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

Mid-term Report

Deliverable D1.4

(Status: 31st of December 2020)

Project acronym:	ESSA
Project title:	Blueprint "New Skills Agenda Steel": Industry-driven sustainable European Steel Skills Agenda and Strategy
Project number:	2018-3059 - 600886-EPP-1-2018-1-DE-EPPKA2-SSA-B
Coordinator:	TU Dortmund University (TUDO)
Funding Scheme:	Erasmus+
Due date of deliverable:	December 2020
Actual submission date:	December 2020
Project duration:	01.01.2019 – 31.12.2022 (48 months)
Work package:	WP 1 - Management
Work package leader:	TU Dortmund University
Authors:	Antonius Schröder (TUDO) with support of Dean Stroud, Luca Antonazzo, Martin Weinel (Cardiff); Félix Bayón (Sidenor); Tugce Akyazi (DEUSTO); Maria Murri, Andrea Tropeoli (RINA/CSM); Jorge Muract (worldsteel / steeluniversity); Carolin Eitner (tkSE)
Dissemination level:	Public

Co-funded by the Erasmus+ Programme of the European Union

Remark

There are overlaps and double text passages with the ESSA Deliverables D5.1 Training Framework and D5.2 Blueprint Prototype. This was done due to the possibility that readers will not read all of these Deliverables and to keep the relevant information for understanding the frame of the specific Deliverable.

Content

Introduction

This report summarises the progress of the European Steel Skills Alliance and Agenda (ESSA) and its implementation strategies based on the results of its first cycle:

Phase 1: Identifying skills requirements and basics for establishing the Blueprint (WP 2, 3, and 4), first contours of the Blueprint (WP5)

Phase 2: Reflecting the first research results and network development with policy, social partner, European and national representatives (WP6, 7)

Phase 3: Upgrade of the research results of phase 1 (WP 2, 3, 4), implementing a prototype of the European Steel Skills Agenda and strategy (WP5).

Starting with (1) the ESSA overview, objectives and methodology, (2) the results of the technological and economic development will be summarised as a background for (3) the industry skills demands and (4) VET system requirements. Against this backdrop (5) first outlines of the European Blueprint Prototype will be presented as well as (6) its first transfer and implementation strategies. Finally, the current status of the ESSA Blueprint will be summarised and next steps be listed.

In line with the new strategies and measures of the European Commission "New Skills Agenda", ESSA is especially committed to the "Twin Transformation: Digital and Green", the "Pact for Skills" and as well with existing VET tools and measures (such as EQF, ESCO, ECVET, EQAVET, Europass and ECQA). Additionally, the ESSA Blueprint benefits highly from the Steel Sector Careers Blueprint (https://op.europa.eu/s/n6SH) by integrating its valuable results.

Executive Summary

The first years of the Blueprint for an industry driven long-term skills strategy for steel companies and VET institutions focused on elaborating the background for proactively adjusting the workforce to deploy and implement new technologies aimed at an optimisation of the production process. The research activities were conducted to get a comprehensive overview of the recent and future technologies for the steel industry. Digitisation in all its facets is shaping the steel industry and informing production processes by digital data, automation, connectivity across production areas, and digital customer access. Digitalization concerns the integration of all systems (e.g. sensors, automation, and IT systems) and all productions units in different dimensions (horizontal, vertical and transversal). In this context, the steel industry's expectations from digitalization focus on quality, flexibility and productivity through optimization and interactions of individual production units.

Against this backdrop, company requirements for new skills were analysed, leading to a focus on production and maintenance jobs and a mainly incremental re- and upskilling of existing job profiles. A T-shape skills approach with professional and transversal skills is characterising the developed checklist template for adjusting the job profiles. Based on a comprehensive overview of task and function-oriented job profiles within 26 family trees (main production units) and more than 200 related job profiles the template was tested for nine representative pilot job profiles. These pilot professional job profiles are matching company job profiles with existing ESCO occupations and covering the major ISCO groups; they were further differently affected by Industry 4.0 and digitalisation and selected

because of their importance to steel production, the most in-demand jobs, their coverage across production and maintenance, and the potential added value for other sectoral (industry) Blueprints. Additionally, the relative coverage of jobs/occupations was considered.

Furthermore, the VET system perspective was analysed and its regulation and contents contrasted with the industry perspective and the technological demands for the steel industry focusing on formal qualifications (mainly IVET) related to production and maintenance occupational profiles. The analysis (combining scientific evidence with practical experience via desk research and surveys) concentrated on VET regulation and provision in five case study countries: UK (market-orientated system), Germany (dual system), Spain (company orientated system), Italy (regional system) and Poland (centralised system) and the main European frameworks and tools related to VET. These countries have recently undergone (or are currently undergoing) VET reforms devised to cope with the industrial and labour market challenges. Most commonly, reforms aim to activate dual training arrangements, relaunch and strengthen apprenticeship schemes, extend VET at the post-secondary level (EQF 4-6), increase flexibility, better integrate social partners in the design of qualifications and in the training provision, and adopt a T-shaped skills approach. Nevertheless, differences between systems reduces the likelihood that a complete harmonization is possible in relation to the addressing of skill needs.

Relevant EU frameworks and tools (e.g. EQF, ECVET, ESCO etc.) have been reviewed to better understand how these can be leveraged to support skilled workers' mobility and transparency of qualifications. Benefits for the industry that would come from an effective implementation of such tools and frameworks include: increased flexibility of vocational paths; shortened distance between IVET and CVET and improved lifelong learning; easier recognition and transferability of qualifications; easier update of qualifications and possibility to combine core technical modules with additional ones (e.g. new digital training).

The evidences collected point to the need of a holistic approach to vocational training. In this perspective, modularisation has to be put in practice in a way that preserves and supports a holistic training. However, it emerges the need to overcome the latent tension between flexibility and modularisation (typically embodied by the UK model), on the one hand, and a holistic approach to occupational training (e.g. Germany's approach), on the other. Such tension becomes more evident in consequence of the changes brought in by Industry 4.0: rapidly changing industrial landscapes and labour markets require not just timely but coherent and strategical responses. Germany's greater involvement of social partners and its more regulated and holistic approach lends itself to broader based and incremental (and specific) skills development, which contrasts with the UK's more fragmented system that is focused more on modular delivery and seemingly ad-hoc approach to skills needs.

Although research points to similar skills demands associated with the penetration of industry 4.0, it must be noted that the European steel industry remains uneven in terms of technological advancements and industrial composition. This highlights the need to frame our findings in terms of "reasonable skills landscapes" associated with an ideal-typical "Steel 4.0 scenario". In particular, the paramount importance of transversal skills within the context of Industry 4.0 has been noted. Evidences suggest that VET systems already equipped with programmes and arrangements that aim for a more holistic workforce development (e.g. longer programmes, balanced contents, co-determination and co-delivery, dual arrangements) are better prepared to respond to current industry demands and economic challenges in this respect.

Finally, a skills-set matrix is being produced to map a sample of nine steel sector occupations to the case study countries' VET most relevant programmes and qualifications to identify potential skills

gaps and scope for improvement/integration of contents. A framework and methodology for further development of the matrix by industry stakeholders beyond the project's end will also be provided.

The results of the current and future technological and economic development in the steel industry, the related company skills requirement and the VET system framework to support the skills adjustments a first Prototype of the ESSA Blueprint was outlined. The core elements of this Prototype are

- The **E**uropean Steel **T**echnology and Skills **F**oresight Observatory (ESSA ETF) (demand side)
- **O**nline **T**raining Eco**s**ystem (ESSA OTS) and **R**egional **T**raining Eco**s**ystems (ESSA RTS) (supply side).

As stated by the Steel Sector Careers Blueprint most companies lack a systematic process for assessing and forecasting skills needs. Therefore, ESSA will establish the European Foresight Observatory (ESSA ETF) (already recommended by the Steel Sector Careers Blueprint) bundling all the necessary activities to monitor and evaluate regularly:

- Technological and Economic Development
- Industry Skills Requirements
- and VET Systems Anticipation and Support of Future Skills.

Central part of the ESSA Foresight Observatory will be a regular (annual or bi-annual) foresight survey: European Steel Technology and Skills Foresight Panel (ESSA ETP) integrating and improving the already conducted surveys in one instrument and tested until the end of the project.

Within the Online Training Ecosystem, a "steelHub" is in the centre integrating the perspectives and inputs from the different ESSA areas: associations, companies, other Blueprints, VET systems, European tools, and the individual learners/workers. A first pilot training course "Continuous Casting Operator" was composed by different training measures (e.g. simulation of processes, evaluation of performance). The focus is on new digital learning arrangements and the integration of existing and planned training activities of the partners related to the technological transformation and the company skills requirements.

Already the Steel Sector Careers Blueprint stressed that multi-sectoral, multi-stakeholder cooperation is an important factor to support up-/reskilling actions and to enhance competitiveness of the steel sector by a well and high skilled workforce. Therefore, the ESSA project partnership was already composed by main European Steel Sector stakeholders, integrating steel companies, education and training providers, associations and social partners, and research institutions. This partnership of 24 relevant steel industry stakeholders was enhanced by a growing number of associated partners (17 up to now) showing the great attention and relevance of this alliance and leading to a sound ground for sustainability already since the start of the ESSA project. In the implementation phase of the Blueprint Prototype we will setup an alliance structure which exists beyond the project life span with reliable leadership governance. The European Steel Skills Alliance is foreseen to systematically linking the European Blueprint with the European, national, and more relevant, the regional level of steel regions. ESSA will be embedded in existing structures (such as ESTEP, EUROFER, the Sectoral Social Dialogue Committee on Steel (SSDCS), and industriALL on the European level first.

The planned rollout of the ESSA Blueprint will be mainly developed and checked in the first pilot implementation phase of ESSA in 2021. But first considerations are leading to the following contours. Within the European Open Coordination method, the ESSA Blueprint will be offered as a general

cross-European framework and orientation to support specific national and regional skills adjustments in the steel companies and regions. This will include policy and funding recommendations and pathways (e.g. via co-financing of ESF/EFRE and national/regional funds). In line with the Steel Sector Careers proposal for combined school- and industry-led initiatives ESSA rollout activities and implementation will focus on the regional level where people live, work and learn with active involvement of companies and VET schools ensuring the "dual approach" by combining practical on the job or workplace-based learning with formal VET and online inputs.

However, the ESSA Blueprint dissemination and collaboration is very much in line with an exchange within the steel industry organisations' regular activities and annual meetings: At the European level e.g. ESTEP, SSDCS; on the national level via the national steel platforms and associations such as Federacciai, Wirtschaftsvereinigung Stahl, CIELFFA, OS KOVO, UNESID. Additionally, an extensive cooperation took place with the Steel Sector Careers project (EASME/COSME) completed by first collaborations and agreements with other industry related Blueprints (esp. on the exchange of approaches and a common strategy for the rollout to the EU Member States).

In its next phase ESSA will implement and test the Prototype Blueprint. ESSA results so far and the Prototype will be improved during the iterative, cyclical update route planned. The rollout strategy, dissemination, transfer and exploitation will be elaborated further with a focus on the steel regions. Policy recommendations will support and provide necessary framework conditions for the open coordination on the European level and a reach out to the steel regions.

The results of this implementation phase:

1. will renew the ground for the Blueprint with an update of the technological and economic development, its impact on industry skills requirements, and VET System anticipation and support of future skills
2. will inform core elements and tools of the Blueprint and their further development within:
    - the European Steel Technology and Skills Foresight Observatory (ESSA ETF) including the European Steel Technology and Skills Foresight Panel (ESSA ETP), integrating an improved skills assessment checklist and foresight survey
    - the Online Training Ecosystem (ESSA OTS) and Regional Training Ecosystems (ESSA RTS).

A stronger focus will be on the cooperation and exchange with other sectoral industry related Blueprints, especially concerning a combined rollout strategy to the Member States and steel regions. Additionally, concerning green skills there will be a close cooperation and exchange with the SPIRE-SAIS Blueprint "Skills Alliance for Industrial Symbiosis - Cross-sectoral Blueprint for a Sustainable Process Industry" (https://www.spire2030.eu/sais). As the Steel Industry is representing one of the ten energy intensive industry sectors in this cross-sectoral Blueprint tangible results also for ESSA are expected to be integrated in the further activities of ESSA.

1 The ESSA Project: Approach, Objectives and Methodology

Economic, digital and technological developments, as well as increasing energy efficiency and environmental demands, present the European (and global) Steel Industry with many challenges, not least of which is to continuously update the qualification, knowledge and skill profile of the workforce. The aim of this project is to realise an industry driven, sustainable and coordinated Blueprint for a *European Steel Skills Agenda* (ESSA) and address the aforementioned challenges in immediate and enduring ways. It delivers a Blueprint strategy for human capital development through Sector Skills Alliances obtained within a social innovation process involving a broad range of key stakeholders: companies, education and training providers, research institutions, social partners (European and national steel associations and trade unions) as well as sector experts. Building on the solid foundations provided by sector level initiatives (e.g. ESTEP, EUROFER, SSDCS), previous and ongoing research activities (see project list in ESSA Deliverable 2.1) ESSA is based on a consolidated approach for addressing industry skills demands and challenges, focused particularly on the workforce and skills necessary for a globally competitive industry. The project developed and will further improve concrete and practical *strategies* and *programmes* (modules and tools) in anticipation of skills demands. Two principal objectives are supported by an underpinning strategy framework:

1. Proactive identification of skill needs and demands for building appropriate training and curricula, including strategising for the implementation of new vocational education content and pedagogies (incorporating training practitioner development) across the sector (thus enabling mutual recognition of skills and training across the sector and promoting mobility), within both companies and education and training institutions.
2. Identification, development and promotion of successful sectoral recruitment and upskilling schemes (including the exchange of existing tools and good practice) and the development of first (framework) training tools for (a) the efficient management of knowledge towards talent development and mobility, and (b) tackling recruitment difficulties (e.g. industry attractiveness) for widening the talent pool and establishing a more diverse workforce.

