CHAPTER 6: Identifying sectoral skills needs: Lessons from Poland and Wales for the Turkish steel industry

Magdalena Jelonek, Marcin Kocór, Barbara Worek, Dean Stroud, Tamer Atabarut and Ruhi Kaykayoğlu

6.1 Introduction

The identification of sectoral skill needs is a critical process in aligning workforce skills with the evolving demands of modern industries. Various methodologies and frameworks have been developed globally to address this issue, focusing on both current and future skills gaps (e.g. Cedefop, 2019; Cedefop, 2023; Hoftijzer, 2015; Maldonado-Mariscal et al., 2023; Wilson et al., 2016).

This paper examines two distinctive approaches – the Polish Sectoral Human Capital Studies (SHCS) and the European Steel Skills Alliance (ESSA) – and evaluates their applicability to the Turkish steel sector. The goal is to provide actionable recommendations for improving skills anticipation mechanisms in Türkiye's steel industry.

While Poland's SHCS offers a national framework for identifying sector-specific skills needs, ESSA provides a sector-focused European perspective, particularly within the steel industry. By comparing these methodologies, we aim to draw lessons that can be adapted to Türkiye's context. The choice of Poland and Wales is rooted in their methodological innovations and relevance to addressing skills gaps in dynamic and transformative industrial sectors. Although Türkiye is not part of the EU, the ESSA's tools and approaches offer valuable insights for structuring sectoral skill needs assessment.

6.2 Understanding the sectoral skills needs approach in Poland: SHCS – addressing the skills needs of 17 industry sectors in Poland

6.2.1 Local context and origins of the solution

Poland's skills needs analysis framework was developed in response to the country's rapidly transforming economic landscape. Following its transition from a centrally planned to a market-orientated economy, Poland experienced significant industrial and technological changes. These changes created a dynamic labour market with evolving demands for new jobs and skills.

The rapid growth of various sectors, including finance, IT, tourism, construction, and advanced manufacturing, highlighted the need for a systematic approach to identify and address skills needs. The integration of Poland into the European Union further intensified the need for a competitive and adaptable workforce. The influx of foreign investment and the adoption of EU standards required continuous improvement of workforce skills to meet international benchmarks.

Local businesses and industries faced challenges related to mismatches between the skills of the workforce and the demands of modern job roles. Employers often struggled to find qualified personnel with the necessary technical and soft skills, leading to productivity problems and hindering economic growth. This situation underscored the critical need for a robust competency assessment to guide education and training programmes.

Poland's economic strategy emphasised innovation, digital transformation, and sustainable development. To achieve these goals, it was essential to understand the specific skills required in different sectors and ensure that the workforce was adequately prepared. Information about the skills

needs of the economy has become increasingly important for policymakers, educators, and industry leaders to align workforce development initiatives with the strategic economic objectives of the country. By identifying the precise skills required for current and future job roles, Poland aimed to bridge the gap between education and employment, improve the employability of its citizens, and maintain its competitive edge in the global market.

Support to achieve these goals has come from systematic research on general skills needs, conducted since 2010 within the Human Capital Study project (Kocór et al., 2021). However, there was a growing recognition of the need to focus on the demand for sector-specific professional skills and to take more decisive action to develop these skills. The response to this need was the establishment of Sectoral Skills Councils in Poland.

The first such council was established in 2016. On the initiative of the Polish Agency for Enterprise Development (PARP), seventeen councils have so far been created in sectors as diverse as automotive and electromobility, construction, high-quality food, and development services. Each council consists of representatives of employers, trade unions, universities and other stakeholders related to the sector.

The tasks of the sectoral councils include:

- gathering knowledge from businesses about the qualification and professional needs in the labour market of a given economic sector;
- dissemination of information on professional qualifications and needs in the sector;
- initiating cooperation between businesses and universities or specific entities to integrate education and employers; and
- formulating recommendations for adjusting the workforce to the current needs of businesses in a given sector.

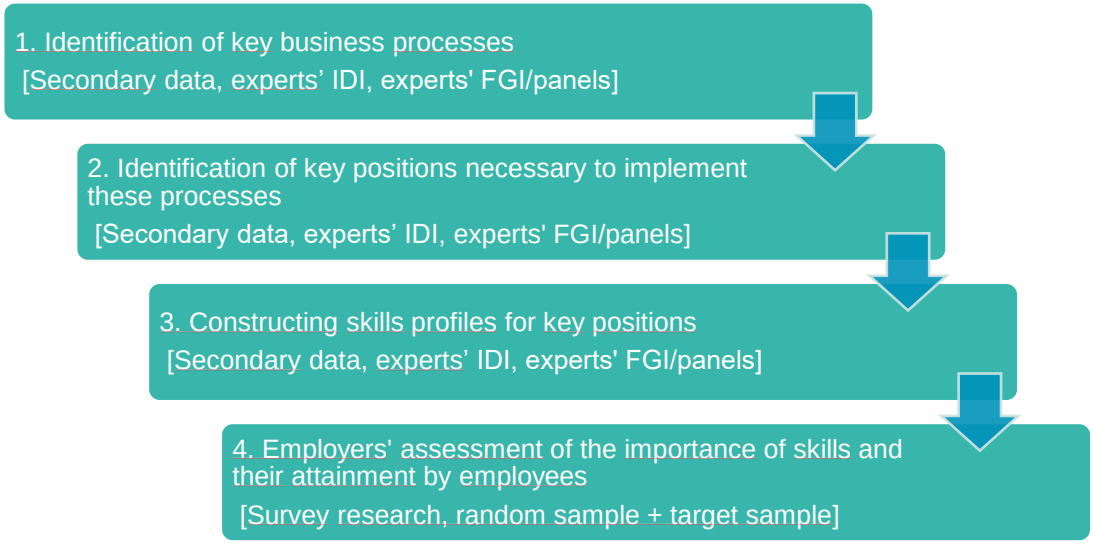
Support for Sectoral Skills Councils in identifying sector-specific skills needs came from research conducted within the Sectoral Human Capital Study (SHCS), carried out by Jagiellonian University in partnership with the Polish Agency for Enterprise Development. The SHCS methodology combines quantitative and qualitative research to provide a detailed analysis of sector-specific skills requirements.

6.2.2 Description of the methodology

The Sectoral Human Capital Studies (SHCS) in Poland aimed to identify the most urgent skills needs of entrepreneurs and mismatches in the labour market by sector and to identify trends that affect each industry and the challenges faced by entrepreneurs. Research has already covered 17 different sectors in Poland: finance; IT; tourism; construction; fashion and innovative textiles; automotive and electromobility; health care and social assistance; chemicals; water and wastewater management and remediation; trade; marketing communications; modern business services; material recovery of raw materials; aerospace; telecommunications and cyber security; development services; and quality food. In each sector, the research was carried out using the same methodology (with some exceptions due to industry specificities). Two editions of the study were carried out in each sector in Poland, the first was conducted in 2000, and the second in 2023.

This section describes this methodology in detail. It included both qualitative and quantitative research carried out on a sample of minimum 800 employers (random sample, multi-mode approach) and minimum 800 employees in key positions or students (separate surveys for each sector). The decision to survey either students or employees was based on the specific information needs of the sector. The approach involves triangulation at the level of sources, using all available foundational data – especially the already existing Sector Qualification Framework – and methods. In addition, both the current situation in the sector and its future were considered in the form of a prospective study. The research in Poland was implemented in several stages, which can be presented schematically in Figure 1.

Figure 1: Main steps of the SHCS methodology in Poland



Source: Own elaboration
Notes: (*) IDI (In-Depth Interview) is a research method used in the social sciences to gather detailed information and a deep understanding of the attitudes, beliefs, experiences, behaviours, and motivations of interviewees. This method produces rich descriptive data that are difficult to obtain through more quantitative research methods such as surveys or questionnaires.
(**) FGI (Focus Group Interview) is a research method used in the social sciences, marketing and market research that involves a discussion of a specific topic with a small group of people, facilitated by a trained moderator.
(***) "Experts" means both representatives of the sector in question (e.g. employers, members of sectoral associations) and representatives of universities or other research institutions that specialise in the field of interest.

