟢	🟢	🟢	🟢

Source: Deliverable 4.2

- EQF is present in all the ESSA case study countries and National Qualifications Frameworks are referenced to this, except in Spain where the referencing process is still underway.
- ECVET is now discontinued. It appeared to be the most challenging framework to adopt at the national level. Even in those countries in which credit systems were present, the actual implementation of credit accumulation and transfer appeared to be often not operational. Where ECVET principles were used (and these are still adhered to), this is

[16] EURES offers a further option for enhancing labour mobility, but is not discussed in detail across ESSA (e.g. D4.2) – ECVET was considered the most appropriate framework to focus on for ESSA but was discontinued during the project.

mainly to promote and support transnational mobility, to ensure a quality experience for the learner/worker and recognition/validation of their learning. From the point of view of learners, ECVET tools (e.g., Learning Agreement, Memorandum of Understanding) were designed to ensure the formal recognition of learning achievements during a mobility period. From the point of view of VET providers, the ECVET framework favoured the establishment of solid trans-national mobility partnerships. This would be particularly beneficial within sectoral domains, hence the focus on ECVET within ESSA till its discontinuation (over more general programmes, such as EURES). Companies could benefit from ECVET through targeting specific learning outcomes that would help their employees to achieve a broader understanding of some aspects, e.g. mobility to countries where Industry 4.0 concepts are more developed (see also point d, section 4).

Given the difficulties with its implementation, an European Council Recommendation of 24 November 2020 on vocational education and training for sustainable competitiveness, social justice and resilience has replaced the ECVET and EQAVET Recommendations. While the principles underpinning ECVET are still valid, it is currently unclear how this area will be further developed at the European level. EQAVET appears to be still operational.

- Quality Assurance (QA) mechanisms based on, or in line with, EQAVET are present in all the ESSA case studies, however, it must be noted that it is often difficult to frame a national QA system as a whole since measures and mechanisms are implemented at different levels (national, regional, local). What is worth noting is that many of the descriptors and indicators of EQAVET are used in the case study countries for quality monitoring.

- DigComp is used in the ESSA case study countries, although in different ways. It varies from being used as a reference for national digital competencies standards to being used to pilot initiatives at the regional/local level. Since national translations and applications are already available, companies could adopt DigComp as a "skills dictionary" and benchmark to design their own provision (see point h, section 4).

- All the ESSA countries have adopted a learning outcomes approach, in line with the EU tools and frameworks. Countries like Poland and the United Kingdom have been classified as early developers of such an approach, whereas Germany, Italy and Spain have been classified as recent developers.

- Modularisation is mostly applied in the ESSA case study countries, however, in Italy and Germany it is applied to a lesser extent (only for some qualifications or part of them). This could be explained by the functioning of the system itself and the understanding of what a qualification is and how it is achieved (e.g., the idea that occupational competencies are intertwined and difficult to break down into separate modules/units). In the German system, an occupation is conceptualized as a whole and, consequently, the qualification is the outcome of an organic learning process. However, also in these contexts, it is possible to shorten training paths through the exemption of parts of the courses, based on previous qualifications or experience. This is particularly significant for steelworkers that need retraining. While some industry representatives expressed a preference for more modularisation of training programmes for apprenticeships to increase the flexibility for employers, in Germany this is unlikely to be intro-

duced any time soon, especially since trade unions are strongly opposed to this fragmentation of training programmes. However, voluntary additional qualifications that can be pursued in parallel to the compulsory elements have been introduced in 2005 into the German VET system. These take the form of self-containing modules that involve a certain prescribed minimal training time as well as formal certification by the relevant Chambers and point to an attempt to make paths more flexible and relevant to the learner (a recent addition to the portfolio of additional qualifications related to all industrial metal and electronic occupations are modules that focus specifically on digitalisation and Industry 4.0 aspects).
A modular approach to VET path could offer some advantages to the industry, as it would allow for:

- increased flexibility of vocational paths
- shortened distance between IVET and CVET
- easier recognition and transferability across countries of single modules
- easier updating of the qualifications
- possibility to ideally combine core national modules with additional modules that satisfy local and sectoral requirements.