The two aforementioned objectives are supported by:

1. Establishing a database of relevant industry occupations, job profiles and skill requirements for facilitating (a) recruitment, (b) job-seeking, (c) skills and training provision at the local/regional, member-state and EU sector level, and (4) skill needs analysis.
2. Securing political support measures through the Skills Alliance for mobilising and integrating (sector) stakeholders and policy makers at the EU and member-state level.
3. Developing Key Performance Indicators (KPIs), within the remit of an established Skills Alliance, for monitoring the social innovation process and success continuously in respect of objectives above, as well as the proactive adjustment of ESSA for addressing emerging challenges.

1.1 Background for Establishing a European Steel Skills Alliance and Agenda (ESSA)

Across recent decades the European steel sector has undergone substantial transformation. The industry has restructured and consolidated, with ownership now largely comprising several large multinational companies, following merger and acquisition activities. The latter went hand in hand with transforming the steel industry towards high-technological production processes and products. Such

developments have had implications for the industry workforce, which is now much reduced: i.e. as the sector has consolidated, it has retrenched, plants have closed and jobs have been shed. Parallel to this, and driven by processes of consolidation, technological developments and changing market conditions have led to changes in the workforce profile in a number of ways:

- First, new technologies (including digital and green transformation processes, Industry 4.0) have contributed to a smaller, more streamlined and higher skilled workforce.
- Second, and related, old patterns of recruitment based on recruiting the workforce from generations of family skilled by experience, have given way to recruitment of the more highly skilled and qualified. (There are however serious recruitment issues - the age structure in most European steel-producing companies is such that more than 20% of the workforce have left the industry in the period 2005-2015, and close to 30% will leave during the following decade up to 2030.)
- 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 working systems.

The restructuring of the European steel sector has been necessary to meet (a) increasing consumer demands and preferences for high specification products (e.g. lighter and stronger steel); (b) stringent energy efficiency targets and reduce carbon emissions; and (c) compete globally in a world sector that whilst manifesting cyclical patterns of market demand operates with excess capacity – European markets, in particular, have experienced dumping from outside the EU region (e.g. China, India).

The rapid and constant changes detailed above 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, recruitment difficulties and talent management issues**. Hence, it is necessary to improve the capacity of the industry to forecast, identify and anticipate skill needs – towards the optimisation of skill use and skill utilisation in the immediate and long-term, including recruiting skills. Thus, sector stakeholders aim to identify skills shortages and mismatches – as a precondition for the efficient design of employment, skills and training policies and strategies.

The core objective of this project is the foundation of a Skills Alliance and Blueprint Strategy to develop the approaches necessary to sustain a competitive industry, which is digitally upgraded, environmentally responsible and promotes sustainable growth, innovation and the creation of highly skilled jobs.

The skills sets that comprise the typical occupations and job specifications for the European steel sector must be transparent, recognisable and comparable as a basis for the development of training content in correspondence with national VET systems, utilising EU and international classifications, mechanisms and frameworks, such as, ISCED, ISCO, EQF, ESCO, ECVET, EQAVET, Europass and ECQA for the standardisation of a sector occupation skill-sets database - informed by a proactive skill needs analysis via foresight measures, training programme design and delivery. The future digital and cleaner (e.g. hydrogen based steel production, Carbon Direct Avoidance, Capture and Utilisation), more energy efficient (e.g. through industrial symbiosis), and high quality specialised products steel industry will require complex technical and general skill-sets, which are in development but necessitate stakeholder partnership (Skills Alliance) for the development of a holistic Blueprint sector strategy to meet current and emerging skill needs systematically and in time.

The sectoral focus on the steel sector is underlined by the Steel Sector Careers Blueprint results by stating that currently:

- Skills-related policies **do not address** the skills needs in the **steel sector specifically**
- Several policies target **technical industries as a whole,** with a specific focus on the promotion of **STEM and digital skills.**

The corollary of this overview analysis of the industry situation is that the sector is faced with the **twin transition challenges** of **digitalisation and greening,** which create specific skill demands.

Twin Transition: Digital and Green Skills

Digital and green skills are of high importance for developing the steel industry and therefore for ESSA. First, technological development, and digital technologies particularly, is changing the way the industry produces steel products and the way work is organised and conducted. Hence the way skills are used and utilised across the industry is changing, with implications for the development of sector skill profiles (including the recruitment of talents). In the interrelated development of Industry 4.0 and Work 4.0, the sector is innovating toward integrated intelligent manufacturing and the trend is towards digital work. Metals, for example, is the third largest sector for adopting industrial robots (after electronics and automotive) and the role of the steelworker is shifting from the execution of tasks to monitoring and supervising (see for example projects like COCOP, Facts4Workers, ROBOHARSH in Deliverable D2.1). Manufacturing will become safer and more efficient, but skills will increasingly focus on collecting, processing and analysing data – for example, for product quality improvement. Such shifts are cognisant with the development of a new automation and information paradigm for integrated intelligent manufacturing in the steel industry following EC investment in innovation and research development (e.g. European Fund for Strategic Investments (EFSI); European Structural and Investment Funds (ESIF), Research Fund for Coal and Steel (RFCS), etc.).

A related and second critical dimension of Industry 4.0 is a focus on improved systems of energy management and the development of carbon reduction technologies. Energy management and carbon reduction are together part of wider efforts to develop sustainable manufacturing across the EU and reflected in HORIZON Europe and Commissions aims and objectives. The steel sector is energy intensive and highly polluting (emissions to water and air, including carbon) and regulation, at EU and member state level, drives innovation (e.g. carbon capture) as a beneficial constraint – for reducing costs and innovating towards a more environmentally and socially responsible industry (Porter and van der Linde, 1995). The challenge is strategy development for greater environmental awareness (i.e. green steel production and products) and integrating within training programmes skills for greener ways of working (e.g. energy saving skills through the training of energy auditors and energy managers) and green innovation (e.g. recycling of process gases to produce electricity). Hence, the sector has pledged its commitment to sustainable steel production and meeting environmental/economic challenges, as well as 'greening' (or upskilling) the workforce in line with such processes (Evans and Stroud, 2014). The greening of skills and occupations across the industry is required, not only to secure competent and environmentally safe performance of specific job roles, but also because such knowledge and skills can facilitate worker involvement in proposing (and implementing) suggestions for further green improvements. Previous projects, such GT-VET, point the way towards the integration of green skills within the industry.

Digital and green skills needs require to be identified in systematic ways (e.g. the ESSA job profile and skills database and foresight analysis) and integrated within national vocational education programmes for steel industry related occupations. The ESSA project aims to develop sustainability, both within the strategy itself and in the substantive goals of the Blueprint. Within ESSA necessary networks (Skills Alliance) are established for skill needs identification, which place digital and green skills requirements at its core. An iterative process will involve engagement with policy, social partners, European and national representatives, and other Blueprints (esp. SPIRE-SAIS steel sector related results) to review and update the implementation of a prototype of the European skills agenda and strategy. The final phase is on optimisation and finalisation of the European Blueprint in line with national skills agendas for anticipating digital and green skills demands for fostering smart, inclusive and sustainable growth.

1.2 ESSA Approach

ESSA contributes to developing a sectoral skills strategy in relation to two main priorities outlined in Communique COM(2016) 155 Final 'Steel: Preserving Sustainable jobs and growth in Europe'. In accepting the wider aims and objectives of the communique, for a globally competitive and sustainable industry, the proposal develops its skills strategy across two related concerns: (1) investing in a modernised and sustainable steel industry, which involves investments in future solutions and technologies for a more competitive industry, and (2) investing in the workforce. It builds moreover on the 'New Skills Agenda', which calls for investment in a broad array of economic sectors (including steel) and the Erasmus+ approach on sectoral Blueprints for different sectors (https://ec.europa.eu/social/main.jsp?catId=1415&langId=en).

As a goal for supporting a globally competitive and sustainable industry the Commission has invested significantly in innovation and technological development and in this way created the foundations for investment in people. In the first instance it is necessary to acknowledge the wider implications of technological developments and innovation, which may lead to structural change and job losses. The consequences of restructuring are serious for those concerned and their families. Funding from the European Global Adjustment Fund (EGAF) supports active labour market measures and others EU instruments and measures are in place to achieve a fair and socially responsible transition. However, an important part of skills development within the sector is developing employability and transferability of skills, which will contribute to mitigating the deleterious effects of such processes. Indeed, by identifying avenues for transferable skills development and employability within future industry needs, mobility will be enhanced for those continuing to work within the industry, as well as those exiting. The integration of the latter within national VET (and degree) programmes from which the sector draws its recruits, provides the foundations for sustainable workforce recruitment, development and retention (i.e. management of talents).

The ESSA approach to develop the Blueprint is based on a sequential and cyclic work program. Beside Management and Quality Assurance (WP 1) and Monitoring and Evaluation (WP8) ESSA is working in an iterative way. Starting with exploring the main current and future Technological and Economic Development (WP2), ESSA provides a reliable sector account for the subsequent work packages on industry skills requirements (WP3) and VET system context and support (WP4). These work packages feed into the Blueprint development (WP5) to be transferred and implemented in the sector (WP6).

On the background of these work packages (mainly the blueprint and its implementation) policy recommendations are elaborated and dissemination activities are planned and conducted (WP7) (see Figure 1 below with the related main questions or activities).

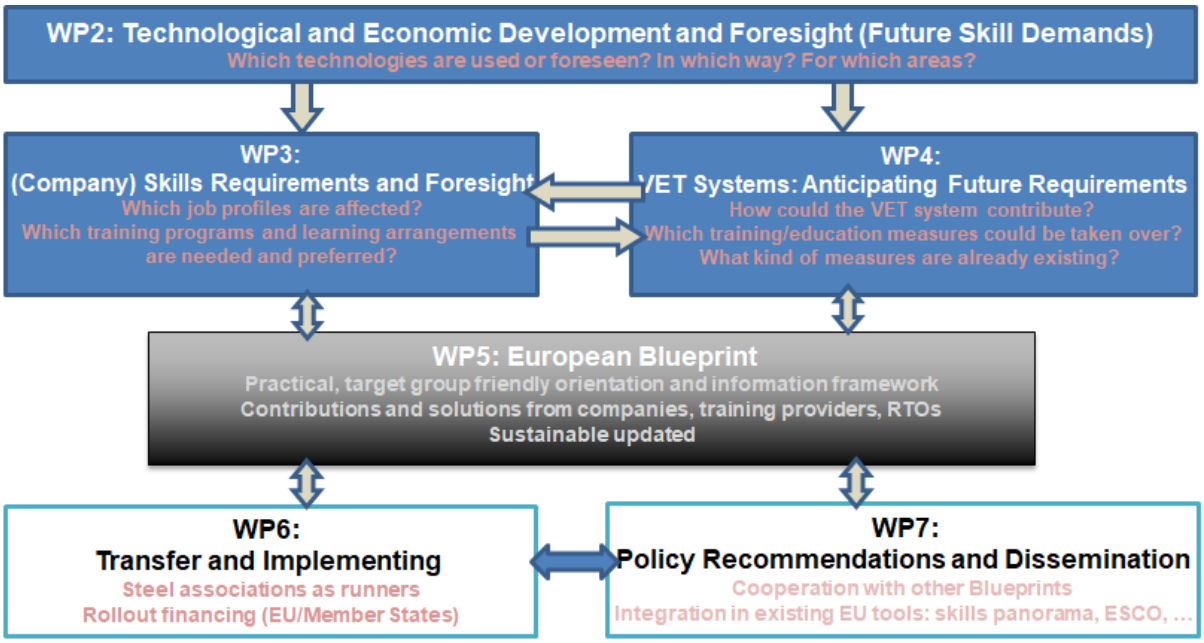


Figure 1: ESSA approach

By bringing together information from partners and governing body members, together with market information and technological development strands, this approach and work program:

- ensure a constant view on the changing skills needs in the steel sector, linked to the main drivers (emerging technologies and trends) that are influencing the change.
- aggregate and continuously update sectoral knowledge and skills intelligence at European level, thus defining and continuously update the Blueprint strategy for skills in the sector.
- provide direction for the Blueprint development and its transfer and implementation as well as for policy recommendation and dissemination - ensuring that future skills needs are met.

Within a comprehensive social innovation process, development and implementation affords a cyclical iteration of research, solutions and strategies. Therefore, two rounds of Blueprint development are foreseen, leading to five phases of the project:

- **Phase 1:** Identifying skills requirements and basics for establishing the Blueprint, first contours of the Blueprint
- **Phase 2:** Reflecting the first research results and network development with policy, social partner, European and national representatives
- **Phase 3:** Implementing a prototype of the European skills agenda and strategy / upgrading the results of phase 1
- **Phase 4:** Reflecting the upgraded research results and networks approach as well as the comprehensive European skills strategy in a first implementation and transfer phase with policy, social partners, European and national representatives, setting the ground for the future sustainable strategy

- **Phase 5:** Optimisation and finalisation of a concerted European Blueprint in line with national skills agendas for anticipating skills demands and fostering smart, inclusive and sustainable growth.

In parallel to these phases European and national events have been and will be used strategically, to consider the different perspectives and VET systems of the involved Member States, emphasizing a strong focus on exploitation and sustainability of the Steel Sector Blueprint right from the beginning of the project. The first step to sustainability is placing the ESSA homepage as part of the ESTEP web-site (https://www.estep.eu/essa).

Against this backdrop, the *industry driven pro-active skills strategy* of the Blueprint is focusing on:

- Identifying and promoting successful sectoral upskilling schemes, including the exchange of existing tools and best practice (e.g. on national occupational standards), as well as the efficient management of knowledge on skills and qualifications for the sector.
- Development of training activities and modules, including for leadership, training the trainers, to be integrated into VET provision at European, national and sector level.
- Strategising on improving 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.
- Strategising for the implementation of measures to meet defined skill needs.
- Implementing the Skills Alliance by strategising for necessary political support measures and the means for mobilising and integrating stakeholders and policy makers of the EU and national level to meet Blueprint aims and objectives.

Building on the described activities implementation and transfer of the Blueprint is done in a collaborative way at European and Member State level, incorporating steel associations, VET system institutions, national roll-out preparation, collaboration with other blueprint developing sectors. Key Performance Indicators (KPIs) monitor success and adjust needs continuously in respect of implementation of Blueprint goals and to adjust the agenda and strategy in time to upcoming new developments and environments.