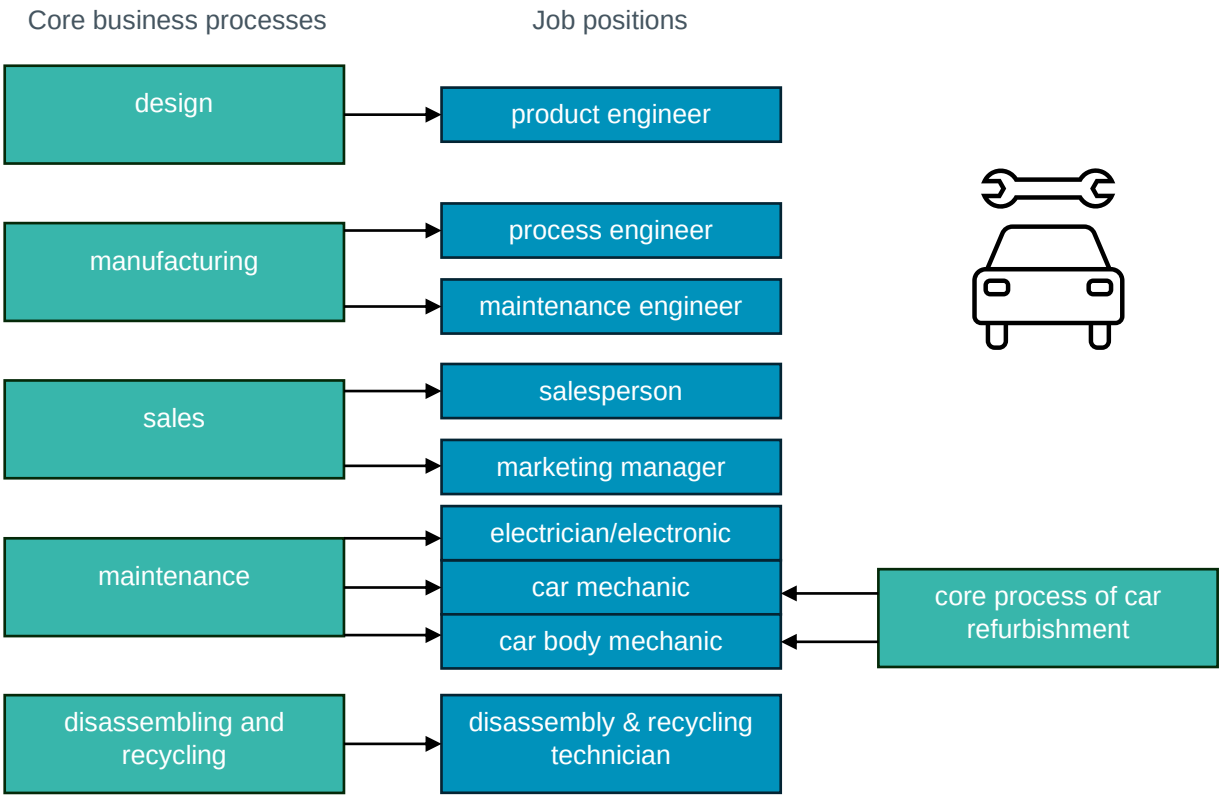
The first step in the research was the identification of the main business processes within a selected sector/industry[31]. A business process is a sequence of activities leading to a specific business objective. A business objective is an outcome that is both achievable and valuable to the customer of the process. On the basis of our experience, between three and ten such processes were identified per sector/industry. To pinpoint these main business processes, we took the following actions:

- Analysis of available secondary data.
- In-depth interviews with industry experts, including representatives from companies, the industry environment, and researchers.
- Creation of a preliminary list of main business processes.
- Verification of the list by an expert panel.

In the second step, key positions / occupational roles necessary for the implementation of the main business processes within a sector/industry were identified. Typically, a list of such key professional roles includes 10 to 20 positions. To create this list, secondary data analysis was used, along with in-depth interviews and verification of the occupational roles list by an expert panel. An example of the identified core business processes of an industry, along with the associated occupational roles essential for their execution is presented in Figure 2 for the automotive and electromobility industry.

[31] A business process is a set of related activities or tasks performed in a specific sequence to achieve a particular business goal or outcome. It involves various resources, such as people, tools, and technologies, working together to deliver value to a customer or the organization. Business processes can include activities such as manufacturing products, providing services, managing resources, or processing orders (Davenport, 1993).

Figure 2: Business processes and job positions in the automotive and electromobility industry



Source: Own elaboration.

The third step was to create skills profiles for each of the identified key jobs/job roles[32]. These profiles include elements of knowledge, skills, and attitudes that are necessary to perform the tasks of each occupation. Skills profiles were designed to be as simple as possible, with only the essential elements needed to perform professional tasks. The process of building these profiles followed a similar approach to that used in previous stages: analysis of available secondary data, including the Sector Qualifications Framework (if applicable); in-depth interviews with industry experts, such as company representatives and researchers; and verifying the profiles through an expert panel.

In the final (fourth) step, skill profiles were used to create questionnaires for employers and employees. As mentioned before, a sample of minimum 800 employers and minimum 800 employees in key positions were surveyed through these questionnaires. The study employed stratified random sampling, with strata defined by company size and voivodeship (Polish administrative level). The samples ensured statistical representativeness of the sector.

The survey aimed at managers and executives of selected companies aimed to assess:

- the importance of skills for specific positions (rated on a 1-5 scale, with 1 being marginal and 5 crucial); and
- the difficulty of finding candidates with these skills (rated on a scale of 1-2, with 1 being difficult and 2 easy).

Interviews were also conducted with employees in key positions, where they evaluated their own skill levels on a scale of 1-5.

Based on the results of these surveys conducted with both employers and employees, a skill balance was developed for specific job positions based on comparing the demand for a specific skill with its

[32] A skills profile is a description of the skills, knowledge, and behaviours needed to perform a specific role effectively, aligning employees' capabilities with organisational goals (Boyatzis, 1982; Spencer et al., 1993).

availability. This balance includes information on the importance of skills as declared by employers, anticipated changes in the importance of these skills, the difficulty of acquiring them, and the results of employees' self-assessment. In addition, "hot skills" were identified - these are skills that are currently of high importance and are expected to increase in importance in the coming years. Figure 3 provides an example of the 'skills balance' for the role of car mechanic.

Figure 3: Car mechanic - skill balance

Source: Own compilation based on BBKL moto - 2nd edition 2023 (employers N=274; employees N=157).
Notes: (k) – knowledge, (a) – abilities, (ss) – social skills.

In the given example, it is evident that both employers and employees rated the required and possessed skills relatively high – all above the theoretical mean on the rating scales, which is a value of 3. There are also no significant differences between the ratings of the importance of competencies for employers and the level of competencies possessed by employees in this position, indicating a lack of major mismatch.

Identification of skills gaps was based on the same questions and refers to the situation when employers indicate the existence of skills, which they consider relatively more important and, at the same time, difficult to obtain in the labour market.

The final stage of the research was the synthesis of results and conclusions of the studies conducted in the 17 sectors of the Polish economy. The aims of this synthesis were:

1. Identification of megatrends that affect each of the sectors analysed, intersectoral trends (affecting clusters of sectors) and trends specific to a given sector. The identified megatrends that impact the Polish economy overall include: technological changes; digitalisation and automation; demographic changes; green transition; and globalisation and deglobalisation. Among the intersectoral trends identified were: digitalisation; the development of remote services; the use of big data analysis; the internationalisation of labour markets and their interconnection; and changes in socially responsible consumption as a lifestyle choice.
2. Identification of sectors interconnected due to their field of operation, character, and range of services provided, similarity of trends that affect them, and critical factors for their development. Analysis of similarities in conditions and developmental opportunities resulted in the distinction of four main clusters, among which the IT sector together with telecommunications and cybersecurity hold a central position. For each sector within a given cluster, a realistic development scenario was developed, containing an indication of the trends that affect the sector, the critical factors for sustaining activity, and the resulting skills challenges.
3. Identification of intersectoral transferable skills that are in increasing demand across most of the analysed sectors as a result of the impact of identified trends. Examples of such skills include the ability to analyse data and make informed decisions, the processing and analysis of large data sets, the proficiency in using IT tools, and cybersecurity.

6.2.3 Post-solution reflection: successes and challenges

The approach implemented in Poland allowed for the creation of a comprehensive description of the situation in each sector in terms of its human capital needs, positions that companies are looking for and plan to seek employees for, skills for which demand is increasing (so-called hot skills), and current and future skills deficits. The applied methodology allows both to assess the current demand for skills in a given sector and to indicate the development directions of this sector and the resulting skills challenges.

Combining the analysis of existing data with qualitative and quantitative methods and diagnosis with techniques used for building future scenarios allows one to formulate recommendations regarding the current demand for human capital in a given sector and changes in this demand in the short and medium term. The advantage of the sectoral approach is the ability to identify not only universal and transferable skills common to different sectors and different job positions, but also skills specific to given professional roles.

One of the key findings of the SHCS research, which also presents a challenge, is the difference in how employers and experts assess the current and future situation in a given sector. Employers tend to focus on short-term perspectives and often do not recognise the long-term challenges that experts predict for the sector. This suggests that research on the future development of the sector should be more heavily based on existing data and expert opinions rather than solely on employer assessments.

Another major challenge for SHCS research is ensuring that their findings are more widely used in planning processes and interventions affecting the labour market, particularly in addressing skills shortages and mismatches. The results from these studies have already been utilised by sectoral councils from 17 industries of the Polish economy to formulate recommendations for both formal and non-formal education systems. They also helped identify priority areas for human capital development, supported by national and European Social Fund resources. The SHCS studies, Sectoral Skills Councils, and public funding mechanisms for skills development have become integral components of the workforce development system in Poland's economy.