However, as pointed out by Cedefop (2020b), while there is certainly a case for flexible and more learner-centred approaches to vocational training, "some stakeholders argue that systems integrating a host of piecemeal credentials may lose transparency and undermine the status of strong initial education and training which lays the groundwork for individuals' future adaption and change" (Cedefop 2020b, p. 3). In this respect, we believe that the emphasis on modularisation requires a strong caveat. As discussed in Deliverable 4.1, the research conducted so far points to the need for a holistic approach to vocational training to increase workers' adaptability (and resilience) to changing working conditions, especially in a context of fast technological transformation. Vocational qualifications need to provide a set of interrelated (technical and transversal) competencies in a broad occupational area to cope with the challenges brought in by the fourth industrial revolution. From this point of view, modularisation should not be put in practice in a way that hinders a holistic approach to education and training, but rather in a way that complements it (e.g. offering add-on qualifications and the possibility to shorten vocational paths based on prior experience). Modules need to be organised hierarchically, with core and special modules (which could be more easily replaced or updated, avoiding the reformulation of the core structure of the qualification). Indeed, a hierarchical design of the curricula offers the opportunity to combine core and special requirements through the combination of different modules. Spain provides an interesting example of good practice in this sense, combining national and local needs: about 70% of the contents of VET curricula are established at the national level, about 30% is defined at the local level (*comunidad autónoma*).

- Finally, arrangements for the recognition and validation of prior learning coming from informal and non-formal settings are now in place in all the case study countries, although their scope (from IVET to Higher Education) and their outcomes vary (e.g., from awarding a full qualification to exempting a module or part of a course). It has also to be noted that the approaches in this respect could vary from having a national framework in place to arrangements implemented only at the regional/local level.

Transparency and cross-referencing are prerequisites for the transferability of skills and talents' mobility. In this respect, the ESCO database provides a relevant reference by offering a common understanding of skills, competencies and occupations. The ISCO-08 complementarity establishes a hierarchical structure and allows ESCO to be used for cross-national comparison (thus increasing transparency). Furthermore, ESSA could offer ESCO a sectoral refinement of those occupations that are at the core of the industry (e.g. starting with the 10 selected occupational profiles). This would add to ESCO a sectoral dimension through real-world case studies.

Overall, our findings show that, while the EU frameworks could effectively support workers' mobility, flexible vocational paths, re-skilling and competencies benchmarking, their establishment in the ESSA case study countries (and we can infer in Europe more widely) is still uneven. Also, some concepts need to be considered in the light of the specificities of the national VET systems and should be adopted in a way that avoids internal inconsistencies.

To conclude this section, we offer some final remarks based on the findings presented above:

a. Technological development is producing more complex and integrated (both horizontally and vertically) workplaces. The need for a stronger process and system knowledge was indeed one of the most common remarks coming from the respondents. There is an urgent need to overcome the parcelling out of competencies and embrace a more holistic approach to occupational training. The German concepts of *Berufsprinzip* (occupationality) and *Handlungskompetenz* (capacity to act) seem to go in this direction. The need for a holistic approach to training is consistent with the main finding of the fieldwork concerning skills needs. It appears more and more important that these skills are integrated into vocational curricula in a T-shaped structure, and organically complement the technical competencies.

b. Vocational qualifications at any level are strengthened when coupled with actual work experience. This need was again remarked upon by companies' representatives as well as unions' representatives. In-company training, in the form of placements or dual apprenticeships, can help to tailor skills and competencies to the industrial environment that is specific to a sector or a company, remedying shallow sector customization at the IVET level.

c. Completing IVET and obtaining a vocational qualification cannot be considered anymore the final goal, rather the first step in a lifelong commitment to learning. The pace and width of change in the workplaces require systematic upskilling (or re-skilling). In this respect, IVET acquires the status of foundational training, on which everyone could build more specialised and up-to-date competencies. Being foundational, IVET needs to be broad in its scope and balance technical and transversal skills.

d. Although employers' participation in the design of vocational standards for qualifications is important, allowing employers to have a central role in this respect without including also the workers' representatives can and does lead to a proliferation of narrower occupational standards as the example of the UK appears to demonstrate. This would limit the breadth of learning that would afford both protection and resilience to workers. This is in contrast with the foundational understanding of IVET as in the previous point.