Finally, policy recommendations will be developed related to the main challenges identified:

- Definition of policy recommendations, individuation and analysis of the main issues to be covered
- Compliance with the legislative framework at European and national level
- Planning and conducting dissemination actions to make the defined policy recommendations effective
- Actively identify, implement, promote and secure political support measures for mobilising and integrating stakeholders and policy makers of the EU and national level.

1.3 Objectives and Expected Results

The identification and anticipation of skill needs is a core European objective for many years (e.g. Masstricht and Helsinki comminques; the European Council's integrated guidelines [19, 20 and 24] for employment for 2005-08; Regulation (EC) No 1083/2006 of the European Social Fund (Council of the EU, 2006) and currently supported by funding and support measures (such as the renewed New Skills Agenda, the Erasmus+ program, up till now more than 20 running sectoral Blueprints, the Skills Panorama, and the Pact for Skills). The objectives in this respect are for skills 'fit for the future' and their

implementation within education and training pathways and curricula, with the aim of addressing skill shortages and bottlenecks; better matching supply and demand, and anticipating emerging skill needs and gaps for European labour markets.

In particular, early identification and anticipation of skill needs is important for the timely development of appropriate training policies and programmes. There is, for example, a likely time-lag between what is happening at a sector level (e.g. technological innovations) and the skill requirements that subsequently emerge and require integrating within education and training programmes. The time-lag will, moreover, differ according to member-state institutional, legal and regulatory contexts. The impacts of globalisation, an aging labour force and productivity gaps bring further pressures within the European region to forecast future skill needs in effective ways, including the need to develop transferable skills that address issues of sector restructuring and job losses.

The challenges faced by European steel sector, as detailed in the sections above, make the identification and anticipation of skill needs necessary for the continued competitiveness of the European Steel Industry. The Blueprint for the **industry driven long-term skills strategy**, as the principal outcome, is expected to facilitate steel companies and VET institutions efforts to transition the workforce and meet future needs in relation to, for example, the deployment and implementation of new technologies, the material and environmental optimisation of the production process, energy efficiency improvements, high-performance materials development, and so on. In meeting the emerging demands of the industry, the basis for highly skilled employment is established and the foundations for attracting and retaining talented people to the steel sector laid down, thus keeping jobs in Europe and fostering smart, inclusive and sustainable growth.

This background is of high relevance for the skills development in the steel sector. Hence, the aim of this project is to contribute to achieving European objectives in skills identification and anticipation within the steel sector in direct and immediate ways. The Blueprint of the new skills agenda and strategy of the steel industry is set-up as a **social innovation process**, combining technological development with skills and social impact by integrating the different and relevant stakeholder groups and beneficiaries in a co-creation process. Therefore ESSA:

- combines a European, cross-border sectoral approach with national/regional specifications by including national and regional system requirements - thereby reflecting different national conditions and VET frameworks and ensuring interconnectedness with the European labour markets;
- sets up a foresight scheme to identify current and future demands and requirements in a pro-active way, driven and run by the steel industry;
- comprises the cooperation of companies, education and training providers supported by research institutes and the involvement of the social partners to anticipate skill needs and develop appropriate content;
- develops concrete tools and activities together with the people concerned (such as HR managers, technicians and engineers, workers, trainers and teachers); a high number of workers of involved steel companies participated directly via internal workshops to integrate their perspectives right from the beginning of the project;
- fosters an interrelated and joint development of Industry 4.0 and Work 4.0 specific to the industry;
- ensures a cross-sectoral development and exchange of industry representatives, companies, policy, science and education.

In achieving the above the project adopts a **Blueprint for an industry driven long-term skills strategy** for steel companies and VET institutions that:

- Recommends proactive skills adjustments to the workforce in response to the deployment and implementation of new technologies aimed at optimisation of the production process;
- Monitors and shortens the implementation of industry relevant qualifications in national VET systems, continuously;
- Develops and exchanges modules, tools and the experiences with the implementation process of the new skills agenda and strategy;
- Develops a blueprint to be discussed and compared with the solutions/blueprints of other sectors.

The project partnership in its entirety is concerned to deliver the necessary skills to industry and invest in the employability of its workers. Close cooperation between industry stakeholders will contribute to enhanced '**skills intelligence**': the monitoring and forecasting of skills needs, understanding skills mismatches and improving dialogue between education and the labour market. ESSA is strongly supported as the appropriate platform to provide the permanent basis for setting skills agendas and developing the right skills policies in close cooperation with European policymakers. Doing this, an ongoing platform and sustainable innovation process is perceived, run by the industry, taking up future challenges and improving the Blueprint continuously - affording a cyclical iteration of research, solutions and strategies, which reflect European objectives in the field of skills identification and anticipation (see social innovation process description and figure 3 below).

Hence, the main objective is to develop an *industry driven pro-active skills strategy* or Blueprint that is able:

1. to identify in proactive, rather than reactive, ways the skills needs and demands of the industry, considering skills gaps and shortages, and forecasts of supply and demand;
2. to 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;
3. to improve and update training for high quality and develop new programs for train the trainer and leadership
4. to identify, implement and secure necessary political support measures by mobilising and integrating stakeholders and policy makers of the EU and national level;
5. to identify and promote successful sectoral upskilling schemes (including exchange of existing tools, best/good practice exchange, knowledge) and efficient management of knowledge;
6. to 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;
7. to identify Key Performance Indicators (KPIs) to monitor success and adjustment needs continuously in respect of these goals and to adjust the agenda and strategy in time to upcoming new developments and environments.

ESSA utilises existing European tools like ESCO, ECVET, EQF, Europass, ECTS, EQAVET and ECQA (in addition to international classifications, such as ISCED and ISCO) for job profiles and skills content assessment to fed company skills demands for specific job profiles in line with existing occupation databases. Therefore, ESSA connects the skills classification, assessment and foresight as much as

possible with the steel sector relevant ESCO occupations and certification and aknowledgement tools (such as ECQA, ECVET).

In addition, relevant national programmes will be included especially when it comes to the rollout to the member states. For example, in the UK National Occupational Standards for the steel sector are set and reviewed by SEMTA for the rigorous and high-quality skills infrastructue for occupations within engineering and advanced manufacturing and these set out skills, knowledge and understanding for steel jobs and occupations. Understanding of national programmes and standards is imperative for improved worker mobilisation but also for a more consolidated approach to tackling skill needs in immediate ways.

1.4 ESSA Partnership: A European Steel Community Involvement

The European Commission's Sectoral Blueprints Program and the results of the Steel Sector Careers Blueprint underline that multi-sectoral, multi-stakeholder, and multi-level cooperation is an important factor to support up-/reskilling actions and to enhance competitiveness of the steel sector by a well and high skilled workforce. Therefore, the ESSA project consortium was composed by the main European Steel Sector stakeholders, integrating steel companies, education and training providers, associations and social partners, and research institutions. All in all, ESSA comprises now more than 40 partners (24 consortium partners and 17 additional associated partners up to now) from 11 EU countries (Belgium, Czech Republic, Finland, Germany, Italy, Lithuania, Netherlands, Poland, Spain, Sweden, and Slovakia) and, following Brexit in January 2020, the former EU member state, the United Kingdom. The transnational and multi-stakeholder composition of the partnership based on already existing platforms and networking on the European and national level is ensuring the European, member states, and steel regions integration.

The core partnership comprises 24 partners (some are placed in more than one area; e.g. the central training centres of large steel companies):

- **Steel companies:**
  ThyssenKruppSteel Europe (also training provider), ArcelorMittal Poland, ArcelorMittal Spain, Salzgitter AG, Sidenor, Celsa Group/Barna Steel, Tata Steel
- **Education and training providers:**
  Steel Institute VDEh , IMZ, Scuola Superiore Sant'Anna, Worldsteel Steel University, DEUSTO, Cardiff University (also research institution), ThyssenKruppSteel Europe Training Centre (part of the steel company)
- **Steel associations and social partners:**
  EUROFER umbrella organization of the steel industry employers, World Steel Association (also training provider), UNESID Spanish Steel Association, Belgium Steel Platform, German Steel Federation, Federacciai - Italian Steel Federation, European Cold Rolled Steel Association CIELFFA, Association of Finish Steel and Metal Producers, OS KOVO (trade union)
- **Research institutions:**
  TU Dortmund University, Cardiff University, CSM/RINA, Visionary Analytics VA

Completed by a still growing number of associated partners:

ESTEP European Steel Technology Platform, industriALL (European Industry Union), EIT RawMaterials, Industriarbetsgivarna (Swedish Industry Federation), Polish Steel Technology Platform, Enrico

Gibellieri (European Steel expert), Unite and Community (UK unions), CEPIS Council of European Professional Informatics Society, University of the Basque Country, Warwick University, Swansea University, ArcelorMittal Italy, Fédération Métallurgie CFE-CGC, Metalowców NSZZ „Solidarność", UK Steel, SAAT Consulting.

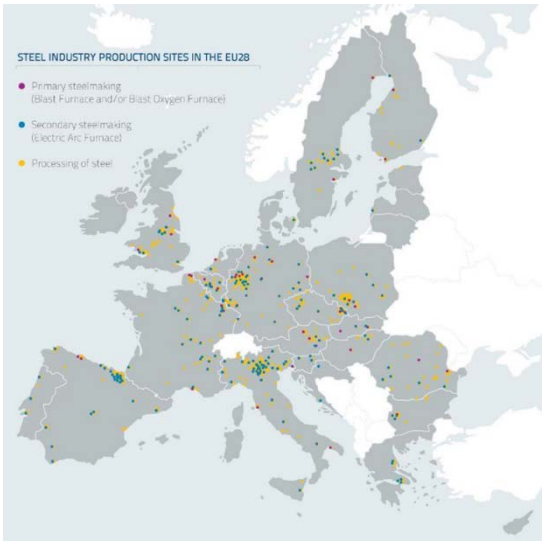


Figure 2: Steel making and processing in Europe (source EUROFER, more information https://www.eurofer.eu/about-steel/learn-about-steel/where-is-steel-made-in-europe/)

The partnership builds on previous and existing networks and skill alliances which were supported by the EC (e.g. European Steel Skills Council of the Sectoral Dialogue SSDCS). It is designed to deliver on industry led concerns as identified through EC funded pilot projects and, more particularly, EC funded steel research (e.g. via RFCS, SPIRE) and steel industry development mechanisms (e.g. ESTEP). This is the ground for a *sustainable* European Steel Skills Alliance (ESSA) *beyond the project life span* with reliable leadership governance - systematically linking the European Blueprint with the European, national, and regional level of steel regions. Via the main European and national Steel Associations and Platforms ESSA covers the European Steel Industry entirely (see Figure 2 below). ESSA is embedded and run within these existing governance structures to continuously update, initiate and launch stakeholder activities for skills adjustment, strategies, measures, and tools for associations, companies, and training providers.

The dedicated main roles of the different stakeholder groups are:

- Steel companies and social partners are central and engage with ESSA aims and objectives for skills needs identification and analysis, and the upskilling of the workforce for the overall contribution to competitiveness, through database and foresight tools as well as training module development.
- Education and training providers contribute to the creation and development of the network by assisting in conducting analysis of existing training and qualifications frameworks and development of new programmes and curricula as well as supporting training modules development.
- Universities and research institutions offer state of the art knowledge of the technical and social dimensions of the European steel industry. These partners have long-evidenced engagement with the steel industry through project partnerships and training module development, as well as technological research and development activities. The research institutes provide the social and technical basis of the skill needs analysis and contribute to skill requirements and foresight in respect of Work 4.0, as well as contributions to the analysis of national VET requirements, regulations and systems and Blueprint development, including training and train the trainer modules and the interrelation to existing EU tools (like ESCO, EQF, ECVET, etc.). A contribution to policy recommendations (including collaboration with EU and Member State Stakeholders, national funding institutions) is also coordinated by the research institutes.
- European and national associations and social partners provide their expertise, give feedback, access to their respective members, and support measures for transfer, implementation and monitoring, cooperation and dissemination activities at EU and Member State Level, supporting national roll-out preparation and collaboration with other blueprint developing sectors. In this framework the European Cold Rolled Steel Association CIELFFA is guaranteeing with its membership the perspective of small and mediums sized companies.
- The contribution of sector experts is for integrating their knowledge of areas covered by the project, to get sound feedback on Blueprint processes and progress, as well as key contribution to policy recommendations and transfer, implementation and monitoring processes.

The partners bring together the full range of stakeholders and perspectives required to establish a sustainable strategic sector Skills Alliance (ESSA) and ensure the Europe-wide delivery of a sector-wide skills Blueprint that engages with national VET systems and cross-European frameworks to meet skill needs. Especially the integrated steel federations, associations and unions are not only essential for representing the economic sector form different perspectives but also for contributing directly to the roll-out of the Blueprint and informing its strategic direction.

ESSA collaborates with other sectoral Blueprint sectors (namely automotive, advanced manufacturing, construction, green technologies and renewable energies, maritime technology, but also other approved blueprint sectors), especially concerning the roll-out to the member states as a joint lobbying and action of the Blueprints.

In particular, the European Steel Technology Platform (ESTEP) – within the European initiative to improve the competitive situation of the European Union by the establishment of European Technology Platforms in central sectors – provides a critical basis for linking ESSA (a) to the current and future technological development with the consolidation of skill development approaches, and (b) for leadership and government of the Blueprint. ESTEP is led by a Strategic Research Agenda (SRA) conducted by its Focus Groups (where most of the ESSA partners are involved) (https://www.estep.eu/estep-at-a-glance/working-groups/) on:

- Low Carbon & Energy Efficiency (Breakthrough and Continuous Improvement)
- Circular Economy (Circular Economy & Sustainability)
- Smart Factory (Integrated Intelligent Manufacturing)
- Transport and Mobility (Better Steels for Better Transport)
- Construction and Infrastructure (New Steels for Construction)
- Energy Market & Engineering (Steel in the Energy Sector)
- People (Steelworkers for the Future).