6.3 Understanding the sectoral skills needs approach in Wales: ESSA – focusing on the steel sector across European, national and regional levels

6.3.1 Local context and origins of the solution

Unlike the Polish studies covering 17 national sectors in the previous chapter, the ESSA approach was applied to a single sector (steel industry) at several geographical levels: European, national and sub-national/regional. European Steel Sector Alliance (ESSA) was an EU-funded project to support multi-sectoral and multi-stakeholder cooperation through identifying current and future skill needs of the sector and developing an overarching upskilling/reskilling strategy to support a sustainable, efficient and competitive European steel industry[33]. Overall, it has included the steel sector from 13 EU countries and collaboration with more than 40 partners[34]. ESSA was an industry-driven initiative, and sector stakeholders sought solutions to identify skills shortages and mismatches – as a precondition for the efficient design of employment, skills and training policies and strategies.

The project has developed several tools for the development of skill intelligence such as steelHub; Technology and Skills Foresight Survey & Panel; Skills Assessment Template; National and Regional Rollout (to be explained later). The origin of the solution for the sector was found in developing (i) a Skills Alliance and (ii) a Blueprint Strategy to develop necessary approaches to sustain a competitive and environmentally responsible sector with innovation and the creation of highly skilled jobs. The project worked towards the transparency, comparability and recognition of the skill sets that comprise the typical occupations and job specifications in the European steel sector as a basis for developing training content in correspondence with national VET systems, utilising EU and international classifications, mechanisms and frameworks (Antonazzo et al., 2023a; Schröder, 2023). Based on the main findings, skills intelligence concerning the steel sector was not limited to the preparation and presentation of data/analysis, but also required the creation of a governance structure at regional levels to mitigate skills imbalances.

National and regional rollouts have been implemented to transfer the ESSA project results and tools to selected steel regions in UK (Wales), Spain, Czechia, Finland, Germany, Poland, Italy and Netherlands (Maldonado-Mariscal et al., 2023). The rollout tool is a pillar to implementing skills intelligence in practice by initiating co-creation processes in the countries and regions. It is a tool as it provides interaction at various levels, thus generating information exchange, synergies, increased stakeholder engagement and collaboration for large-scale upskilling and reskilling strategies. By identifying skill needs and demands, ESSA aimed to inform the development of training and help inform new vocational-programme content across the sector. However, this requires an understanding of how VET systems work and provide skills to the sector in different local contexts, as it is often at the regional level that such skill strategies are adapted and then implemented in a local context.

This chapter presents the approaches used by ESSA for the skills needs analysis of the European steel sector, but some particular observations are made on the situation in Wales to explain the dynamics between European, national and regional levels. The European steel sector has undergone substantial transformation, restructuring and consolidation, with ownership now largely in the hands of several large multinational companies, following mergers and acquisitions. This went hand in hand with technological innovation and changes in production processes and products. Such developments have had implications for the industry workforce, which is now much reduced i.e. as the sector has retrenched, plants closed and jobs have been shed – this process continues with thousands of steel

[33] For more info, see New Skills Agenda Steel: Industry-driven Sustainable European Steel Skills Agenda and Strategy (ESSA) | CEDEFOP, or ESSA homepage at ESSA.
[34] The countries involved are Belgium, Czechia, Finland, France, Germany, Italy, Lithuania, Netherlands, Poland, Romania, Spain, Sweden and UK.

jobs lost in the UK as plants in Wales and the north of England transition to Electric Arc Furnace (EAF)[35] production, as part of the need to decarbonise the industry.

Parallel to this – and driven by processes of consolidation, technological innovation, decarbonisation and changing market conditions – there have been changes in the workforce profile, which creates new human capital needs (see Stroud et al., 2024):

- First, new technologies (including digital transformation processes i.e. Industry 4.0) have contributed to a smaller, more streamlined and higher skilled workforce. Efforts to decarbonise production utilising new and established technologies is also having similar outcomes e.g. Wales and the transition to EAF production.
- Second, and related, old patterns of recruitment based on recruiting men from generations of family skilled by experience, have given way to recruitment of an increasingly diverse and more highly skilled and qualified workforce.
- Third, the reduction of workforce numbers, technological developments, and changes in patterns of recruitment have facilitated changes in work organisation and the introduction of high-performance work systems, which creates demand for a wider skill profile comprising T-shaped skills (transversal and technical).

Rapid and constant changes require the industry to continuously update the skills of its workforce. To remain competitive, the industry must facilitate the development of a highly qualified, specialised, and multi-skilled workforce. However, the industry faces skills shortages and gaps, recruitment difficulties, and talent management issues. Hence, it is necessary to improve the capacity of the industry to forecast, identify and anticipate skill needs, as well as tackle supply issues – towards the optimisation of skill use and skill utilisation in the immediate and long term, including recruiting skills.

Previously, emerging sector skill needs in broader areas have been identified (see, for example, Naujok and Stamm 2017; EC-EASME 2020), some of which are common across energy intensive industries (EIIs) more broadly, particularly skills related to Industry 4.0 technologies and decarbonisation. ESSA investigated more closely the precise character of the skill needs identified for the steel sector across several regions, including Wales. The importance of specific skills was identified in relation to technological advancements and decarbonisation at a job level, utilising surveys, interviews, and workshops.

Each steel-producing country presents specific institutional frameworks for skill formation. Institutions operating in a society are shaped by their historical path, and once considered in their joint combination, make up coherent models which can differ deeply from one another. Different institutional contexts produce different approaches with regard to market regulation, industrial relations and skill formation systems. Country comparison is of benefit in the definition of a new skills agenda and strategy for the steel industry as it allows to identify good practices and criticalities associated with the different institutional models, as well as common trends. Such comparisons can be considered within the context of technological developments, the decarbonisation agenda and related sector skill needs (see, for example, Vallejo-Peña et al., 2018; Antonazzo et al., 2023a and 2023b).

The approach of Wales to tackling skill needs is particular, as it will be for any country (and sometimes regions within countries). Wales is set within the wider context of the UK but is also a devolved administration with responsibility for education and training and so differs in some ways from the other constituent parts of the UK (England, Northern Ireland and Scotland), e.g. it develops its own qualifications and curricula. But, as with the UK more broadly, Wales' pattern of skill formation is market oriented. Similarly, it is often characterised as functioning with a low-skill/low-pay equilibrium and a voluntarist market-based training system, but this perhaps overlooks some concentrations of

[35] An electric arc furnace (EAF) is a furnace that heats material by means of an electric arc between electrodes. As the name implies, the process uses an EAF to melt the charge to make steel. It is a batch melting process producing batches of molten steel known as heats. It is more energy efficient while allowing for increased flexibility in the steelmaking process. Other methods include basic oxygen furnace (BOF) and induction furnace plants. While EAF steelmaking relies on electricity and recycled metals, BOF depends on raw materials like iron ore and metallurgical coke as part of a process where oxygen is blown into the furnace at a high velocity.

high-skill value-added economic activity in Wales (e.g. aerospace, steel production). In general, Wales and the UK are market-based models that rely on intense product-market competition, making firms more sensitive to shocks and triggering higher flexibility of employment. Social protection is underdeveloped and there is little incentive to invest in specific skills since these would not be protected by the welfare state or by job security and a rapid structural change would quickly devalue them (as is currently occurring in South Wales with the transition to EAF steel production).

In such a context, competition also extends to the education system, where colleges and universities compete for attracting the best students, and students for entering the best universities, with vocational education and training (outside of universities) a relatively neglected area of skill formation. Indeed, UK vocational education programmes, and apprenticeships specifically, are often compared unfavourably with those embedded within more corporatist and collectivised VET systems (e.g. Germany's dual apprenticeship) (Antonazzo et al., 2023b). ESSA aimed to understand the sector needs across Europe, but also to identify priorities and strategies to address them at the regional and national level.

6.3.2 Description of the methodology

Under the ESSA project, a Blueprint at sector level was developed for a sustainable steel industry overall, but also sensitive to the particularities of countries e.g. Wales. The particularities were drawn out through regional workshops with industry stakeholders (steel companies, trade unions, training providers, regional skills partnerships, Welsh Government) (see below for the workshop methodology). In Wales, initially three workshops were conducted. The specific focus was on South Wales, as the location of its major steel plants, to identify the challenges of digitalisation and decarbonisation for the steel sector, and to a degree address the skills questions facing EIIs in Wales more broadly (see Schröder et al., 2023b for detail).

The workshops across ESSA resulted in clear recommendations – the main focus in Wales was on decarbonisation and related skills, i.e. green skills. For industry in the South Wales region, it is recommended to conduct an independent audit on skill needs to meet decarbonisation goals. To be able to meet the ever-changing skills landscape, a continuation of the skill needs assessments between now and 2050 was recommended, with a dedicated role developed within devolved government to facilitate delivery of the skills needed. Above that, long-term funding and sharing of knowledge and resources are needed. There must be a long-term investment plan involving the central UK government and the Welsh government to address skills and training needs. The skills landscape for industry also needs further mapping, to fully understand the current system and how it addresses the needs of industry more generally, and the challenges of 'green skills' and decarbonisation specifically.