e. Some remarked that the goal of IVET is to provide a cultural advantage, producing knowledge and competencies, and fostering new ideas. Although in-company experience is recognised as important, where curricula are too much tailored to sector or company needs, this might cause a diminishment of the innovative potential of prospective workers. These considerations apply particularly to technical roles, involved in departments that thrive on innovation, but have also wider implications.

f. There appear to be somewhat divergent interests that VET systems need to absorb and mediate to deal with tensions between company needs, workers' demands, and governments' ambitions reflected in VET. Companies often emphasise the need for more specialised training in metallurgy and steelmaking. However, IVET as a societal institution is expected to produce the knowledge, skills and competencies needed to act in different domains of society. Finding the right balance through better coordination of all parts is a key challenge in the coming years. Offering workers and employers' vocational qualifications that are solid and incorporate a balanced diet of technical and transversal skills, and a reasonable time to spend in the company to adapt their skills to companies' requirements is the goal that national VET systems have to reach.

g. Rapidly changing industrial landscapes and labour markets require not just timely but coherent and strategical responses. Our comparative analysis shows a latent tension between fast responses and mid- to long-term incremental adaptation. This appears to be exemplified by the cases of the United Kingdom and Germany. While fast responses might lack coherence and do not point to a long-term strategy, too rigid (and unidirectional) vocational paths have shortcomings in meeting the flexibility required by labour markets.

h. This tension is reflected also in a different vision of occupational standards. In liberal market contexts, such as the United Kingdom, employers increasing importance in updating and designing new qualifications might lead to a proliferation of narrow-defined occupational standards. This, in turn, might undermine the capacity of the system to deliver what ESCO defines as skills with a higher degree of reusability, so limiting workers as well as businesses' resilience.

i. Another criticality concerns the degree of fragmentation of a VET system. Where governance is complex and localised, the consistency of the whole system and its capacity to align with a national (long-term) strategy might be undermined. Where the system is more fragmented, policy structures are both more complex and more unstable (e.g., the constant renewal of the UK VET), and this can inhibit employers and learners' engagement and trust.

4. Sector Skills Matrix

Given the findings of D4.1 and D4.2 as discussed above, the Sector Skills Matrix (D4.3 and 4.4) that has been developed within WP4 offers industry stakeholders a tool for capturing (and

comparing) information about steel-relevant qualifications and relative transversal skills provision across different countries (starting with four of the five ESSA case study countries).[17]

The matrix is designed to fulfil three main functions:

a. to identify steel sector relevant occupational qualification programmes in several countries;
b. to provide a range of standardised and thus comparable formal information about each identified qualification programme and
c. to provide an assessment of each occupational qualification programme in terms of adequacy of current and future transversal skills provision.

The Matrix succeeds in two of the three main aims as it identifies steel-sector relevant qualification programmes in four case study countries and provides a range of accompanying information that can help to compare programmes to some extent. For numerous reasons (see D4.3) it has, however, not been able to produce reliable and trustworthy results with regard to the analysis of current and future skills gaps.

Identifying steel-sector-relevant occupational qualification programmes (OQP) has been relatively straightforward as occupational qualification programmes are sufficiently standardised to be identifiable. The research found that only very few, if any, steel-sector specific OQPs exist, reflecting the diminished importance of the sector even in traditionally steel-producing countries. The way qualification programmes are organised across most European countries suggests that an 'industrial sector matrix' might be a more appropriate tool than one that focuses on a single sector.

As VET systems are almost exclusively a domain for national states with very limited influence, coordination or oversight at the EU level, documentation related to the OQPs is non-standardised and therefore hard to compare. Even when relatively standardised measures such as qualification levels underpinned by the European Qualification Framework are used across European countries, this mostly creates the illusion of compatibility. It is possible, for example, that a Level 3 maintenance qualification in one country is entirely school-based and organised in modular fashion, while in another country, the qualification is non-modular and has strong practical, on-the job learning elements. Thus, while comparability is potentially possible, it requires deep understanding of the various European VET systems to not lead to faulty conclusions.