ESTEP and its Focus Groups in line with steel related innovation projects of the RFCS, SPIRE, and Horizon 2020 programs are addressing the challenges faced by the industry till 2030 and foresight of the major changes driven by new scientific and technological discoveries. While six Focus Groups are mainly dedicated to technological development, ESTEP is the only one of more than 30 European Technology Platforms with a dedicated People focus group. The transformation of the European steel industry, led by science, technology and innovation, necessitates the development and recruitment of people to drive these changes and the ESSA project provides a consolidated framework for building on existing approaches.

In short, partnership and skills alliance are integrating the complementary skills of all partners for stakeholder networking, policy making, training delivery and integration, and Europe wide dissemination and implementation – all of which is needed to create such a competitive initiative. The partnership is for a Blueprint that creates a future vision for the industry and engages companies, trade unions, universities, training bodies, and industry and dissemination networks for the continuous development of a competitive set of skills for the European steel sector. It is innovative and covers the entire industry and associated expert networks within *one* consortium for the effective delivery of the Blueprint.

1.5 Target Groups

The beneficiaries of ESSA are directly involved and represented in the consortium: steel companies, training providers, steel associations and social partners (and thus indirectly involving the perspective workers and students as learners). Via its partnership ESSA is a continuous topic of existing steel organisations (a) on the European level: European Steel Technology Platform ESTEP, EUROFER, Sectoral Social Dialogue Committee Steel (SSDCS, including EUROFER and industriALL), CIELFFA and Worldsteel and (b) on the national level via the involved national associations and platforms: UNESID, GSV, Federacciai, Wirtschaftsvereinigung Stahl, Finnish Steel and Metal Producer Association, Polish Steel Technology Platform, OS KOVO.

This guarantees the exploitation, transfer and dissemination of the results (the Blueprint) to steel companies and those national associations not directly involved, ESTEP informs the research and training developers of its support and working groups (including the RFCS related technical support groups), the social partners are informed on the regularly Sectoral Social Dialogue Committee Steel (SSDC, industriALL, EUROFER). Therefore, all the potential beneficiaries are targeted as well. First roll-out strategies will encompass ways to transfer and implement the Blueprint on the level of the involved member states focusing on dedicated steel regions.

As for target groups, firstly, the main direct target groups of this project are the company training centres and HR departments as well as the VET providers and institutions that we recommend adapt their curricula to the new realities of the steel sector (also to a certain degree to the industry sector as

such), following ongoing technological and market demands. Through the companies, the education and training partners as well as through the national steel associations involved, we are able to disseminate the project results, utilizing their networks and connections also to the national relevant institutions. Some of which recognized the importance of the work being carried out by ESSA, since our efforts are in sync with their national Industry 4.0 strategies.

The second group of beneficiaries are the workers and students themselves. By disseminating our Blueprint and training framework to the steel companies, its associations and social partners, apprenticeships, dual and tertiary education as well as continuous VET and lifelong learning within the companies and training providers we will deliver qualification requirements to the existing and upcoming staff of the steel industry (and the industry sector as such) based on the needs of the employers and the workers. Further, workers and apprentices will be able to participate and access information, through online courses, meaning that their employability will be improved directly.

1.6 Social Innovation Process

The common development of the Blueprint Strategy and Alliance with such a huge consortium is desirable but not easy to handle. Different perspectives, interests and inputs of the involved stakeholder groups have to be aligned and harmonised; new measures and tools to be developed; European, national, and regional levels to be considered (including different working cultures, VET systems, legal frameworks, etc.) and incorporated; and others. Therefore, ESSA is composed as a *social innovation process combining technological and social innovation* (Kohlgrüber et al. 2019, Kohlgrüber/Schröder 2019, Howaldt 2019) ensuring to work in synergy, providing an overarching account of industry developments and skill needs for integration within European and national VET frameworks. Setting up the development of the Blueprint as an industry driven social innovation process means that technological, organisational and social aspects and impacts were considered right from the beginning of the process in an interrelated way. It also means that the workers, trainees and responsible managers of the companies have to be included in the development process, integrating their know-how and ensuring their view on both demands and solutions. Within such a social innovation process a constant view on the changing skills needs in the steel sector, linked to the main drivers (emerging technologies and trends) of change, aggregating and continuously updating sectoral knowledge and skills intelligence at European level, thus defining and continuously updating a Blueprint strategy for skills in the sector is guaranteed.

The social innovation process is a mutual learning process, discussing different perspectives and leading to a common strategy to establish new social practices solving the skills adjustments of the industry better than the existing ones. This process will not stop at the end of the project, but rather set the ground for a continuous improvement process embedding technological innovations and their impact on the skills needs of the workforce leading to a proactive adjustment process.

Starting with the **challenge** of adjusting skills needs because of new technological and economic development, the **idea** of a sectoral Blueprint offered by the European Erasmus+ program was taken up, leading to the **intervention** of setting up a first European Steel Skills Agenda and Alliance (Blueprint) with the interested stakeholders from companies, training providers, social partners (steel associations and unions), testing the developed Blueprint during an **implementation** phase, and setting the claims for **institutionalisation** and impact right from the beginning. Already in the planning of the project **iterative and cyclical feedback loops** were designed, ensuring upgrading of the interventions and implementation of the Blueprint during the course of the project and beyond.

To monitor this process and consider appearing modification ESSA defined process-oriented Key Performance Indicators (KPI) (such as stakeholders' involvement and endorsement of the Blueprint). Feedback loops helped and will help to adjust our ideas, objectives, intervention, implementation strategies and the institutionalisation procedures and structures as well as the impact.

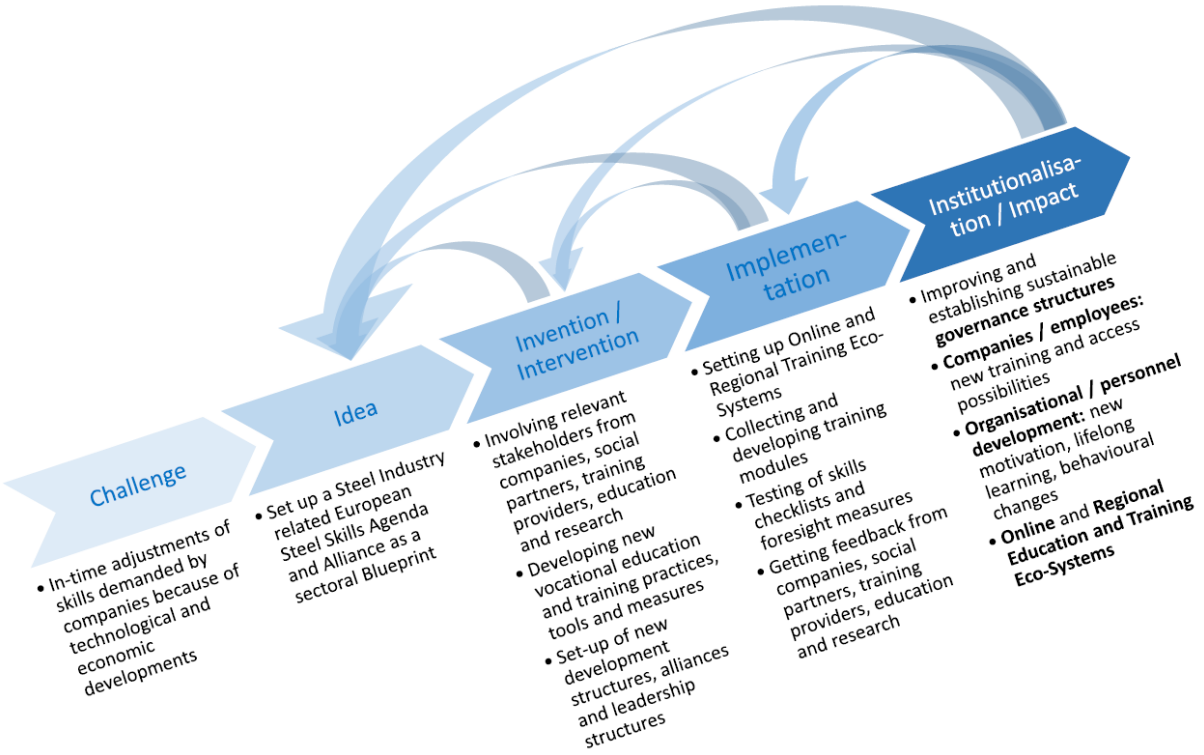
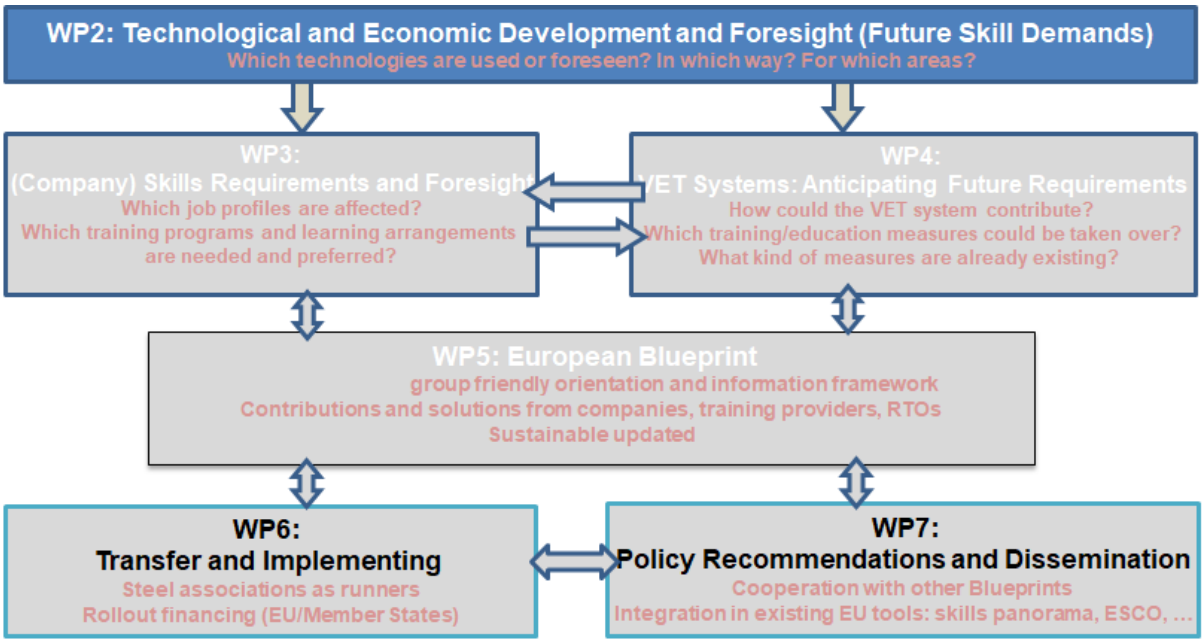


Figure 3: Blueprint development as a social innovation process

2 Technological and Economic Development and Foresight (WP2)

In line with the general ESSA approach and objectives this work package is the starting point of ESSA by evaluating the technological and economic development in the steel industry of today and tomorrow. It is setting the ground for the analysis of the (company) skills requirements and the anticipation of the (future) support of the Vocational Education and Training (VET) systems to close the skills gaps in the steel industry shortly and systematically across the sector.



2.1 Objectives

Technological development is an ongoing process, which also affects the European steel industry. New high-performance IT systems, the diffusion of system networking, the mobility of equipment, the ever-increasing number and variety of monitoring devices and the consequent massive application of advanced technologies exploiting the huge amount of collected data are just some examples of technological innovations that affect all areas of steelworks involving all the workers: from top management to technical personnel and plant operators.

Against this backdrop ESSA assessed the current state and the future development of the **digital and green transformation** of the Steel Industry. Based on the current state, the upcoming techniques and developments were and will be analysed on the basis of the main digital transformation levers and related projects and technological market trends. In close cooperation with steel companies and their training providers, enhanced by feedback and inputs of all partners of the consortium a first future scenario was elaborated describing the industrial steel production in the next three years (and beyond as far as possible), by identifying the main categories of technological and related economic developments and the related required skills and competencies. Each of the previously identified categories is linked to the affected processes/areas of the production cycle and to the affected personnel, in order to assess the adequacy of the present skills and the gaps to be filled, the competencies to be provided to the already employed personnel and the eventual new professional profiles to be searched and formed.

While the determination of the current state of the digital transformation of the European Steel Industry as well as current and upcoming developments in digital transformation and Industry 4.0 are already examined in a first phase, the development of a future scenario of a digitised Steel Factory inclusive of economic evaluation and impact on the personnel is still under construction.

2.2 Methodology

The adopted methodology is based on an integrated approach. It foresees to collect all the necessary information through *desk research* (European funded projects and literature) and a *survey* addressed

to European steel companies. A review paper ("The Challenge of Digitalization in the Steel Sector§ https://www.mdpi.com/2075-4701/10/2/288/htm), deriving from this analysis, was recently published.

2.2.1 Desk research

Concerning the desk-research and literature analysis the following sources have been analysed:

- European Innovation Projects (e.g. RFCS, HORIZON 2020, etc.)
- Journal/Conferences Articles, Reports, EC Document
- Best Available Technologies for the Steel Sector
- Technologies for low-carbon steel industry in EU funded project
- Technology for Additive Manufacturing.

European innovation projects provide useful information about the main developments funded by EU Research Programs achieved in the technological transformation in terms of advanced tools for the optimization of the whole production chain and specific technologies for low-carbon production. In particular, in the European steel sector, the most important funding program for the technology development is the Research Fund for Coal and Steel (RFCS). This funding program concerns aspects related to the innovation in the digitalization of the steel industry to a high degree. In the last years more and more RFCS projects developed innovative solutions based on the application of several KETs (Key Enabling Technologies) opportunely customized to be implemented in the different (production and maintenance) areas of the steel companies. Some of the analysed projects are shown in Figure 4 where it can be observed that (1) the main innovation technologies are covered and (2) many innovative solutions require the application of more than one technology opportunely integrated: such as internet of things, big data, simulation, cyber physical systems, cyber security, augmented and robot assisted work.