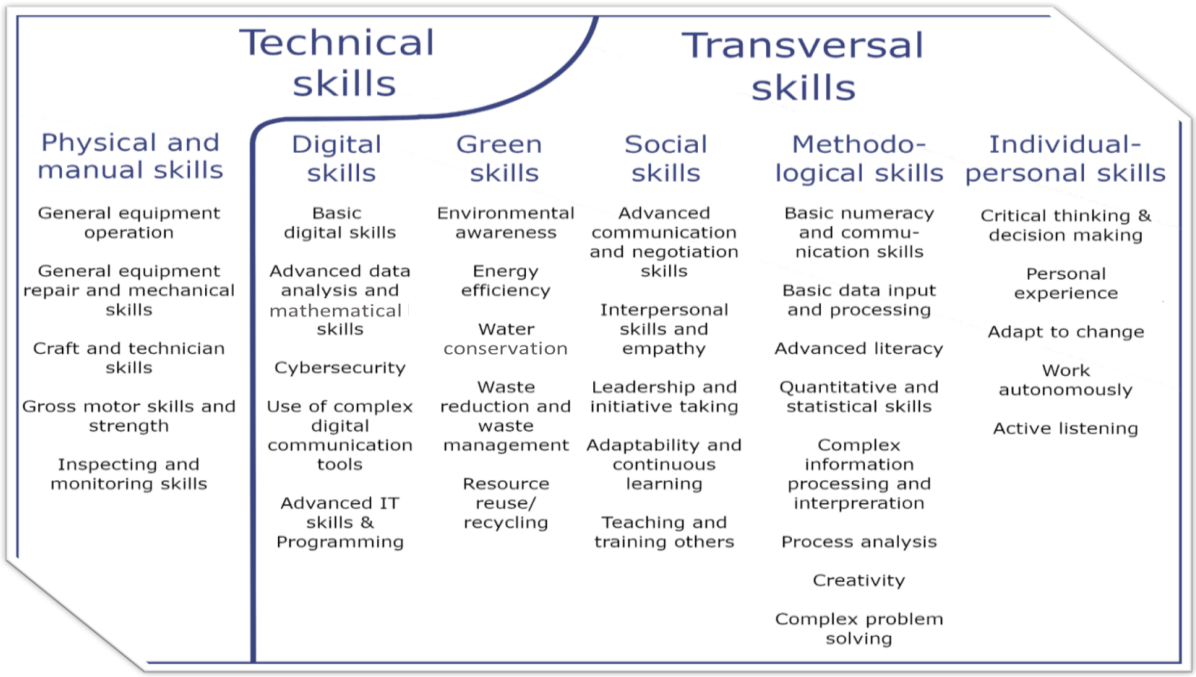
Another concrete recommendation revolved around the formation of a skills hub, or hubs, as a one-stop-shop for providing, and signposting to, courses and providers that can deliver skills quickly. To build collaboration between stakeholders to address the challenge of decarbonisation and green skills, it was recommended to develop a collaboration framework that involves representatives of all key stakeholders. The workshops also showed that there is a need for greater policy coordination, particularly between different government departments (Education and Skills, Economy, Climate Change). It was recognised that the identified skill needs were for the sustainability of the industry, which will also serve workers as long as they remain within the industry. What requires further consideration is the transferability of sectoral skill needs beyond its confines – particularly given recent events in South Wales and the loss of 2,800 jobs at Tata Steel.

Beyond these specific considerations for Wales, the wider blueprint is a European Steel Skills Agenda and strategy for meeting new skills demands in the sector, including in regions like Wales. This is a blueprint informed by the sector and designed by the sector. It aims at the development of modules and tools to build awareness and new skills for a globally competitive steel industry, ready to anticipate new skills demands and to allow proactive practical activities to meet the future requirements of the industry. Hence, the main objective and innovation has been to develop an industry-driven proactive skills strategy or Blueprint to:

- identify proactive, rather than reactive ways to meet the skill needs and demands of the industry, taking into account skills gaps and shortages, and forecasts of supply and demand;
- identify training and curricula requirements, including ways to implement new vocational education content in immediate and effective ways, within both companies and formal education and training institutions;
- improve and update training and develop new programmes for 'train the trainer' and leadership (key elements of a new skills agenda);
- identify, implement and secure necessary political support measures by mobilising and integrating stakeholders and policymakers at EU and national levels;
- identify and promote successful sectoral upskilling schemes (including exchange of existing tools, best/good practice & knowledge) and efficient management of knowledge;
- improve the attractiveness of the steel industry and careers for talented people (recruitment and retention), including the identification of strategies for overcoming recruitment difficulties and widening the talent pool for a more diverse workforce; and
- identify Key Performance Indicators (KPIs) to monitor success and needs continuously in respect of these goals and to adjust the agenda and strategy in time to respond to upcoming new developments and environments (Schröder, 2023).

The data generated was used to identify emerging skill needs across eleven job profiles (defined according to ESCO profiles): Maintenance and Repair Engineer; Process Engineer; Manufacturing Engineer; Process Engineer Technician; Production Supervisor; Industrial Electrician; Metal Processing Plant Operator; Metal Working Machine Tool Setter and Operator; Factory Hand; Training and Staff Development Professional; and Vocational Education Teacher. These job profiles were analysed using technical and transversal skill needs (T-shape approach), listed in detail in Figure 4 below:

Figure 4: ESSA T-Shaped Skill Needs: example of broader job profiles



Source: (Schröder, 2023).

Furthermore, the survey identified gaps between skill needs and current VET provision in the case-study countries, including Wales.

Document analysis: *An* extensive literature review and document analysis was carried out that focused on the following areas and topics:

1. Steel industry scenario at the national and European levels.
2. Skill formation systems.
3. Skills gaps and forecasting programmes at the national and European level.
4. National VET systems' regulatory frameworks, functioning and programmes.

The collected documents, which included scientific papers, institutional reports and national regulation, provided secondary data, insights and inputs for the further research and the Blueprint strategy.

Qualitative Data: Further to the results of the exploratory survey and desk research, semi-structured interviews with experts in steel production and vocational training, along with trade union and employer association representatives, and steel company HR officers, Production Managers and Training Centre Managers were conducted. The distribution of the interviews/responses points to a strong industry component, in accordance with ESSA's industry-driven approach. This has helped to identify national and cross-national trends in terms of emerging skill needs and national VET programmes that feed into the industry.

As indicated above in relation to Wales, national-regional workshops and roundtables were rolled out to discuss the results of the surveys and interviews and the tools and measures of ESSA within the context of national/regional skill needs concerns, using the following steps:

- ESSA partners develop a common Framework for the National-Regional Workshops.
- A first round of workshops in the pilot regions: information, verification of interest & willingness to participate of stakeholder groups in the region (companies, trade unions, training institutions, research institutes, public employment and education institutions, and civil society).
- Reviewing experiences, developments and events and their integration in the ESSA structures, tools and measures.
- Conducting more in-depth workshops on specific topics that were raised in the pilots (rounds 2 and 3), supporting additional activities within a social-innovation process. In Wales, this focused on the demand and supply of 'green skills'.
- Setting up of a European-national-regional European Community of Practice for supporting National-Regional Training Ecosystems, exchanging good practice and mutually learning from each other.

6.3.3 Post-solution reflection: successes and challenges

The outcome is a Blueprint for sustainably ensuring reliable alliances and strategies to adjust the skill needs of the steel industry proactively and continuously, within which Wales is integrated. A reliable and accepted governance structure for the main elements of the ESSA Blueprint on a European, national and regional level comprises three main elements (see Figure 5) and apply to Wales and all other steel producing regions of Europe:

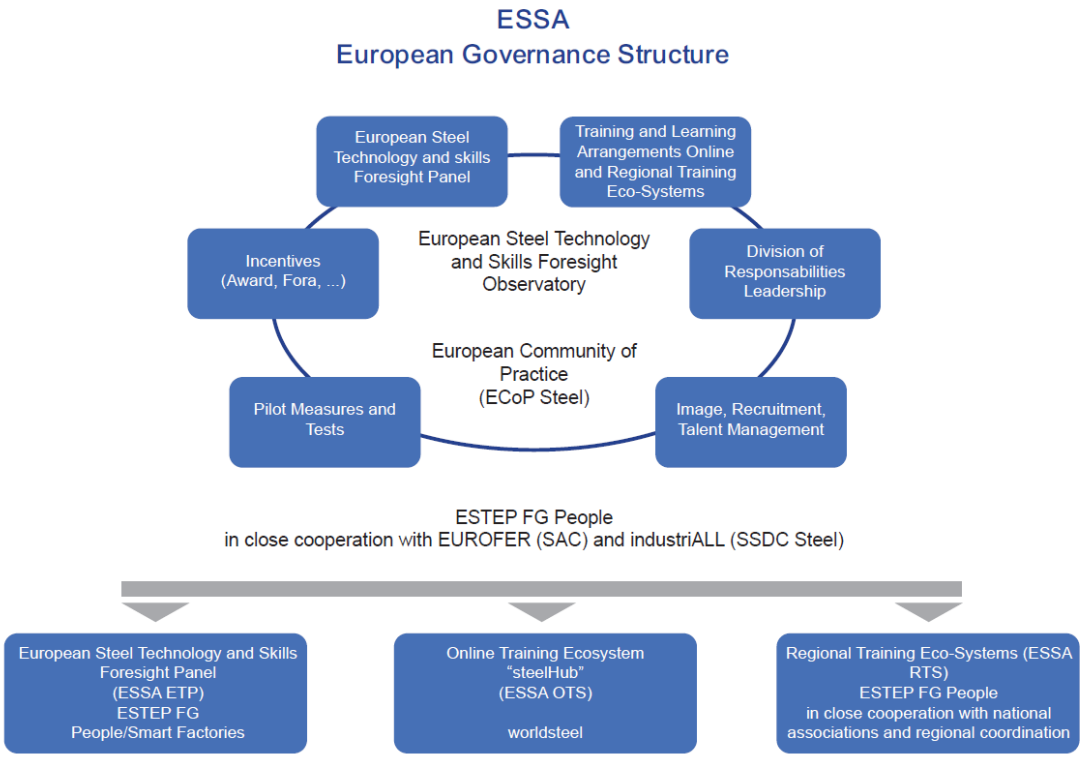
- ***The European Steel Technology and Skills Foresight Observatory*** (ESSA ETP) as the main European coordination unit, conducting a regular (annual or biannual) European Steel Technology and Skills Foresight Panel. Essentially, this comprises an iterative validation process that works to understand the skills anticipated by industry stakeholders and align them with available training provision.
- ***The Online Training Ecosystem "steelHub"*** (ESSA OTS) - this is responsible for meeting the supply of skills. It comprises an online platform that acts as a repository of training programmes