The third element of the Matrix, the evaluation of current and future skills gap analysis, illuminating the discrepancy between current and future competence requirements and what OQPs currently offer in terms of skills provision, has proved to be the most difficult to establish for a variety of reasons (see ESSA D4.3 for details). While industry engagement with the research process was sub-optimal, even with greater or complete industry engagement, it is still questionable whether a SSM-based skills gap assessment does have much practical value. The main reason why this is doubtful is related to the 'politics' and organisation of VET systems. Apart from the hyper-fragmented VET system in the UK, most VET systems across Europe do not allow specific sub-sectors (e.g. the steel sector as a sub-sector of industrial or manufacturing sectors) to individually influence the curricula of OQPs as these tend to have relevance for a number of such sub-sectors. While this limits the flexibility for particular sectors to shape VET

[17] In the course of the Matrix development, the UK had to be excluded from the Matrix because its hyper-fragmented VET system cannot be captured by a tool such as the Matrix that relies on some degree of standardisation and coherence within a VET system. See also ESSA D4.3.

curricula, it also prevents the fragmentation of VET systems which can have many undesirable effects.

The Matrix still opens up a range of angles for comparing national vocational programmes. Beyond the confines of the ESSA project, there is potential usefulness of the sector skills matrix for a range of actors operating at three different levels.

At the European level, the Matrix might prove useful to EU institutions such as the Commission but also EU-funded research projects as well as European-level institutions representing social partners. The matrix can inform EU-level steel-sector focused strategic decision-making related to policies, research programmes and development and/or adjustment of European VET tools. EU-level industry bodies and trade unions can use the information provided by the matrix in similar ways or to use it to inform campaigning or lobbying efforts.

Industry bodies and trade unions operating at the national level could use the Matrix to try and influence the direction of national VET systems or to develop additional training programmes in response to identified skills gaps. The Matrix can also serve as useful feedback mechanisms to national VET institutions, which in turn might adjust decisions and activities to close identified skills gaps. Further, it might also prove to be of value to a range of training providers as identified skills gaps offer opportunities to those with the capacity of closing them through the development of training offers.

Finally, at a regional level, the Matrix might prove useful to regional economic development initiatives. Given the industry- and sector-transcending nature of transversal skills, the matrix might inform broader regional and local initiatives for cross-sectoral transversal skills development. Given also the fact that steel companies are often concentrated within particular regions and localities, VET institutions operating at this level might also find the Matrix useful to inform their approaches to training provisions or to underpin wider skills development campaigns.

Despite the limited success developing a useful Sector Skills Matrix, especially with regard to the failure of producing a reliable and trustworthy transversal skills gap assessment, a number of recommendations can be made.

a. We suggest that systematically understanding and evaluating VET provisions relevant for particular sectors is an important element in an increasingly turbulent economic and social environment characterised by rapid technological and organisational change, increasing recruitment challenges and the as yet uncertain consequences of climate breakdown.
b. VET systems across Europe are still not ‘Europeanised’ to a level that justifies creating a sector skills matrix on an European level, i.e. to look comparatively at various European countries. While the Europeanisation of VET provisions, despite recent efforts (see ESSA D4.2 for an overview) is still at a rudimentary stage and also taken into account that worker mobility within the steel sector appears to be quite limited, a European approach to the Matrix, i.e. the attempt to create European comparisons and benchmarks, might not be the most appropriate approach at this moment.
c. Despite our setbacks in this regard, performing skills gap analyses as an element of wider efforts in skills forecasting and skills requirement predictions is a valuable and important task. Rapid technological and organisational change in the face of Industry 4.0, intensified digitalisation and demographic and educational trends and global climate breakdown will inevitably lead to changes in the skill needs of companies including those operating in the European steel sector.

d. Fourth, based on our research and experience with the current Matrix we would make a number of suggestions how to take the development of such a tool forward. In line with the suggestion to drop the European dimension, in our view national or regional approaches appear more appropriate. National steel associations appear to be best placed to either engage in or commission skills gap analyses and skills forecasting as these organisations are ideally placed to bridge the gap between a specific sector needs and national and/or regional VET systems. They not only represent the sector companies but tend to be to some degree involved in the shaping VET system provisions. Moreover, a purely survey-based approach as initially pursued by WP4 does not seem to be a promising method, despite its potential advantages in terms of efficiency and effectiveness of data generation. The main draw back is the lack of possibility to understand the quality and reliability of data, but survey fatigue within companies is another good reason to avoid a purely survey-based approach.