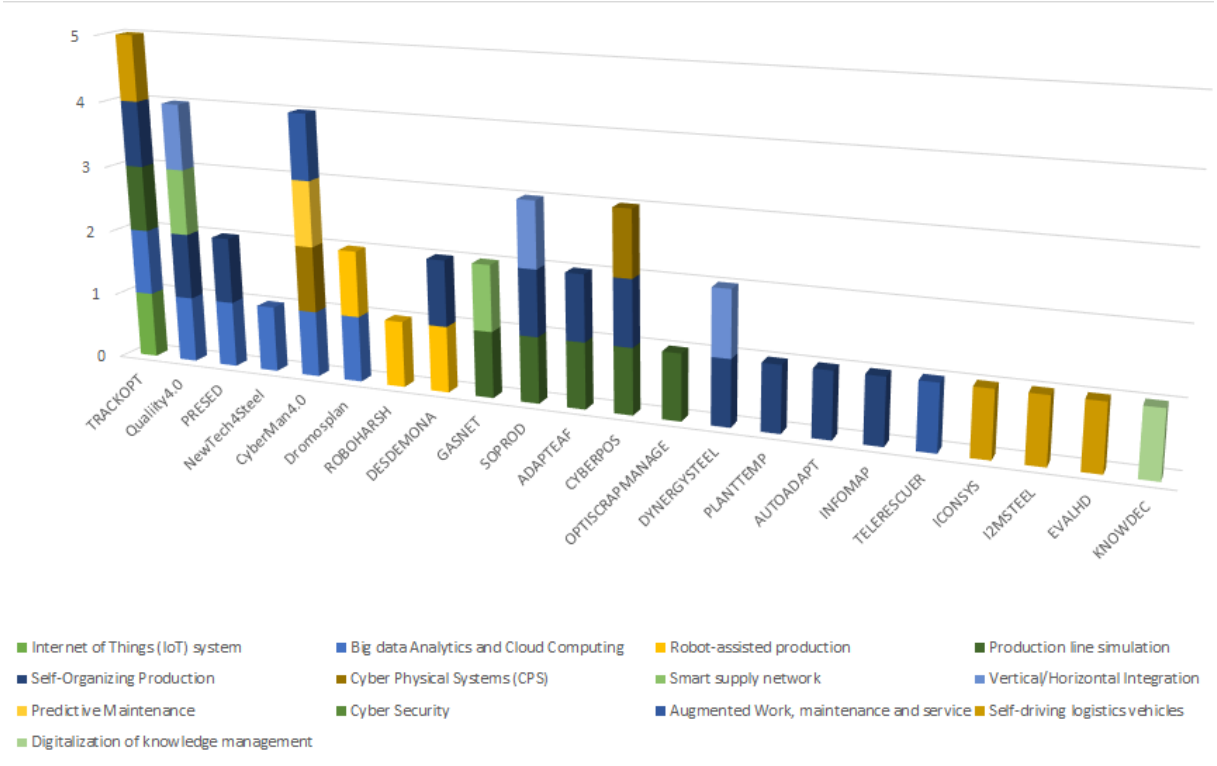


Figure 4: RFCS projects and the applied key enabling technologies

In the field of **CO2 mitigation technologies**, the RFCS and H2020 programs - the latter with particular focus on the energy intensive process industry under the Public Private Partnership SPIRE (2014-2020) - provide important information about the status of development of the technologies for low-carbon steel production, focused on three pathways: Carbon Direct Avoidance (CDA), Process Integration (PI) and Carbon Capture, Storage and Usage (CCU). According to Figure 4, several EU projects have been funded in the Process Integration pathway in order to develop technologies for reducing the use of carbon: Process Integration (14 of the analysed projects), Carbon Capture Storage and Usage (7), CDA Technologies (5).

Another important data source is represented by the **Best Available Techniques (BAT)** document (https://eippcb.jrc.ec.europa.eu/sites/default/files/2019-11/IS_Adopted_03_2012.pdf). It provides information, mainly based on the application of digitalization systems, in particular in the Energy management, Water and Wastewater management and in some production processes. The application of BAT aims at achieving continuous improvements in the steel sector, in particular regarding quality, costs, energy consumption and environmental performance. In this context, digital technologies help to reach these objectives, adapting and integrating them with the traditional ones and with the new process. For this reason, the analysis of this document is an important step to understand the innovative and emerging techniques for the steel production processes.

2.2.2 Survey

A survey addressed to steel companies has been implemented in order to collect information directly "from the field", that is from the various company's representatives, in order to provide the current state of the digitalization in the European Steel Industry. The existing level of plant automation and the adoption of the new paradigm of Industry 4.0, including the resulting impact on the workforce, have been and will be further assessed. To this aim, a questionnaire has been developed and launched during the early stages of the project organized by considering different sections, as shown in Figure 5 (below).

Figure 5: The questionnaire structure

The first section mainly includes general information: country, company size, such as small, medium, and large enterprise, type of product, production route and production output.

The second section includes questions related to the implemented strategy, such as the traditional solution applied before the Industry 4.0 paradigm, the state of digitalization, the priorities on digital technologies and what of them will be adopted, how they will affect the workforce, and the company involvement in research projects on digitalization (past, current and future/planned project).

The third section proposes questions related to technical aspects, such as the awareness of the opportunities and threats from additive manufacturing, areas of applications of digital technologies, and expected benefits and major barriers.

The fourth section, concerning the human resources, includes questions about the gender balance, the age profile, the percentage of each category of employers with higher education, the size evolution of the workforce in the next few years, the awareness of the staff categories about the needs for digital competences, training programs on Industry 4.0 topics.

The questionnaire was launched in June 2019, and made online available in order to facilitate its compilation.

2.3 Results so far

According to the above described methodology the results so far are exploited in the ESSA Deliverable 2.1 "Digital transformation in European Steel Industry: state of art and future scenario". This first version has been released September 2019, updated with the results of the survey (October 2019). Due to the rapid technological changes nowadays a second version is due on June 2021, integrating new data from the desk research, survey, and the project partner discussions and feedback.

The main results of the **desk research** are summarised related to the main objectives above.

Current state of digital transformation in steel industry:

- The identified new Key Enabling Technologies (KETs) under the paradigm Industry 4.0 are represented by: new generation of sensors, Big Data, Machine Learning, Artificial Intelligence (AI), Internet-of-Things (IoT), Internet-of-Services, Mechatronics and Advanced Robotics, Cloud Computing, Cybersecurity, Additive Manufacturing, Digital Twins, Predictive Maintenance.
- The application of new technologies in the steel sector already supports and can further sustain the optimization of the entire production chain, although the steel production is already automated to a certain extent and often the systems work in an isolated way.
- The steel industry is becoming smart and more agile evolving towards industry 4.0:
    - The European steel industry has been involved in several policy activities, R&D projects, activities and patents in the field of digitalization.
    - The European Commission plays a crucial role in order to maintain the competitiveness of the European steel companies.
    - The new technologies can really support the optimization of the entire production chain through real-time operational data providing better and faster decision-making.
    - The steel industry expectations from digitalization focus on **quality, flexibility and productivity** through the optimization and the interactions of the individual production units.

Current and upcoming development in digital transformation:

- The challenge of digitalization concerns the integration of all systems (sensors, automation, and IT systems) and productions units in different dimensions:
    - Vertical Integration → Integration of systems across the classic automation levels from the sensor to the Enterprise Resources Planning system;
    - Horizontal Integration → Integration of systems along the entire production chain;
    - Life-cycle Integration → Integration along the entire lifecycle of a plant from basic engineering to decommissioning;

  - Transversal Integration → based on the decisions taken during the steel production chain, considering technological, economic and environmental aspects at the same time. This will only be possible by new IT, automation and optimization technologies and by their combination in an integrated way.
- The identified digitalization trends are represented by adaptive online control, through-process optimization, through-process synchronization of data, zero-defect manufacturing, traceability, intelligent and integrated manufacturing.
- Knowledge (Data and Human expertise) Management is a key factor for achieving improvements in the digitalization process, through new approaches based, for instance, on the methodology knowledge-based decision support system.

Digitalization and its Economic/Environmental Impact:

- The most important economic factors, related to technological applications, as real-time production chain optimization, human robot collaboration, smart energy management, predictive maintenance, analytics, are related to:
  - Reduction of energy and raw material consumption;
  - Lower OPerational EXpenditure (OPEX);
  - Reduction of losses;
  - Increased product quality and productivity;
  - Improved flexibility and reliability of processes.
- New business models & organizational structures are requested based on a stronger networking between business processes, creation of efficient interfaces, integrated data exchange and management.
- Environmental impact can benefit from innovative tools able to monitor and assess the environmental performance of processes by combining digital and CO_2 mitigation technologies, i.e. Carbon Direct Avoidance (CDA), Process Integration (PI) and Carbon Capture, Storage and Usage (CCU), leading also to new ways of circular economy and industrial symbiosis across different industry sectors (see SPIRE-SAIS Blueprint, where steel is embedded).

Digitalization and Impact on the Workforce:

- Soft-skills as collaboration, communication and autonomy are required for employees in order to be able to carry out their jobs in hybrid operating systems.
- The workforce should increase their ability to be flexible and adaptable and develop the habit of continuous learning in an interdisciplinary perspective.
- The impact of the digitalization on the low skilled workers is an open issue to be faced in different ways, e.g. up-, reskilling, reduction of "middle" workers (polarization), use of external personnel, etc.
- The effects of digitalization on the employment in terms of reduction or increase is an open question to be discussed.
- Continuous training activities and updated programs represent the key aspects for the steel companies in order to achieve a successful future and to improve the interdisciplinary skills.

The **survey results** underline and confirm the desk research results by providing direct answers from company representatives. The answers collected up to the end of October 2019 allowed to form a sample of 28 valid observations. Although the size is not optimal, the sample has a good representativeness in terms of general information: country of origin of respondents, company size, production route and product types. Figure 6 reports the characterization elements of the sample.

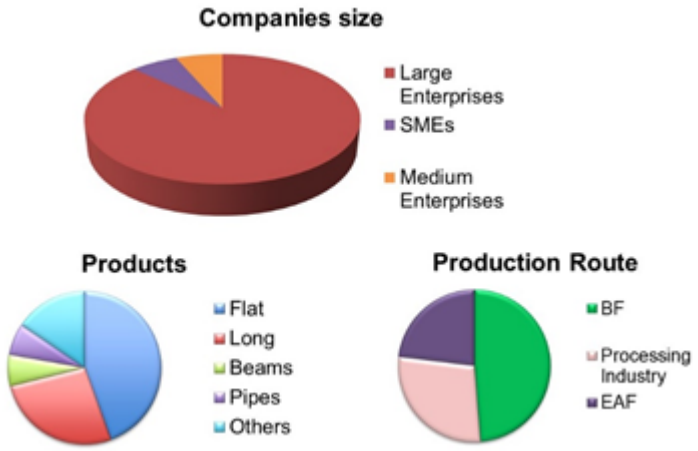


Figure 6: Sample characterisation

The respondents are from steel companies located in several European countries. Most of the data come from large enterprises, involving different professional profiles, i.e. board of director, plant managers, ICT, HRs, etc. All the production routes are represented (with a prevalence of blast furnace route), as well as the product type (with a majority of flat products).

As mentioned above, the aim of the survey was to determine the current state of the digital transformation in the European Steel Industry, starting from the existing level of plant automation and considering the possible adoption of the new paradigm of Industry 4.0 (i.e. the adoption of innovative digital technologies to enhance both the production operation and the information management) as well as the resulting impact on the personnel in terms of skills needs and development in the steel sector.

Below the main results for the different sections of the questionnaire are described.

The **strategy** section aimed at assessing the state of digitalization and plant automation in the steel industry before the Industry 4.0 paradigm, and the level of both knowledge and interest concerning the Industry4.0 enabling technologies. In addition, an evaluation of the impact of digitalization on workforce was required as well as the participation to European funded projects.

The survey analysis highlighted a significant level of automation in the steel plants (Figure 7) as a starting point to evolve towards a technological improvement.

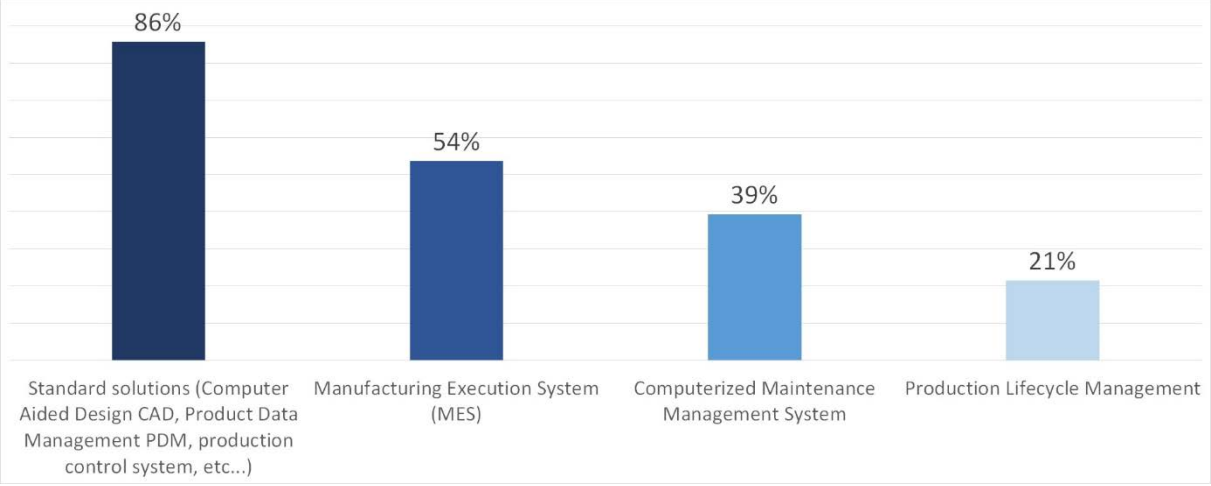


Figure 7: Traditional solutions currently applied in the steel companies

Among the broad range of relevant Industry 4.0 technologies, in general widely known, the companies' interest and priority are oriented on Internet of Things (IoT), Analytics, Cyber Security and Process Integration (both horizontal and vertical), which are also the most already applied. The same technologies are also mentioned among the planned investment mainly within short time (i.e. 3 years) as shown in Figure 8.