and is informed in its content by the skills demand research of ESSA. SteelHub is operated by the World Steel Association's steel university[36].

- ***The European Community of Practice of Steel Regions (ECoP Steel)*** - connecting and supporting steel-related member states and the main European steel regions as a European platform for the different National-Regional Training Ecosystems (ESSA RTS): exchanging, initiating, developing, and implementing good practice for skills and training. Wales is one steel region and will have its distinct skill needs within the broader parameters of the ESSA Blueprint and the skill needs identified. As indicated above, decarbonisation was identified as a key area of skill needs in Wales, with those needs met within the confines of a fragmented and market-orientated vocational education skills system.

This structure provides the demand side (skills requirements) and the supply side (training offers and exchange, industry image and recruitment activities) as well as an exchange and piloting / testing sphere for innovative solutions (Schröder, 2023).

Figure 5: ESSA European Governance Structure



Source: Schröder, 2023.

The European governance structure is already implemented and accepted by the main steel industry actors on the European level: ESTEP, EUROFER, and industriALL Europe. The core coordination unit is the Focus Group People of ESTEP which has agreed to run the Foresight Observatory and Panel and to establish a European Community of Practice of Steel Regions (National-Regional Training Ecosystems). The Observatory started its continued implementation and regular activities in July 2023.

The Observatory, steelHub, and European Community of Practice are part of the European Steel Community, connected with current European platforms and tools beyond the steel sector, ensuring exchange with the broader European process industry (e.g. within the Process for Planet programme of A.SPIRE and via the SPIRE-SAIS Blueprint). The governance structure of ESSA is built on a division of responsibilities, clarified and checked with the European Steel Associations and the social

[36] For more info on World Steel Association, see https://worldsteel.org/. For info on Steel University, see steeluniversity - Learning for the steel industry.

partners ESTEP, EUROFER, and industriALL. Connections with European platforms beyond the steel sector (e.g. Pact for Skills, Centres of Vocational Excellence) and tools (e.g. ESCO, Europass) are already part of the ESSA strategy, measures, and training (esp. in the steelHub and the Regional Training Ecosystems). To ensure a stronger integration of Small and Medium Sized Enterprises (SMEs), an "ESSA Task Force SME" was founded, ensuring and integrating the SME perspective, but reaching SMEs remains a challenge (see Schröder *et al*., 2023a).

There are still challenges integrating (and engaging) in uniform and even ways the perspectives of a wide range of stakeholders across, and to some extent beyond the sector, ensuring the widest array of voices are heard and included. The Covid-19 pandemic brought some specific barriers to engagement, but online interviews and surveys overcame most of the issues in this regard. However, one aim of ESSA was undeliverable: a sector skills matrix (SSM). The SSM was an attempt to systematically identify, evaluate and compare steel-sector relevant VET occupational qualification programmes (OQPs) in four European countries (Germany, Italy, Poland and Spain) – the matrix would not work for Wales because the VET system is too fragmented.

The matrix's intended three main functions were to (i) identify steel sector relevant VET occupational qualification programmes in several (initially five) case-study countries; (ii) provide a range of standardised and thus comparable formal information about each identified qualification programme and (iii) provide an assessment of each OQP in terms of adequacy of current and future transversal skills provision. However, as VET systems are almost exclusively a national domain with very limited influence, coordination or oversight at the EU level, documentation related to the OQPs is non-standardised and therefore hard to compare. Furthermore, 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, proved to be difficult to establish. The main issue in this regard is the lack of industry involvement, without which an industry-led skills gap assessment is simply not possible. This speaks to the necessity of stakeholder participation when addressing human capital needs (Weinel et al., 2023).

More broadly, ESSA offers a sector-wide strategy and methodology (Blueprint) for addressing steel industry skill needs, but the particularities of skill needs lessons from Wales (and elsewhere) are perhaps less transferable. Important here is to recognise that whilst sector skill needs might be quite common across countries (there are only so many ways that steel might be produced at an industrial scale), political and economic contexts shape the way skills are delivered from place to place. Furthermore, the pace of technological innovation will be driven by numerous factors and thus shape skill needs, and the extent to which decarbonisation is part of the skills agenda is often a political question.

6.4 Transferring local experiences from Poland and Wales to Türkiye

6.4.1 Turkish steel industry: context and background

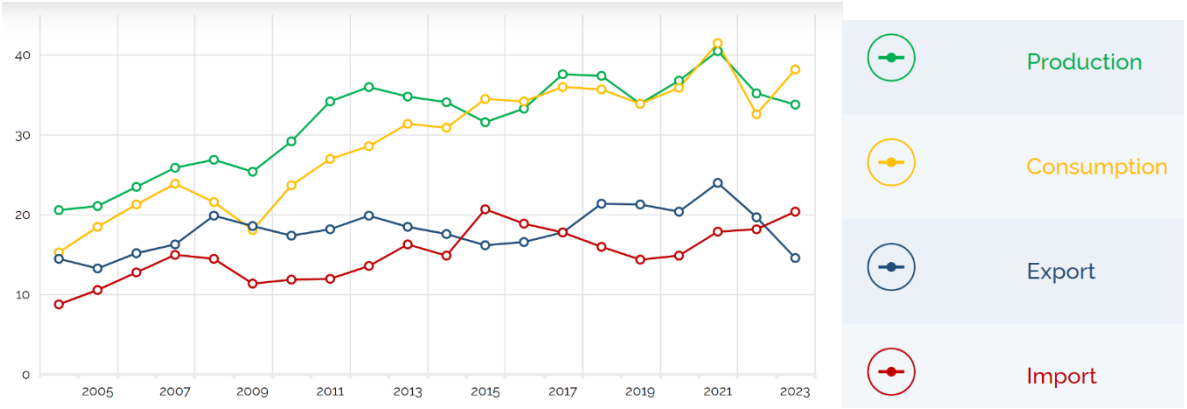
Türkiye is a country with a dynamic and diverse economy that has experienced rapid industrialisation and urbanisation over the past few decades. The steel industry plays a crucial role in this growth, contributing approximately 6.7% to the country's total exports, a value of around 14.9 billion dollars (Turkish Steel Producers Association, 2023). There are currently 41 crude steel production facilities in Türkiye, 27 of which are electric arc furnace (EAF) plants, 11 are induction furnace plants and 3 are basic oxygen furnace (BOF) plants (World Steel Association, 2023). EAF technology is considered more environmentally friendly compared to traditional blast furnace operations, as it reduces carbon emissions by using recycled steel scrap in the production process (European Steel Association, 2022).

Türkiye signed a 'Customs Union' agreement in 1995 with the EU to liberalise the trade of all industrial goods between the country and the EU. As part of this agreement, since 1996 Turkish iron and steel products can be traded without customs duties with all EU member states, in return for ceasing state subsidies to the domestic steel industry (European Commission, 1996). Today, all Turkish steel

companies are privately owned and manufacturers export worldwide, largely due to their competitive pricing and effective marketing strategies. In 2023, the EU was Türkiye's largest steel export market, receiving 4.5 million tonnes, which accounted for 31% of total steel exports. The Middle East followed with 3.3 million tonnes (22.8%) as second export market, followed by other European countries ranked third with approximately 2 million tonnes (14%). North Africa represented 10.9% of exports with 1.6 million tonnes, and Latin America contributed 7% with 1 million tonnes (Turkish Steel Exporters Association, 2023).