5. Strategy and Recommendations

This section draws on the findings summarised above and offers a list of potentially actionable insights and recommendations to navigate the national VET systems, tackle emerging skills gaps and leverage the opportunities offered by the EU frameworks and tools. The recommendations offered below are organised into two lists: a) recommendations to steel companies, and b) recommendations to the Blueprint.

Figure 6 –Recommendations to the steel industry

a. *Lobby at the regional level*. Our comparative study of VET governance in the case study countries points to the regional level as the most appropriate level for companies to lobby. While national regulation will usually address minimum occupational standards that could serve a number of related industries, regional administrations have often the legal capacity to adapt curricula to national contexts (adding extra contents as in Italy, or customise part of the curriculum, e.g. Spain) and have a much wider influence on CVET provision.

b. *Sectoral specialisation through CVET*. From a sectoral perspective, CVET provision appears more appropriate to promptly tackle specific skills gaps emerging from technological innovation, green challenges or market competition. While IVET qualifications, as pointed out earlier, are mostly considered foundational (and broad in terms of occupational expendability), CVET provision offers more specialised training both in terms of technical skills (e.g. metallurgy) and transversal skills (e.g. digital). Furthermore, although with some delay if compared to IVET, CVET provision is gradually being anchored to National Qualifications Frameworks (and consequently EQF). This guarantees that, where recognised through national frameworks and standards, CVET provision is also transparent, certifiable and potentially transferable to different contexts (thus supporting talents' mobility).

c. *Engage with schools to promote dual training and placements*. While in countries like Germany and the United Kingdom, apprenticeships and dual forms of training have been historically valued (although with many differences between the two), countries

like Italy, Poland and Spain have only recently introduced dual training schemes (re-introduced, in the case of Poland). Along with these, the importance of job placements in VET programmes has also been highlighted by the most recent regulation. In consideration of this, steel companies should be highly aware of the opportunities of offering placements or partnering in dual training schemes to better promote the industry, attract young talents, and offer an earlier specialisation at IVET level.

d. *Engage with national programmes for mapping occupations and skills foresight*. Many European countries have in place skills foresight programmes, mechanisms to review and update the contents of vocational qualifications (feedback mechanisms, see D4.1), and/or national catalogues of occupations. Steel companies and sectoral representatives need to be aware of such tools and of the benefits of engaging with such programmes. Offering sectoral feedback to qualifications and occupations reviews guarantees that national catalogues (of occupational standards and qualifications) are always aligned with the real status of the sector. This, in turn, guarantees that policymakers have highly reliable and up-to-date information on which they can base regulations.

e. *Engage with European programmes, tools and activities for mobility*. Steel companies should take advantage of mobility opportunities managed by the EU, external VET providers/schools and/or employer mobility schemes (e.g. EURES). The potential benefits of such programmes for the industry is the meeting of skill needs and avenues for qualification recognition. In a context of still uneven technological advancement, mobility can offer a valuable opportunity for workers' continuing development.

f. *Consider the opportunities and limits of modular provision*. As pointed out in the previous section, modularity could offer valuable opportunities for shortening vocational paths, re-skilling and upskilling of workers. However, it was also shown that not all systems align with ECVET guidelines on modular provision because of potential incompatibilities at different levels. Whether modularity allows for shortening vocational paths through recognition of prior learning or adding extra modules to core contents, these opportunities should be known and well understood by companies to make the best use of them.

g. *Encourage workers to make use of national schemes for validation of prior learning*. Most of the European countries, following the Recommendation on recognition and validation of non-formal and informal learning of 2012 and the ECVET recommendation of 2009 have put in place a framework for assessing and recognizing prior learning deriving from previous learning or working experiences. The way such recommendation has been implemented varies from country to country. However, it opens up to opportunities for shortening vocational paths, especially in the case of steelworkers that have been long in the industry but do not possess an adequate qualification, or to workers that need to retrain.

h. *Align internal provision with national/international frameworks/benchmarks.* Steel companies are often tackling workers' skills gaps through internal, non-formal, training. When designing their own training programmes, steel companies could consider using European frameworks such as DigComp and e-CF as a benchmarking reference (e.g. DigComp for daily digital skills and e-CF for more advanced IT skills). Companies might also consider designing their provision based on national standards and modules (where present) to favour the recognition of the received training within the national

education and training system. This will help workers to capitalise on their non-formal training and obtain certifications that could favour their mobility and resilience.