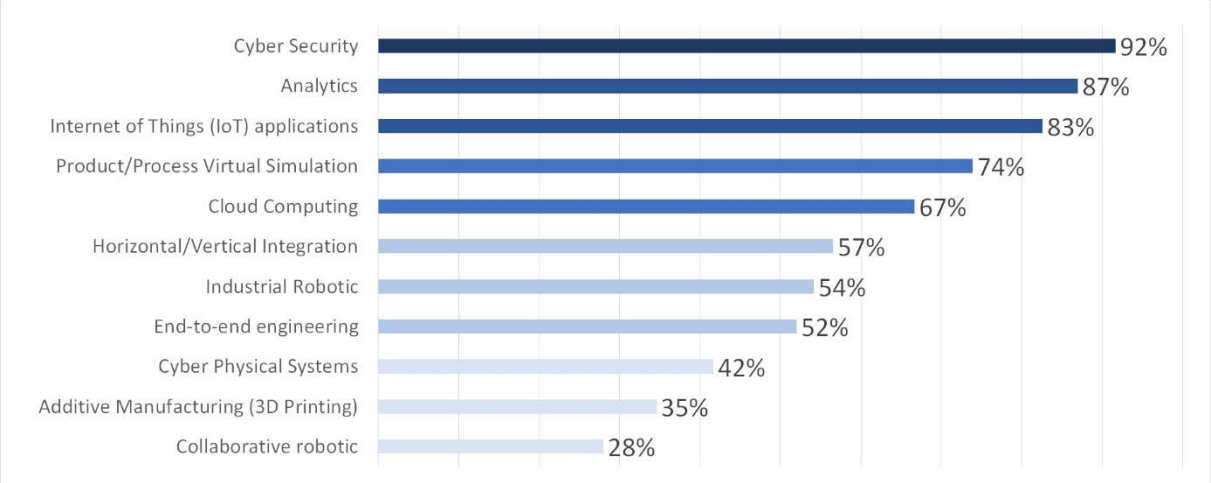


Figure 8: Planned investments in I4.0 technologies within 3 years

The impact of the digital technology on the workforce is considered relatively high both for the need of suitable skills and other aspects directly affecting the employees (like general improvement of the work conditions, for the workplace environment and health and safety, as well as increasing of working time and work-life balance).

There is also a growing interest on joint European research projects (no funding programme mentioned for the current and planned ones), although one of three respondents state no involvement in such projects.

Technical Information part of the survey aimed at awareness of the opportunities, implementation areas, expected benefits and major barriers within the companies.

The digitalisation is generally widespread applied in all the company's areas, as shown in Figure 9, especially in the process chain control and where the management of large amounts of data is required, i.e. production, business, etc. Maintenance, administration, quality control and HR management are also mentioned among the areas where digitalisation is mostly applied.

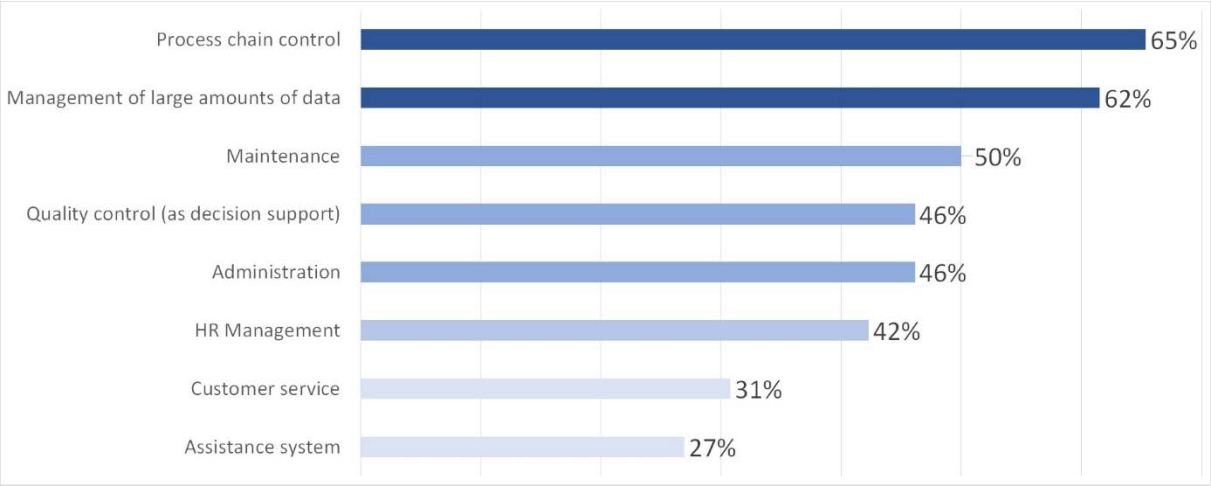


Figure 9: The level of digitalisation diffusion in the companies' areas

The major expected benefits are focused on production (i.e. cost reduction and quality improvement), a positive impact on workforce in terms of safer and healthier workplaces, and environmental improvements, i.e. reduction of wastes, emissions, and resources consumption. Figure 10 is reporting the ranking of the expected benefits and shows that this is reflecting a broad range as well.

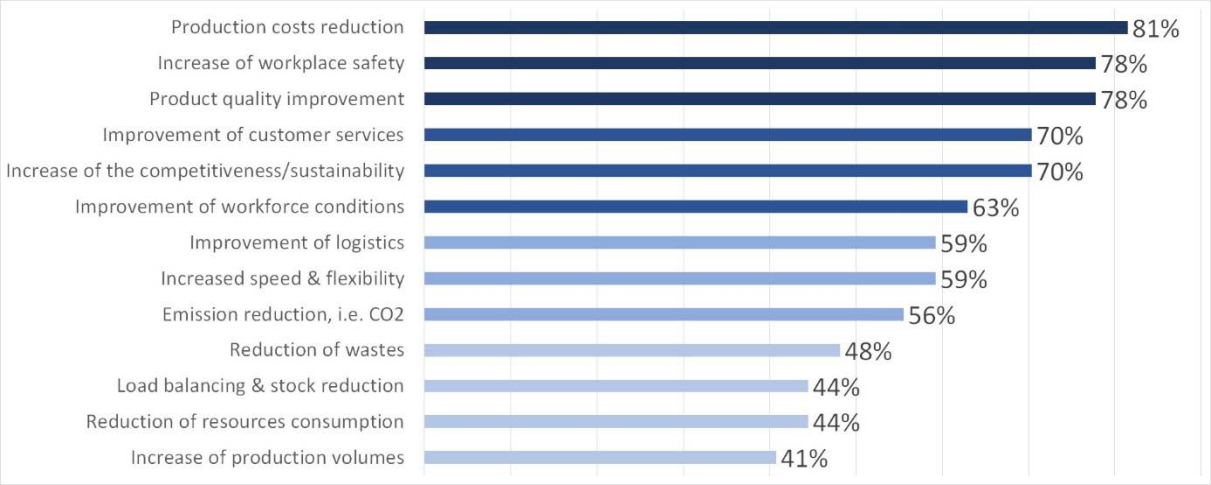


Figure 10: Main expected benefits from the adoption of the enabling technologies.

The main barriers for the adoption and the application of the enabling technologies has been essentially individuated in the costs of the investment, that need to be also evaluated considering the obsolescence of plant/infrastructures and equipment as well as the compatibility to existent technologies. It is important also to highlight the barriers related to workforce topics, such as the lack of highly skilled workforce, skills gap and acceptance of the new technologies by the workforce. Figure 11 shows the ranking of the main barriers grouped in three classes of importance.

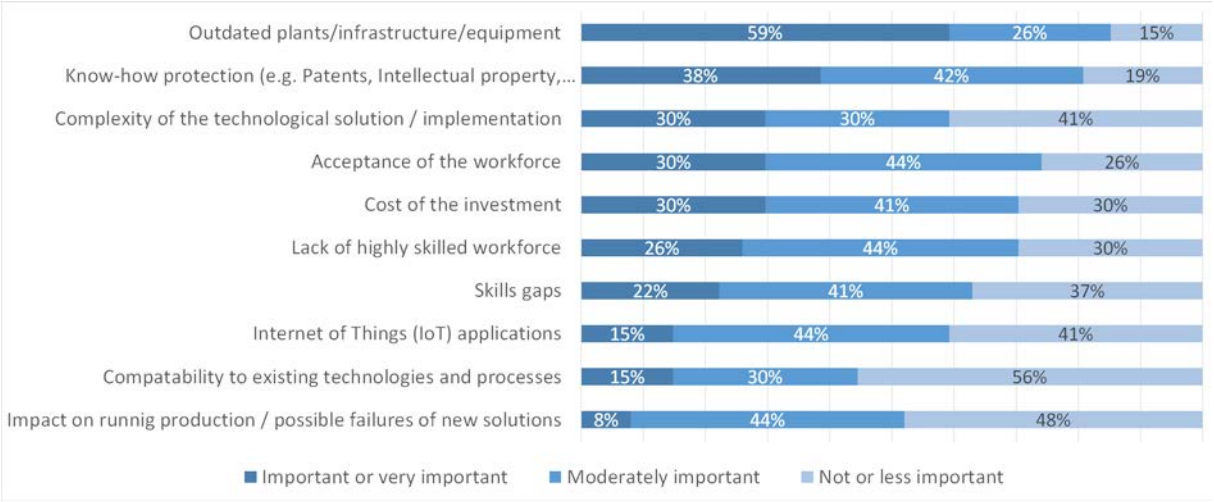


Figure 11: Main barriers for the application of the enabling technologies.

Concerning **human resources** and the **current and future workforce organization** the workforce profile in the last five years considering age and education was in focus. Despite the lack of data and/or data inhomogeneity characterizing this section of the questionnaire, some results can be highlighted:

- There is a general imbalance of male and female percentage in favours of males in all the three considered areas: operations, administration and services.
- Regarding the age profile, according to the few valid data, a certain stability in each presented age class can be estimated, with a substantial rising in the last two years for the personnel from 35-44 years old.
- Higher education (i.e. Universities, Occupational Colleges, etc.) is a requisite for most of the production managers and engineers respect to technicians, operators and apprentices/trainees.
- Concerning the future evolution of the workforce (in the next 3-5 years), the sample was quite divided about growth in workforce numbers or not (50% yes, 50% no); in the positive case, it appears a higher interest to employ more women and high qualified people, mainly because of the use of new technologies.

Production managers and engineers are the most aware of the needs of digital competences, while technicians, operators and apprentices/trainees seem less aware.

Concerning the training aspects, few training programmes are currently scheduled on company's digital products and services, communication, technology and innovation.

However, the data background has to be improved by further skills related surveys (see skills checklist in **chapter 3** and survey in the Annex) and the last bullet point shows that ESSA has to raise future awareness for a proactive adjustment on skills due to the technological developments described above.

2.4 Next Steps

The work carried out so far allowed to individuate the elements for the Blueprint development relatively to the technological developments in steel industry:

- New Key Enabling Technologies (KETs) are represented by new generation of sensors, Big Data, Machine Learning, Artificial Intelligence (AI), Internet-of-Things (IoT), Internet-of-Services,

Mechatronics and Advanced Robotics, Cloud Computing, Cybersecurity, Additive Manufacturing, Digital Twins, Predictive Maintenance.

- Upcoming technological and economic developments lead to new business models & organizational structures requiring a stronger networking between business processes, creation of efficient interfaces, integrated data exchange and management.
- Future workforce development by continuous training activities and updated programs in order to improve interdisciplinary skills is needed.
- Future evolution of workforce with a higher interest to employ more women and high qualified people, mainly because of the use of new technologies, is demanded.
- Impact of the digitalization on the low skilled workers has to be further monitored: e.g. upskilling, reduction of "middle" workers (polarization?), use of external personnel.
- Digital technologies can further contribute to increase the energy efficiency and to monitor and control the environmental performance of processes (green skills could improve the effectiveness of such technologies application).
- New tools to support operators are appearing, i.e. in predictive maintenance to be implemented by equipment monitoring combined with intelligent decision methods.
- Knowledge Management is a key factor for achieving improvements in the digitalization process, through new approaches based, for instance, on knowledge-based decision support systems.
- Knowledge Management tools are also necessary to maintain and spread the human expertise acquired during the work life and to be transferred to young workers.

After the release of the first version of the Deliverable 2.1, the ongoing activity is focused on monitoring and collecting new literature and new projects on technological and economic development in the steel industry. On this base, an accurate analysis will be carried out in order to update the recent results, considering received comments from other work packages, events, workshops, and other sources. A new deliverable version will be issued in June 2021, the final version at the end of the project in December 2022.

As reported in the methodology description, RFCS projects represent one of the most important data sources concerning updated applications of Industry4.0 enabling technologies in steel plants. Significant information is related to the customization of these technologies in order to be applied in complex plants, as the steel ones, in well-defined use cases referring to the different company's areas.

In this context, in order to exploit the information from EU funded projects, we are working to arrange a short summary of each project in a project card, that can be accessed directly through the ESSA project website. This will allow easy, open and continuous access and a major dissemination of such information among the sector as a whole.

A prototype has been prepared in order to present these projects information grouped according to the applied technologies: Internet of Things (IoT) system, Big data Analytics and Cloud Computing, Robot-assisted production, Production line simulation, Self-Organizing Production, Cyber Physical Systems (CPS), Smart supply network, Vertical/Horizontal Integration, Predictive Maintenance, Cyber Security, Self-driving logistics vehicles, Digitalization of knowledge management.