In 2022, global crude steel production saw a 4% decrease, which had a significant impact on the Turkish steel sector. Recession expectations in Türkiye's main export markets, particularly the EU and the USA, combined with rising energy costs, led to negative repercussions for the industry. Turkish steel exports decreased by 18% and imports fell by 3.6%. However, the value of imports increased by 8.5%, reaching 15.6 billion dollars, which was largely attributed to imports made at dumping prices (World Steel Association, 2022; Turkish Steel Exporters Association, 2023). By 2023, steel exports had decreased further by 25.8%, while imports saw a 12.5% increase, likely due to rising energy costs and Türkiye's growing reliance on domestic energy sources (Turkish Steel Exporters Association, 2023).

Figure 6: Turkish annual steel production (in million tonnes) (Turkish Steel Exporters Association)



Source: Turkish Steel Exporters Association, 2023, https://www.cib.org.tr/en/statistics.html
Notes: The x axis shows years, the y axis shows steel production in million tonnes.

As depicted in Figure 6, Türkiye has experienced a consecutive decrease in steel production and export over the past three years. This decline is largely attributed to rising energy costs, global economic challenges, and the country's increased dependence on imported energy (OECD, 2023). The rate of utilisation of Turkish steel plants fell from 75% in 2021 to 60-65% in 2022 and 2023. The reduction in capacity utilisation underscores the difficulties faced by domestic producers in maintaining competitiveness and profitability amid economic volatility (Turkish Steel Exporters Association, 2023; OECD, 2023).

Increasing energy and labour costs have eroded the competitive edge of Turkish steel producers. In particular, sharp increases in electricity and natural gas prices have had a substantial impact on production, contributing to the sector's challenges. The growth expectations for the Turkish steel industry are contingent on global demand and energy prices. If energy costs decrease and recession fears subside, production is expected to recover. Industry representatives also predict that new investments over the next 2-3 years could increase steel production capacity to 65 million tonnes (OECD, 2023).

Despite these challenges, Türkiye's strategic geographic location, serving as a bridge between Europe, Asia, and the Middle East, offers substantial opportunities for growth. The broad export markets of the country and ongoing urban transformation projects could help stabilise and potentially drive future growth in the sector (Turkish Steel Exporters Association, 2023). Furthermore, advancements in environmentally friendly technologies, such as the increasing use of electric arc

furnace (EAF) plants, could provide Türkiye with a competitive advantage in the global push for greener industrial practices (European Steel Association, 2022).

Nevertheless, legislative changes, such as the EU Green Deal and the Carbon Border Adjustment Mechanism (CBAM), will also play a pivotal role in shaping the future competitiveness of the Turkish steel sector. Iron and steel sector is one of the five sectors that are affected directly and immediately by CBAM[37]. Türkiye plans to introduce a national emissions trading system (ETS) and transition to cleaner energy sources in an effort to reduce carbon emissions. With more than 70% of Turkish steel production based on electric arc furnaces (EAF), which produce lower carbon emissions than traditional methods, the country is well-positioned to remain competitive if the energy transition is successful (European Steel Association, 2022; Turkish Steel Exporters Association, 2023). Thus, Türkiye's steel sector is at a critical juncture due to the challenges of rising energy costs, dependence on imported raw materials, and ongoing economic volatilities.

6.4.2 Human capital challenges of the Turkish steel sector

The steel sector in Türkiye is a significant contributor to the country's economy, employing approximately 150,000 people, which represents about 1.5% of the total workforce. The workforce in this sector is diverse, with a mix of ages, though a significant portion is between 30 and 50 years old. Gender distribution is predominantly male, with women making up around 10% of the workforce. Education levels vary, but a substantial number of employees hold technical or vocational qualifications, with a growing number of university graduates entering the field. Occupational profiles in the steel sector include roles such as engineers, technicians, machine operators and sales professionals (Türkiye Steel Exporters Association, 2023).

The Turkish steel sector, despite its importance in the country’s economy, faces numerous challenges of human capital that are directly influenced by both domestic economic conditions and international policies. The first challenge is the transition to greener production methods, as mentioned above by the EU Green Deal and CBAM. Despite 70% of steel production being based on EAF technology in Türkiye, the transition requires a workforce equipped with new technical expertise in sustainable practices. This creates a pressing need for large-scale retraining and upskilling programmes to prepare workers for greener production methods (European Commission, 1996; World Steel Association, 2022).

The second challenge is the mismatch between the current skills of the workforce and the evolving needs of the industry. As the steel sector increasingly incorporates automation, digitisation and advanced technologies such as artificial intelligence and robotics, the demand for highly specialised technical skills has increased. Unfortunately, Türkiye’s educational and vocational training systems have struggled to keep up with these rapidly changing demands, leaving a gap between the skills available and those required by modern steel production processes (Türkiye Steel Exporters Association, 2023; OECD, 2023).

Thirdly, the sector is also facing demographic problems, particularly an ageing workforce. Many experienced workers are approaching retirement, and there is an insufficient influx of younger workers to replace them. The industry is often perceived as less attractive compared to other sectors that are seen as more modern and innovative, such as technology and finance. Moreover, the working conditions in the steel industry can be demanding, with long hours and physically strenuous tasks, which can deter young people from pursuing careers in this field. This demographic shift poses a serious risk to the continuity of knowledge and expertise within the industry. Without structured mentoring and knowledge transfer programmes, the loss of experienced workers could lead to a significant depletion of critical skills (OECD, 2023).

[37] The EU’s Carbon Border Adjustment Mechanism (CBAM) is the EU's tool to put a price on the carbon emitted during the production of carbon intensive goods that are entering the EU, and to encourage cleaner industrial production in non-EU countries. The initial application of CBAM is foreseen to imports of certain goods and selected precursors whose production is carbon intensive and at most significant risk of carbon leakage: cement, iron and steel, aluminium, fertilisers, electricity and hydrogen.

Compounding these issues is the low participation of women in the Türkiye labour market, particularly in male-dominated industries such as steel, which is often perceived as physically demanding and less suitable for women. This perception, coupled with cultural biases and stereotypes, discourages many women from pursuing careers in this field. This lack of diversity limits the available talent pool, and addressing this imbalance through targeted initiatives could help mitigate labour shortages. Encouraging greater female participation in the steel sector through education programmes and workplace reforms is essential to build a more resilient and diverse workforce (World Bank, 2020).

Given the evolving landscape of the Turkish steel sector and the challenges faced above, it is critical to address the current and future skill needs of the workforce. The rapid adoption of new technologies, coupled with the transition towards greener production, underscores the need for a comprehensive skill needs analysis to align human capital with the sector's long-term goals. Due to increasing reliance on automation and digitisation in the Turkish steel sector, it is crucial to identify the skills necessary for these advancements and ensure that workers are trained accordingly to maintain the sector's competitiveness in global markets. At the same time, compliance with stringent environmental regulations requires equipping the workforce with expertise in renewable energy, energy efficiency, and low-emission technologies.

To strengthen their competitive edge, both locally and globally, Turkish steel producers must understand the specific skills required to navigate the challenges and opportunities of the sector. A targeted skill needs analysis can pinpoint existing gaps, allowing the design of effective training programmes and education strategies that will prepare the workforce for future demands. Furthermore, as the industry seeks to expand production capacity through planned investments, aligning workforce capabilities with growth expectations is vital for sustainable development.

6.4.3 Comparing Polish and Welsh approaches for their potential implementation in Türkiye

Before offering recommendations to monitor competence needs in the Turkish steel sector, based on the solutions developed in Poland and ESSA (Wales), it is essential to carefully consider the fundamental differences between these approaches. Understanding these differences allows us to relate them to the specific needs of the Turkish context. The following section provides a comparative analysis of these approaches and highlights their implications for the Turkish steel industry.

The first notable distinction lies in the objectives behind the studies conducted in Wales and Poland, as well as the methodologies employed. The underlying goals of each approach were shaped by different priorities. In the Welsh case, the primary objective was to create a proactive industry-driven skills strategy, commonly called a “Blueprint” and drawing on the outcomes of the European Steel Skills Alliance (ESSA). The ESSA Blueprint aimed to align the skills of the workforce with the evolving needs of the sector. Therefore, the process of generating specific recommendations was tightly integrated into the broader research framework from the outset, ensuring that the results were directly related to industry requirements. In Poland, however, the primary goal was to provide critical knowledge to Sectoral Skills Councils, which operate in close collaboration with ministries, governmental agencies, educational institutions, and international bodies. These councils are responsible for crafting recommendations that shape VET programmes.

Another key difference is seen in the scope and structure of the solutions adopted in each country. In Poland, the strategy was designed to establish a universal framework that could be applied consistently across a wide range of economic sectors. The advantage of this approach is its ability to facilitate comparisons across industries. By standardising solutions, it became possible to monitor the flow of skills between sectors, identify skills gaps that transcend specific industries, and recognise the importance of transversal skills, that are applicable in multiple sectors or job roles. This approach enabled a broader and more comprehensive view of the labour market and allowed policymakers to implement reforms that could benefit the economy as a whole.