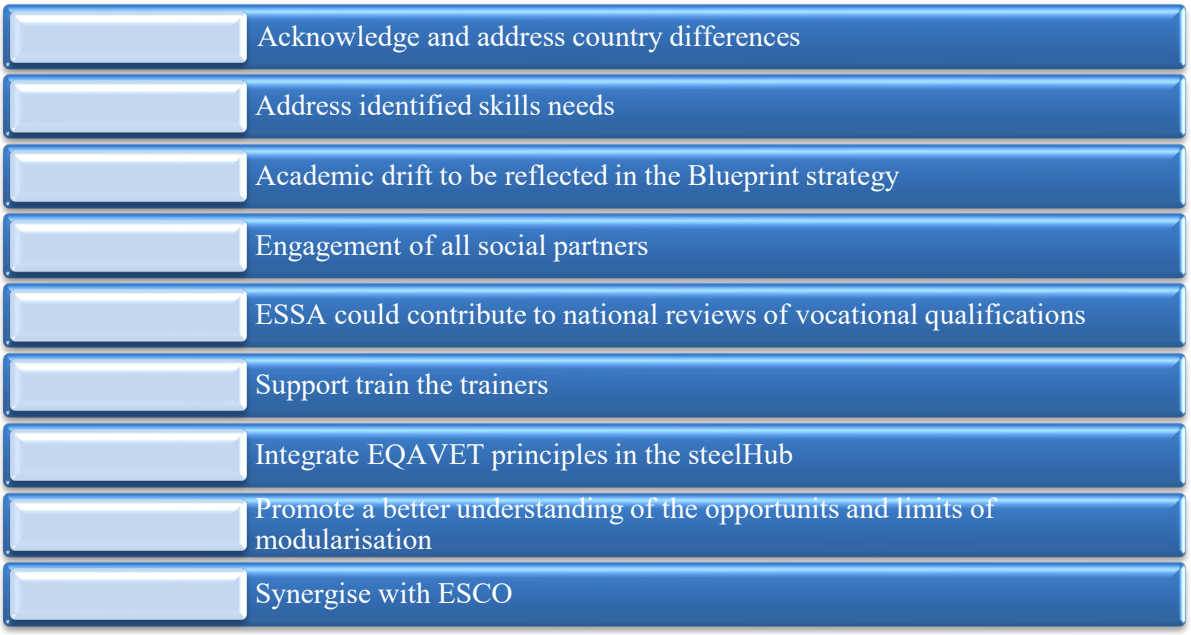
i. *Make use of EQAVET framework for monitoring quality of provision.* When designing their own training offer, companies might follow the four stages devised by EQAVET quality criteria and make use of the appropriate indicative descriptors devised for VET providers. Adopting the EQAVET framework companies would align with national and European quality standards, in doing so enhancing the transparency and recognisability of the training offered.

j. *Nourish an innovation culture at all levels*. As confirmed by the fieldwork, training and skills development are important catalysts of innovation. Companies can act proactively in this respect. Whether relying on their own resources (internal training centres, academies etc.) or on external providers, the training offered to workers can go beyond responding to *ad hoc* needs (e.g. training on specific pieces of technology used in the company) and foster a culture of change and innovation. As suggested by some interviewees, workers at any level could benefit from broader courses ranging from technical to soft skills, which could help them to develop a culture of innovation that they can spread through the organisation. Mobility, as per point e can also strengthen this innovation culture.