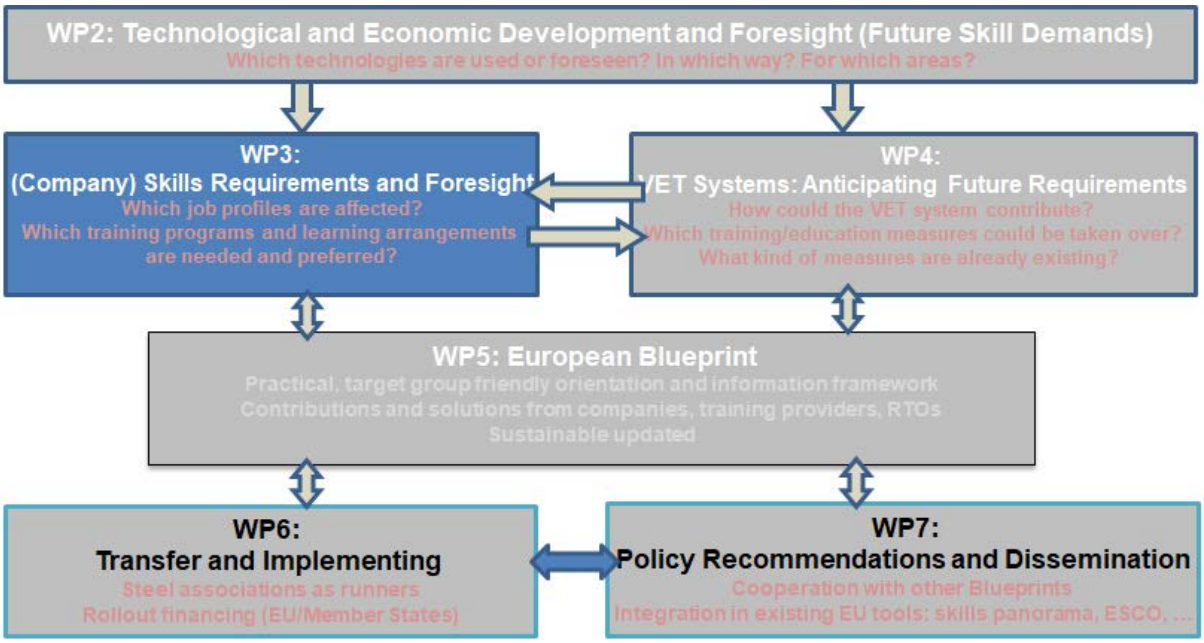
Below, the prototype of the project card is reported:

EU funded project	
Technology:	
Title	
Acronym	
Funding (e.g. RFCS, FP6, FP7, H2020)	
Key words	
Start date- End date	
Short Description: **Objectives:**	
Relevance for the technological transformation:	
Available on: URL (e.g. link to EU bookshop):	

Besides the data identifying the project (title, acronym, start/end date, funding programme, keywords and short description), objectives and relevance for the technological transformation will characterize the information in the project card. It is planned that the final version of the template can be opportunely filled by any steel sector actor in order to report own projects, i.e. national/regional projects, in the field of innovative technological applications. This template-based reporting and an improved method for the technological and economic foresight will be part of a European Steel Technology and Skills Foresight Observatory (ESSA ETF) (see chapter 5.3.1 "Blueprint Development").

3 (Company) Skills Requirements and Foresight (WP3)

Based on the results of the technological and economic development the company related current and future skills requirements are defined and assessed - as a foundation for developing the potential for industry driven VET systems support, as well as informing the European Steel Sector Blueprint development.



3.1 Objectives

The objective is to identify and specify new skills and training needs within the steel sector, considering a framework of growing digitalization and increasing environmental regulation and efficiency concerns, which are to be incorporated into VET and tertiary education training curricula. We thus aim to define recent and future skill needs and incorporate redefinition of professional role profiles. Clarifying the industrial changes and relevant tasks to be performed in the Steel Sector, it is possible to interpret data on the expected evolution of skills needs.

ESSA will serve steel companies to specify and identify the skills and knowledge needs (recent and future), adapting them to their future scenarios and redefine steel sector professional profiles. The latter is conducted by means of an analysis of existing professional role profiles within steel companies and the definition of skills that are related to those profiles and required by steel companies to be more competitive in the future.

By comparing existing and future skills demands and needs of the steel industry, an identification of workforce gaps will be obtained.

3.2 Methodology

The analysis of current and future company skills requirements was based on the **definition of skills needs (recent and future) and redefinition of professional profiles**. Based on a short literature review (see Deliverable 3.2) and a reflection of the technological and economic developments on the background of concrete company demands (based on the results of the proceeding chapter, WP2) the focus was on the analysis of existing professional profiles within steel companies and the knowledge that is related to them. Skills and capabilities that are required by steel companies to be more competitive in the future were delineated.

After this preliminary analysis, steel companies of the ESSA consortium reviewed their current professional profiles in meetings, interviews and workshops and related them to workers' skill formation and any complementary training engaged with by workers to build the competences demanded.

Based on this a first identification of current and future skills for job profiles was made, leading to a common database of professional job profiles related to steel production. Because the technological and economic foresight stressed that almost all production areas are affected by new (digital) technologies this list comprised all the job profiles of all steel production areas, including maintenance and each proficiency level (management and leadership; high, middle and low skilled workers).

Finally, a classification and assessment scheme of current and future skills demanded for each professional profile (or profile group) was developed, allowing a comparison of existing and future skills demands and needs of the steel industry.

The impact of the results for the steel company's organization and their staff was reviewed, conclusions obtained were shared with the partners, and main finding integrated into the European Blueprint (chapter 5).

3.3 Results so Far

Most steel companies are digitizing and greening their processes, incorporating ICT and Industry 4.0 technologies to melting, casting, rolling and other sub-processes. However, the steel sector has always been considered a mature sector with a low level of technological development, and most of workers, although experienced in industrial manufacturing and metallurgical issues, lack of skills related to the new implemented technologies. The main observed consequence is that companies have difficulties to find workers with these required new skills that could maximize the benefits that these increasingly automated, robotized and digitized processes are offering. New skill needs are emerging and a more highly skilled workforce is required by the steel sector companies (see EC 2020).

Strategic investments of the steel sector are aimed at addressing the main challenges that the steel sector is facing, notably preserving competitiveness (through production responsiveness and flexibility, efficient processes and resource savings, increased product quality, maximised plant performance and minimised maintenance and low capital lock-up) and reducing environmental impact of steel production. When investing in new technologies, one has to consider the overall production process as optimisation should happen throughout. Moreover, it is important to consider that difficulties may arise in uptake by the workforce, especially among older workers. Strategic investments are motivated by the future directions of the industry, which concern automation (Industry 3.0), digitalisation (Industry 4.0), decarbonisation and energy efficiency (greenhouse gas emission reduction). These lead to work becoming less physical and more creative, but also create a need for integrated data exchange and management and for efficient interfaces to facilitate the interconnections between business processes as well as for new technologies that can help achieve CO_2 reductions in the value chain.

3.3.1 Skills Definition

Technological developments are expected to change skills needs in the near future. More and more monotonous tasks will be absorbed by assistant systems and machines, while operators (if re-/upskilled) can perform more qualified work and, most importantly, make decisions based on the integrated data that machines will provide. Automation and smart devices will allow workers to make more informed decisions in short timespans to deal with complex situations. Teamwork will become increasingly important, not only between co-workers, but also between workers and assistant systems. Artificial intelligence tools mean that organisations must become more collaborative and team

oriented. Decisions will rest with small and agile teams of operators led by high-skilled engineers and human resources will be concentrated mainly in the control rooms. Human intervention will become more important in the maintenance and supervision of machines and overall a reduced number of operators will be able to coordinate the various operations of the plant. These changes will affect the demand for **professional/technical and transversal skills**: green, digital, methodological, personal, and social (T-shaped Skills Approach, see Figure below). Beneath also called soft skills (social, individual/personal, methodological) we added digital and green skills, because of its general transversal importance for the current and future steel industry.

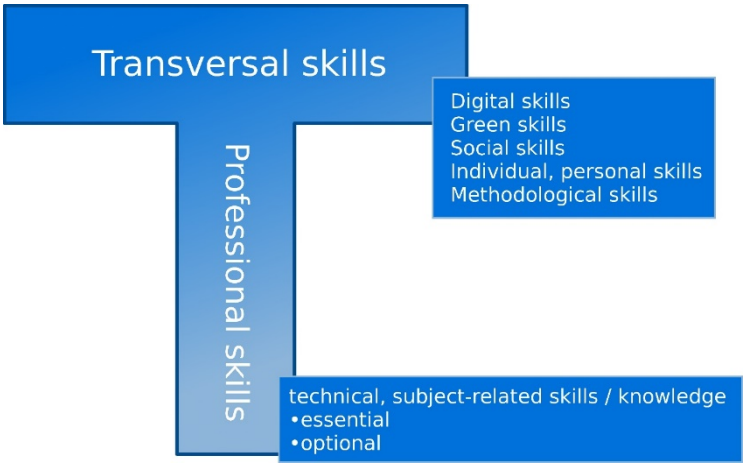


Figure 12: T-shaped skills approach

In summary, it was concluded that most early automation efforts focus on repetitive, predictable, low-value tasks in an effort to gain quick wins from labour reduction, cost savings, and productivity. The main observed consequence of the technological developments introduced by Industry 4.0, is that the need in (digital) **technology related skills** will grow rapidly as companies deploy automation, robotics, AI, advanced analytics, and other new technologies (see figure 8 in chapter 2).

This is underlined by the survey results of nearly 200 steel sector respondents conducted by the Steel Sector Careers Blueprint (European Commission 2019a):

- Specialised technical skills and advanced technology skills remain high in the ranking
- Less importance is given to manual dexterity, while digital skills rise
- Increasing importance given to managerial skills (problem solving, critical thinking, decision making): technicians are more autonomous and independent; engineering positions are management role in small operational teams
- Data skills are still perceived as pertaining to specialised skillsets
- Greater attention is given to green skills.

Overall, the profiles that are sought by the industry are not expected to be replaced altogether, but they will be expected to perform more tasks with a much broader scope. Workers will need to have a wider knowledge and need to be able to do more because there are less and less specialised single jobs. Instead, the industry tends to need people who are able to work in multiple parts of the plant and on multiple operations throughout the career, i.e. increased flexibility and wider skills and knowledge base (European Commission 2019a). The main observed consequence of the mentioned technological changes is that the demand for technology demanded new skills will grow rapidly as companies deploy automation, robotics, AI, advanced analytics, and other new technologies (European Commission 2019a, Bughin et al. 2018, Deming et al. 2015, Stroud and Weinel, 2020). This surge

will affect demand for basic digital skills as well as advanced technological skills such as programming (Bughin et al. 2018). Awareness of data security and protection will acquire importance as will trust in new technologies (European Commission 2019a). Accompanying the adoption of advanced technologies into the workplace will be an increase in the need for workers with finely tuned social and emotional skills - skills that machines are a long way from mastering (European Commission 2019a, Bughin et al. 2018). So, the demand for social and emotional skills will grow also rapidly. While automation and digitalization of work processes increase, workers will be required to take charge of less automatable and more complex tasks, whose completion necessitate solid literacy, numeracy, problem-solving, and ICT skills together with soft skills of autonomy, coordination and collaboration (Karacay et al. 2018, Grundke et al. 2017). Flexibility and transferability will become key, as nearly all steel shop workers will move away from monotonous and repetitive jobs and incorporate more varied tasks (European Commission 2019a).

Work activities that require only basic cognitive skills will particularly decline as automation advances. The decline will be more important, as machines increasingly take over straightforward data input tasks and cause a drop in the need for basic data processing. Demand for cognitive skills will generally shift from basic to higher ones (Bughin et al. 2018). As a result, higher cognitive skills such as creativity, critical thinking, teamwork, problem-solving, decision-making will increase in importance through 2030, together with an aptitude for continuous improvement and lifelong learning (European Commission 2019a, 6).

There will be higher demand placed on all members of the workforce in terms of managing complexity, complex information processing and higher levels of abstraction for obtaining simplified representation of the bigger wholes (Karacay et al. 2018). Skills like critical thinking, problem-solving and decision-making are perceived as crucial, which reflects the new roles that steelworkers will take on in the flat organisational structure of collaborative and team-oriented industrial environments. Abilities such as critical thinking and independent problem solving were deemed important in several reviewed technical positions such as steel fabricators, welders, production operators and control technicians (European Commission 2019a). Moreover, there will be a need to coordinate between virtual and real machines as well as between manual and robotic systems, hence employees will be expected to act more on their own initiative, have excellent communication skills and be able to organize their own work (Karacay et al. 2018). The importance of managerial skills increases significantly on a five-year forecast (European Commission 2019a). Other types of higher cognitive skill - such as advanced literacy and writing (language proficiency), transversal (soft) skills and quantitative and statistical skills - will not see a similar increase in demand, the need for them could remain stable or even decline to 2030 (European Commission 2019a).

The mix of physical and manual skills required in occupations will change depending on the extent to which work activities can be automated. General equipment operation (skills used by manufacturing workers) and inspecting and monitoring skills will decline faster than other physical and manual skills. So, the demand for physical and manual skills, which include general equipment operation, will also drop, but it seems that still will remain the largest category of workforce skills in 2030 in many places (Bughin et al. 2018).

As a consequence of the increased focus on sustainable steelmaking, environmental awareness, green skills are projected to become highly important among European companies over the next five years. This can be explained by the efforts that the industry is making to meet the EU's 2050 environmental targets. It appears to be more common for companies to expect shop floor workers to have

competences in resource efficiency, material reutilisation and recycling. Green skills are considered key to maintain the competitive edge of the European manufacturing industry (European Commission 2019a, Evans and Stroud, 2014).