In contrast, for ESSA and Wales, the approach was narrower in focus, concentrating on a single sector without extensive consideration of how trends in other industries might affect it. However, it did

take into account how the sector operated in different European steel producing countries, offering valuable information on how global and national factors intersect in shaping skill needs. By focussing on a sector undergoing significant transformations, ESSA was able to analyse how shifts in the economic environment led to changes in the desired skills of workers, including by country or region (e.g. South Wales). Furthermore, comparing this sector internationally provided valuable lessons on how institutional frameworks influence the links between the education system and the labour market.

When examining the analysis of skill needs, there are further methodological differences in how specific skills were identified. In both Poland and Wales (ESSA approach), the focus was on evaluating job profiles and identifying skill requirements for specific roles. However, in the ESSA solution and for steel producing countries across Europe, the approach to categorising skills was distinctive. Skills were first grouped into broader categories, such as technical and transversal skills, following the so-called T-shape approach. This method allowed for a general, yet versatile, framework to be applied to a range of occupational profiles, which provided flexibility in adapting the strategy to different job roles and industries (e.g. craft and technician skills).

In the Polish (SHCS) example, skills were identified throughout the research process, without an initial predefined list (the list was developed as the study progressed). This allowed for a more organic and dynamic approach to understanding the skill needs as they emerged during the study. It also allowed researchers to adapt the methodology to reflect real-time insights, ensuring that the final recommendations were more accurately aligned with the current demands of the sector.

As the steel industry undergoes substantial transformations – driven by technological advancements, environmental regulations, and changes in global supply chains – there is a growing need for flexibility in defining the required skills, which ESSA aimed to capture through ongoing Skills Foresight panels. In Türkiye, for example, the dynamic nature of the steel industry means that identifying skills at the beginning may not fully capture the evolving needs of the sector. Therefore, adopting a research methodology that allows for an iterative process, in which skills are continually refined throughout the study, could be more effective.

This approach, as used in Poland but also by ESSA, highlights the importance of responsiveness in skills analysis. For example, by developing the skills list in conjunction with the research findings, the Polish study was able to provide more relevant and actionable information. Furthermore, this flexible model ensured that the skills identified were not only relevant to the present but also forward-looking, preparing the workforce for future challenges and opportunities within the industry.

More rigid approaches, where skills lists are established at the beginning of the study, may fail to fully capture emerging trends or shifts in the sector. As industries such as steel undergo rapid transformation, the ability to adjust and respond to new information becomes increasingly important. Therefore, adopting a similar methodology in Türkiye could offer significant advantages, ensuring that the resulting recommendations are not only comprehensive but also adaptive to the changing landscape of the labour market. In this way, the detailed skills profiles created for specific professions/roles can be utilised by Sectoral Skills Councils in the development of specific solutions.

For ESSA, as in Poland, secondary data analysis was used to create scenarios for the industry. However, what distinguishes the Polish approach is the absence of a systemic and institutional analysis. On the contrary, a key component of the ESSA project was a comprehensive review of existing knowledge about skills formation systems, skills gaps, and forecasting programmes at both the national and European levels, as well as the regulatory frameworks, functioning, and programmes of national VET systems.

Considering that the material developed in Poland was intended to serve as significant support for the Sectoral Skills Councils, it could have been beneficial to supplement it with these additional elements. Members of these councils are not always educational experts, and having access to concise and synthesised knowledge about key institutions and systems of competence formation relevant to the industry could prove to be a valuable resource in assisting the councils in formulating their recommendations.

By incorporating this broader institutional perspective, the Polish approach could gain depth, allowing for a more informed process to address the needs for both current and future competence. Furthermore, providing Sectoral Skills Councils with information on how different VET systems function and how regulatory frameworks shape skills development at the national and European level could improve their ability to align their recommendations with broader industry and policy trends. This would ultimately allow for more strategic and informed decision making in response to the evolving demands of the labour market.

Table 1: Key differences in the approaches to monitoring skills needs in the Polish and ESSA/Welsh examples

Characteristics	ESSA/Wales	Poland
Goal and the implementation of results	To develop an industry-driven proactive skills strategy or blueprint.	Providing key information to Sectoral Skills Councils, which are responsible for developing recommendations.
Scope and structure	Specific to one sector, tested in various countries. Enabling the identification of transnational trends, characteristic of a single sector.	Universal solution, tested in various sectors. Focused on understanding broader market processes and intersectoral relationships, as well as their impact on human capital flows. Enabling the identification of cross-sectoral trends characteristic of a selected country.
Universality of the solution	The solution was developed to be implementable and comparable across different countries (partially achieved).	The solution was developed to be implementable and comparable in different sectors in Poland (objective achieved).
Definition of skills	Skills defined quite broadly, with the same groups for different professional profiles (T-shaped approach).	Detailed skills, specifically defined for different professional profiles.
Institutional context	Institutions and educational systems as a component of the study.	Exclusion of the analysis of systems and institutions.

Source: Own elaboration

In summary, before making a decision regarding the adoption of a specific solution in Türkiye, it is essential to address several strategic and political considerations. The first of these is to contextualise the skill needs study within the public policy framework. One must determine whether the research team will be responsible for formulating recommendations while public agencies will be responsible for their implementation, or if an intermediary organisation will be established to facilitate this process. In Poland, such intermediary roles are fulfilled by Sectoral Skills Councils, which also play a role in generating pressure on decision makers to implement optimal solutions. It appears that in the case of Türkiye, establishing a similar body would be necessary, particularly to influence the implementation of specific solutions by decision-makers.

The second issue concerns the nature of the solution: whether it should focus on a single industry from a transnational perspective or cover multiple sectors, perhaps Energy Intensive Industries (EIIs), within a national context. This decision is primarily driven by the knowledge we aim to acquire: whether we wish to understand the interactions between different sectors within a given country or focus on a specific narrow industry. Both approaches have their advantages and disadvantages. A solution that incorporates a transnational perspective and involves partners from other countries has an additional benefit. It appears that an internationally rooted solution enhances transparency in the recommendation development process and can also serve as a valuable tool for influencing decision-makers (including in the context of Türkiye's potential accession to the EU).

For Türkiye, conducting a thorough institutional and systemic analysis is crucial, as is the development of customised recommendations for educational institutions, sectoral bodies, and national administrative agencies. This approach mirrors the strategies used by ESSA, including in Wales,

which have proven effective in addressing similar challenges. Furthermore, considering the anticipated transformation in the steel sector, an in-depth qualitative forecast similar to the SHCS methodology used in Poland would provide valuable information.

A fundamental aspect is not merely assessing the current skills needs in Türkiye, but rather forecasting future changes in those needs. This forward-looking approach is essential given the potential shifts in regulatory and market environments influenced by significant international legislation. The ability to predict how the needed skills will evolve in response to such changes is critical to ensure that educational and training systems remain relevant and effective.

Furthermore, from a practical standpoint, it is vital to precisely define the skills required for various professional profiles. This precision, similar to the approach taken in Poland, helps ensure that educational programmes and workforce development initiatives are aligned with actual market needs, with ESSA doing this at a wider level. By clearly delineating the skills necessary for different roles, Türkiye can better tailor its educational and training programmes to address current and anticipated demands, thus improving the overall effectiveness of these programmes in preparing individuals for the evolving job market.

6.5 Conclusions and recommendations for Türkiye

The comparison of Polish and Welsh approaches highlights key methodological differences that can inform the development of skills monitoring systems in Türkiye. While the broader scope of the Polish method allows for the identification of cross-sectoral trends, the ESSA approach in Wales offers valuable insights into tailoring solutions for a single sector undergoing transformation, such as the steel industry. Given Türkiye's position as a major steel producer facing similar challenges, including technological advancements and environmental regulations, adapting these methods could significantly improve the country's ability to meet future skills needs. The following recommendations draw on the strengths of both approaches to propose a framework for the Turkish steel sector.

Sectoral skill needs analyses conducted in Poland and Wales offer robust frameworks that can be adapted to the Turkish context, particularly in the steel sector. Sectoral Human Capital Studies (SHCS) in Poland and the European Steel Skills Agenda (ESSA) in Wales have shown effective methodologies for identifying critical skills gaps and future requirements. These methodologies combine quantitative surveys with qualitative interviews, as well as stakeholder workshops, ensuring a comprehensive understanding of sector-specific skills and aligning vocational education and training (VET) systems with industry demands.

Adapting SHCS and ESSA methodologies to Türkiye's steel sector holds considerable promise. By incorporating these approaches, Türkiye can develop a detailed understanding of its workforce needs and create targeted training programmes to address current and future skills demands. Establishing sector-specific skills alliances, similar to those promoted by ESSA, which were cascaded down to the regional level could enhance collaboration among industry stakeholders, educational institutions, and policymakers. This would ensure that training programmes remain responsive to market demands and technological advances at the sector level and, where appropriate, regional level.

To effectively address the skills needs in Türkiye's steel sector, it is essential to integrate sector-specific insights with a flexible, future-orientated framework. Drawing from both the Polish and Welsh experiences, the following recommendations can be proposed:

- Sector-specific studies: Conduct comprehensive sectoral studies similar to Poland's SHCS to identify critical skills gaps and future requirements. This approach should include both quantitative surveys and qualitative interviews with industry experts.
- Stakeholder collaboration: establish sector-specific skills alliances to facilitate collaboration between industry stakeholders, educational institutions, and policymakers. This will ensure that training programmes are aligned with market needs and technological advances. ESSA provides a template for a sector skills alliance, drawing on all relevant stakeholders.