k. *Integrate with online training platforms (e.g., ESSA steelHub).* The Covid-19 pandemic has accelerated an already ongoing process. Online training has become in the last ten years, through massive open online courses platforms (MOOC), an important option for training at distance in many fields. Digital technologies allow learners to take remotely advantage of lectures, interact with simulators (e.g. the virtual steelmaking developed by SteelUniversity), and practice with hands-on laboratories (e.g. in data analytics). Such opportunities become even more relevant for SMEs which often do not have enough resources to develop their own training programmes. In this respect, the steelHub that is currently being developed by the ESSA partnership will offer a steel-specific MOOC system to which companies can connect to expand and/or benchmark their training offer.

l. *Adopt tools to compare and evaluate national qualifications (e.g. ESSA Sector Skill Matrix).* Sector stakeholders could benefit from tools that allow them to systematically evaluate steel-relevant vocational programmes with a view of keeping them up-to-date and responsive to the needs of relevant stakeholders. While the Sector-Skills Matrix developed as part of WP4 (D4.4) can contribute to such endeavours, the usefulness of a range of forecasting and evaluation tools ought to be explored. .

Figure 7 – Recommendations to the ESSA Blueprint



1. *Acknowledge and address country differences*. As noted, the VET systems in each country differ in particular ways. This demands a blueprint strategy that is sensitive to such differences to meet the identified skills gaps. Enduring differences between systems reduces the likelihood that a complete harmonisation is possible in relation to the addressing of skill needs. The Blueprint needs to acknowledge such differences and aim to produce more tailored recommendations to the different steel regions (e.g. taking into account the slightly different gaps identified in the case study countries, the understanding of VET purposes in the different contexts and the overall functioning of the systems).

2. *Address identified skills needs*. The skills and knowledge identified in Figure 4 represent the most common needs in the ESSA case study countries as emerged from WP4 fieldwork and provide a general indication of the direction that the industry is taking (particularly as a consequence of technological advancement, environmental regulation and market competition). The Blueprint should incorporate a viable strategy to tackle and close such common gaps, also considering the specificities of the different VET systems as underlined in point 1.

3. *Academic drift to be reflected in the strategy*. The trajectories that VET in the case study countries has shown in the last two decades (academic drift vs. vocational drift) need to be recognised and reflected in the Blueprint strategy to ensure synergy between VET direction and Blueprint recommendations for addressing sector skills gaps.

4. *Engagement of all social partners*. The comparative analysis of VET systems shows that the involvement of both companies' and workers' representatives in the provision

and design of VET curricula is more effective in meeting emerging skills needs, compared to market- or state-led design and provision. The Blueprint should stress the strategic role of social partners in identifying and closing skills gaps and devise strategies to strengthen cooperation within the sector, both at the European and national level.

5. *ESSA could contribute to national reviews of vocational qualifications*. The ESSA Technology and Skill Foresight Observatory (ETF) will systematically produce up-to-date sectoral data that could be particularly useful in the context of national reviews of vocational qualifications. For this to happen, it is important that the regional rollouts provide an opportunity for ESSA to connect with the key players in the governance of VET in the case study countries.

6. *Support train the trainers*. The adequacy of vocational teachers and trainers has become in recent years an important matter in VET. The Blueprint should stress the importance of "train the trainers" schemes and identify opportunities both within companies (e.g. internal Academies) and the national VET systems.

7. *Integrate EQAVET principles in the steelHub*. As an online training platform, the steelHub could benefit of integrating Quality Assurance measures based on EQAVET descriptors and indicators. This would guarantee high quality standards and a better alignment with the EU principles.

8. *Promote a better understanding of the opportunities and limits of modularisation*. Based on the reflections outlined above, the Blueprint should address the topic of modular VET provision and promote amongst the stakeholders a better understanding of the state of play of modularity in the case study countries and of the opportunities and limitations deriving from this.

9. *Synergise with ESCO*. In addition to enhancing transparency of occupations (and related skill-sets) and favouring workers' mobility through the recognition of similar occupational profiles, ESCO might incorporate sectoral case studies to offer means for cross-comparisons. In this respect, the Blueprint could suggest making use of ESSA results through incorporating a steel sector case study made of a limited number of occupations (e.g. the 10 selected ESSA occupational profiles). This could allow to assess emerging and future skills required within the sector and compare these with the more general skill-sets that make up the ESCO database.

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