- Integration of green and digital skills: emphasise the development of skills related to green technologies and digitalisation, crucial for maintaining competitiveness in the global market. Training programmes should focus on renewable energy, energy efficiency, digital transformation, and advanced manufacturing technologies.
- Continuous monitoring and adaptation: implement a continuous monitoring system to regularly update skills profiles and training needs based on emerging trends and industry feedback. This will help keep the workforce's skills relevant and up to date. The ESSA foresight panels (ETP) provide an example of how this could be achieved.
- Inclusive employment practices: promote diversity and inclusivity in workforce development initiatives, ensuring equal opportunities for all individuals, regardless of their background and gender. This can help to tap into a broader talent pool and foster innovation.

It is important to be aware that integrating these solutions into the Turkish steel sector presents several promising opportunities and notable challenges. These must be taken into account when a decision is taken by the Turkish stakeholders.

Opportunities

- **Enhanced competitiveness:** implementing these methodologies can significantly improve the competitiveness of the Turkish steel sector. By addressing skills gaps and aligning training programmes with industry needs, Türkiye can better position itself in the global market.
- **Sustainable development:** the emphasis on green technologies and digitalisation aligns with global trends toward sustainability and Industry 4.0. This focus can help Türkiye's steel sector reduce its carbon footprint and adopt more efficient production processes.
- **Economic growth**: developing a skilled workforce capable of meeting future demands can drive economic growth. As the sector grows, it can create more job opportunities and contribute to overall economic stability.

Challenges

- **Implementation costs**: adapting and implementing these comprehensive methodologies may require significant investment. The costs associated with conducting extensive surveys, developing new training programmes, and establishing skills alliances could be a barrier.
- **Stakeholder coordination**: ensuring effective collaboration among various stakeholders, including industry leaders, educational institutions, and policymakers, can be challenging. Aligning interests and securing a shared commitment is crucial for the success of these initiatives.
- **Cultural and institutional differences**: the approaches developed in Poland and Wales may need to be tailored to fit Türkiye's unique cultural and institutional context. Differences in educational systems, industrial structures, and labour markets must be carefully considered.
- **Political and regulatory support**: obtaining consistent political and regulatory support is essential for the successful implementation of these initiatives. Political instability or changes in government policies could pose significant challenges.

To conclude, integrating skill needs assessment methodologies from Poland and Wales/ESSA into Türkiye's steel sector presents a valuable opportunity to improve workforce skills and industry competitiveness. Although there are notable challenges to implementation, including costs, stakeholder coordination, and the need for political support, the potential benefits in terms of economic growth, sustainable development, and global competitiveness are significant. By proactively addressing these challenges, Türkiye can develop a dynamic and resilient workforce capable of supporting the sustainable growth of the steel industry and ensuring long-term economic prosperity.

References

Antonazzo et al., *ESSA Identification of National (Sector) VET Qualification and Skills (Regulatory) Frameworks for Steel*, Project Report, European Steel Skills Agenda and Strategy, 2023a. Available at: https://www.estep/essa/download-area/deliverables/

Antonazzo et al., 'Institutional Complementarities and Technological Transformation: IVET Responsiveness to Industry 4.0 – Meeting Emerging Skill Needs in the European Steel Industry', *Economic and Industrial Democracy*, 44(1), pp. 25–46, Sage, 2023b. https://doi.org/10.1177/0143831X211059227

Boyatzis, *The Competent Manager: A Model for Effective Performance*, John Wiley & Sons, New York, 1982.

Cedefop, *Online Job Vacancies and Skills Analysis: A Cedefop Pan-European Approach*, Publications Office of the European Union, Luxembourg, 2019. http://data.europa.eu/doi/10.2801/097022

Cedefop, *Skills Forecast Methodological Framework*, Publications Office of the European Union, Luxembourg, 2023. https://www.cedefop.europa.eu/files/skills_forecast_methodological_framework.pdf

Davenport, *Process Innovation: Reengineering Work Through Information Technology*, Harvard Business School Press, Boston, 1993.

European Commission, *European Vision on Steel-Related Skills and Supporting Actions to Solve the Skills Gap Today and Tomorrow in Europe*, Executive Agency for Small and Medium-sized Enterprises, Publications Office, Luxembourg, 2020.

European Commission, *European Coal and Steel Community Agreement with Türkiye*, EUR-Lex, 1996. Retrieved from: http://data.europa.eu/eli/dec/1996/528/oj

European Steel Association (EUROFER), *Environmental Benefits of EAF Technology*, 2022. https://www.eurofer.eu/issues/climate-and-energy/

European Steel Association (EUROFER), *Green Transition in the Steel Industry*, 2022. https://www.eurofer.eu/publications/reports-or-studies/environmental-benefits-of-eaf-technology/

Hoftijzer, *Forecasting Labor and Skill Demand by Sector and Occupation: Case Studies and Guidance*, World Bank Group, Washington, DC, 2015. http://documents.worldbank.org/curated/en/251591531754581450/

Kocór et al., 'Methods of Measurement of Skills' Needs in Different Economy Sectors', *Society and Education*, 21(2), 2016. https://ruj.uj.edu.pl/server/api/core/bitstreams/b3d466e5-3d88-4f4d-b278-f6eadfade17a/content

Kocór et al., 'Methods of Measuring the Skills Mismatch in the Human Capital Study', *Ask: Research and Methods*, 30(1), 2021. https://doi.org/10.18061/ask.v30i1

Maldonado-Mariscal et al., 'Skill Intelligence in the Steel Sector', *Machines*, 11, Article 335, MDPI, Basel, 2023.

Naujok et al., *Industry 4.0 in Steel: Status, Strategy, Roadmap and Capabilities*, 2017. Available at: https://futuresteelforum.com/content-images/speakers/Dr-Nils-Naujok-Holger-Stamm-Industry-4.0-in-steel.pdf (Accessed 26 September 2024)

OECD, *Economic Outlook for Türkiye: Energy Costs and Industrial Production*, OECD Publishing, Paris, 2023. https://www.oecd-ilibrary.org/economics/oecd-economic-outlook-volume-2023-issue-2_c2ca9af0-en (Accessed 26 September 2024)

Spencer et al., *Competence at Work: Models for Superior Performance*, John Wiley & Sons, New York, 1993.

Stroud et al., (eds.), *Industry 4.0 and the Road to Sustainable Steelmaking in Europe: Recasting the Future*, Topics in Mining, Metallurgy and Materials Engineering, Springer Nature, Switzerland, 2024.

Schröder, *ESSA Blueprint Strategy*, Project Report, European Steel Skills Agenda and Strategy, 2023. Available at: https://www.estep/essa/download-area/deliverables/

Schröder et al., *ESSA Policy Recommendations*, European Steel Skills Agenda, 2023a. Available at: https://www.estep/essa/download-area/deliverables/

Schröder et al., *Piloting and Implementing the Blueprint Report: Strategy, Tools and Measures*, Deliverable D6.2, European Steel Skills Agenda and Strategy, 2023b.

Turkish Steel Exporters Association, *Sector Statistics*, 2023. https://www.cib.org.tr/en/statistics.html

Turkish Steel Exporters Association, *Annual Report on Turkish Steel Exports*, Turkish Steel Exporters Association, 2023. https://www.cib.org.tr/

Turkish Steel Producers Association, *Steel Industry Statistics for Türkiye*, 2023a. https://www.cib.org.tr/en/statistics.html (Accessed 26 September 2024)

Robert et al., *Working at Sectoral Level: Guide to Anticipating and Matching Skills and Jobs*, Volume 3, European Training Foundation / Cedefop / International Labour Office, 2016. https://www.etf.europa.eu/en/publications-and-resources/publications/working-sectoral-level-guide-anticipating-and-matching

World Bank, *Türkiye in Transition: Next-Generation Human Capital Investments for Inclusive Jobs*, World Bank, Washington, DC, 2022. https://openknowledge.worldbank.org/handle/10986/38249

Turkish Steel Industry, *Sectoral Perspective 2024*, KPMG Türkiye, 2024. https://kpmg.com/tr/tr/home/insights/2024/07/celik-sektorel-bakis-2024.html

Weinel et al., *Sector Skills Matrix Report*, Project Report, European Steel Skills Agenda and Strategy, 2023. https://www.estep.eu/assets/Uploads/ESSA-D4.3-Sector-Skills-Matrix-final-version-2023-06.pdf

World Steel Association, *World Steel in Figures*, World Steel Association, 2022. https://worldsteel.org/data/world-steel-in-figures-2022/ (Accessed 26 September 2024)

World Steel Association, *World Steel Industry Production Report 2023*, World Steel Association, 2023. https://www.worldsteel.org

Vallejo-Peña et al., 'The Mediterranean Variety of Capitalism, Flexibility of Work Schedules, and Labour Productivity in Southern Europe', *Region*, 5(3), pp. 21–38, 2018.