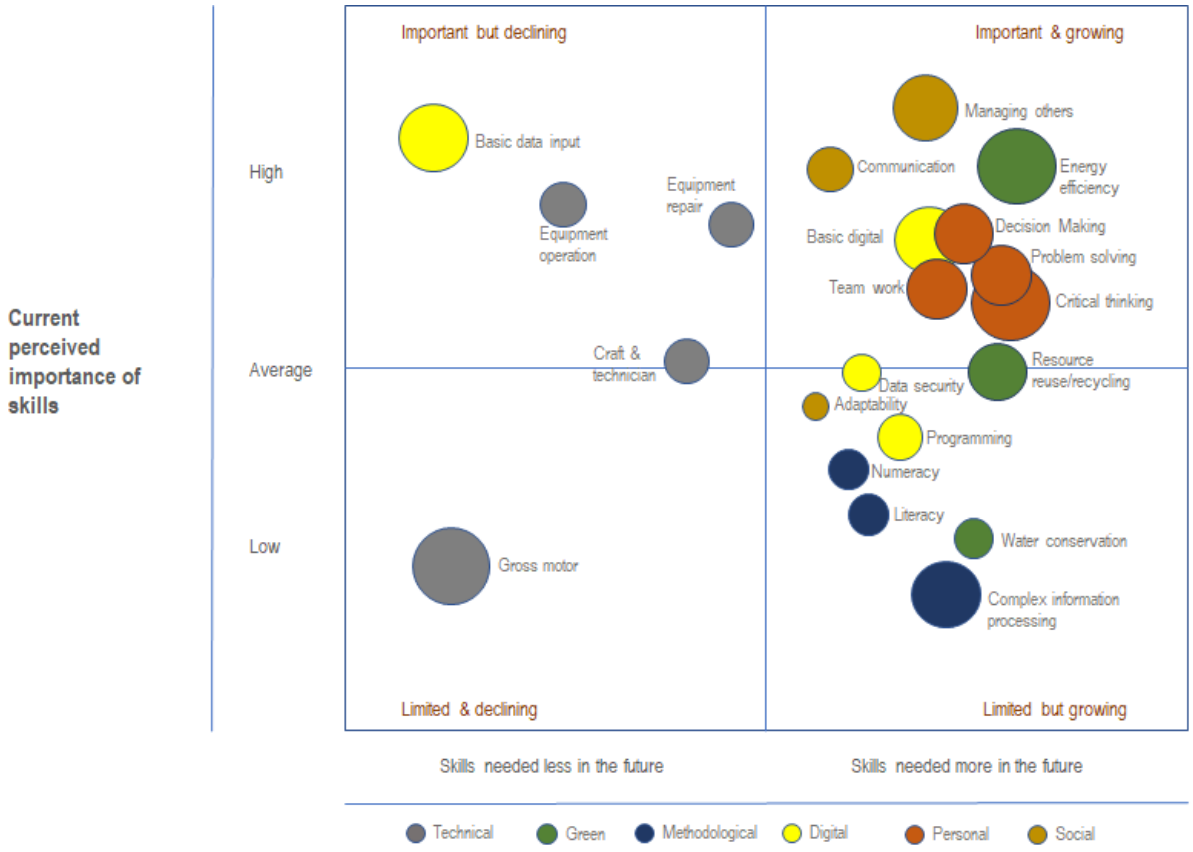


Figure 13: Current and future importance of skills (Steel Sector Careers final conference 28/04/2020 - Felix Bayon: Strategic investments and skills)

As a conclusion and based on the findings presented in "Steel Sector Careers Final Conference 28/04/2020 - Strategic investments and skills" (see Figure 13), the skills forecasts for 2030 could be summarised in this way:

- Top technical/professional skills (important, but with declining relevance): Equipment operation; Equipment repair; Craft and technician
- Top digital skills (limited perceived importance, but growing): Basic digital; Programming; Data security
- Top green skills (already relevant, with growing importance): Energy efficiency; Resource reuse/recycling; Water conservation
- Top personal skills (already relevant, with growing importance): Critical thinking; Problem solving; Decision making
- Top social skills (already relevant, with growing importance): Managing others; Communication; Adaptability
- Top methodological skills (limited perceived importance, but growing): Complex information process; Literacy; Advanced numeracy

Against this backdrop, a first classification and definition of relevant future skills was made leading the following overview (table 1, see detailed description in the Annex).

Level 1	Technical skills	Transversal skills				
Level 2	Physical & Manual	Digital	Green	Social	Individual / personal	Methodo-logical
Level 3	General equip-ment operation General equip-ment repair and mechanical skills Craft and tech-nician skills Gross motor skills and strength Inspecting and monitoring skills	Basic digital skills Advanced data analysis and mathe-matical skills Cybersecu-rity Use of com-plex digital communica-tion tools Advanced IT skills & Pro-gramming	Environmen-tal aware-ness Energy effi-ciency Water re-duction Waste re-duction and manage-ment Resource re-use/ recy-cling	Advanced communica-tion and ne-gotiation skills Interper-sonal skills and empa-thy Leadership and manag-ing others Entrepre-neurship and initiative taking Adaptability and continu-ous learning Teaching and training others	Critical thinking & decision making Personal ex-perience Adapt to change Work auton-omously Active listen-ing	Basic nu-meracy and communica-tion Basic data input and processing Advanced literacy Quantitative and statisti-cal skills Complex in-formation processing and interpre-tation Process analysis Creativity Complex problem solving

Table 1: ESSA skills classifications and definitions (overview)

Based on the results of the technological and economic development and foresight (in chapter 2) different applications of Industry 4.0 are expected to affect more or less (and with uneven progress) almost all the job profiles in production and maintenance of the steel industry. No specific game changer could be identified leading to a high number of disruptive new digital jobs and emerging occupations. The main skills adjustment is on **digitisation of existing occupations and job profiles** by upgrading of existing skills or adding new skills leading to an incremental change of former job descriptions, roles and functions. Besides this there will be moderate upskilling, changing a lot of or almost all existing job profiles and occupations (digitalisation of unchanged occupations). Changes leading to new jobs and emerging occupations are not yet discernible.

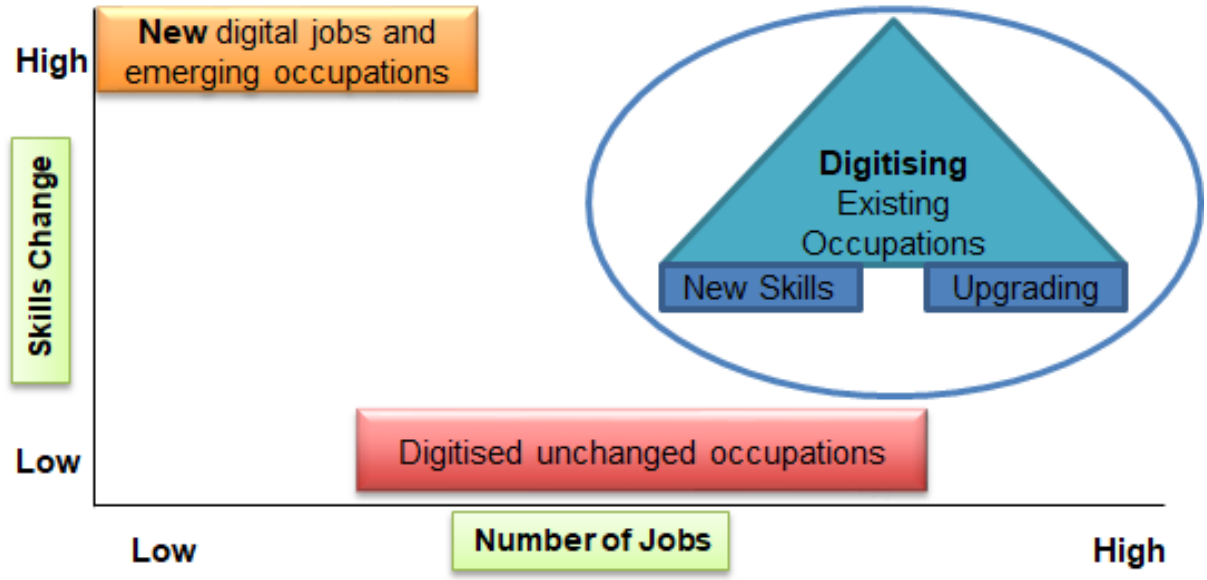


Figure 14: Number and skills degree of affected jobs (based on Schmid, CEDEFOP, World Congress on TVET, 13-16 May 2012)

Although ESSA is focusing on *incremental* technological changes in production we will be mindful of emerging *disruptive* technological changes (mainly based on automation and concerning the unfolded potential of digitalisation in maintenance) and related new digital jobs and emerging occupations in the steel industry, but the main company strategy nowadays is to buy-in missing digital know-how externally and to upskill the existing workforce. Whilst this buy-in strategy might meet emerging needs in the short-term, it might be proven costly in the long-term. So besides recruiting problems this increases the necessity to develop missing skills within the directly employed workforce also from a cost-benefit perspective.

3.3.2 Database of Job Profiles

Based on these demands the current professional steel industry profiles were checked to create, analyse and standardize the job profiles of the steel sector, leading to a **European Steel Sector Profiles Family Tree**. Professional role profiles were elaborated in a family tree basis for all the production and maintenance functions in steel companies. The family tree is a valid view which can be used to facilitate navigation and demonstrate relationships between job profiles. It also gives a clear idea about the organizational structure of a company. Thus, utilizing the family tree, the profiles may be used for reference or alternatively as a base to develop further profile levels. The final version of the family tree aimed to be used as reference for the whole steel sector.

The First European Steel Profile Family Tree was generated by Sidenor, shared with ESSA partners and completed with the contribution of other industrial partners. The Family Tree reflects the whole map of profiles covering the European Steel Industry. In the end, 26 main families (level 1) and more than 200 professional role profiles (level 2) belonging to each family were generated in order to reflect the European Steel Sector Profile Family Tree. Figure 15 is listing the (level 1) families and Figure 16 is showing an example of the functional role profiles within the Melting Shop family (level 2). The complete overview of the Family Trees and related Job Profiles are listed in the annex.

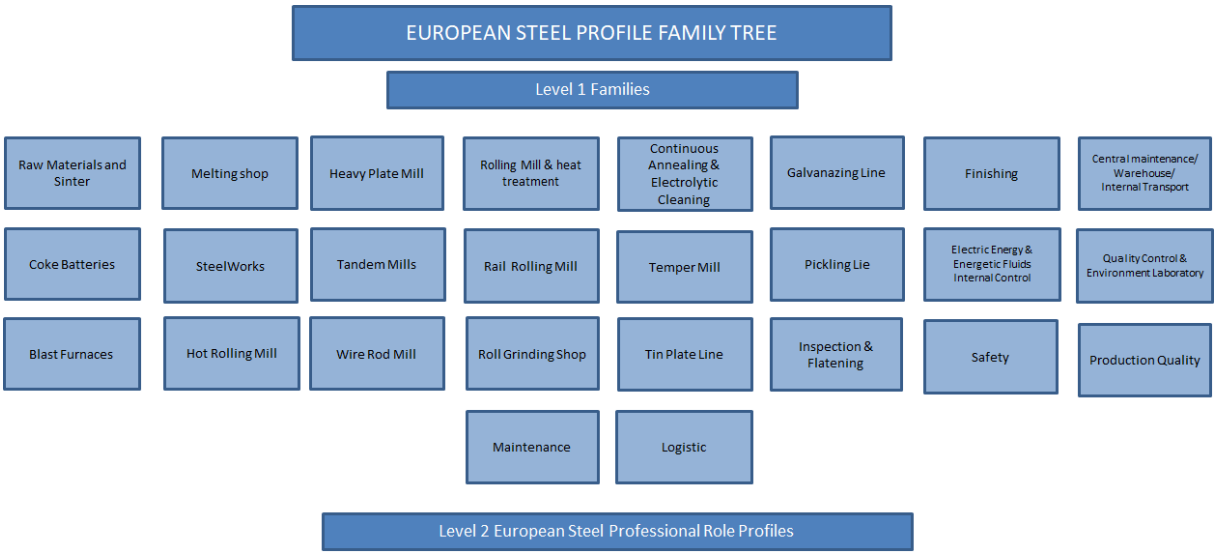


Figure 15: European steel sector profiles family tree: 26 families (level 1) at the top of the European steel sector

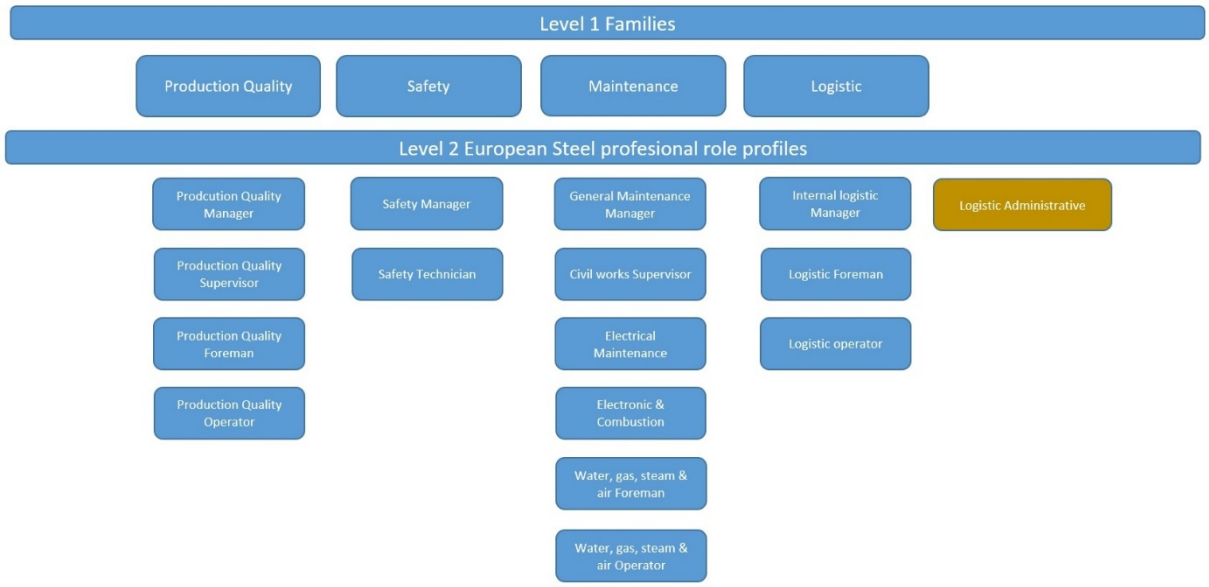


Figure 16: Job profiles (level 2) example melting shop family (blue: production, orange: administration)

The potential equivalence between the European Skills Competences Occupation Database (ESCO) and the profile titles in the Steel Sector opens the door to the automatization of the description of the European Steel Sector Professional Role Profiles taking the ESCO description of occupations as the basis for a full description of the Steel Sector Professional Role Profiles. The European Steel Sector Professional Role Profiles are constructed consistently to provide a common template, since a standard template makes it easier for users to compare different profiles and provide a fast start for developing new or adjusted profiles or contributing to designing new job descriptions.

The description template was designed to respond to the questions included in the following table, to assist users in communicating the purpose and potential application of the profiles within their organization.

Question	Template Descriptor
What is the role about?	**Title** Formed of a few words, the title offers a common name for the role
What is done in this role?	**Summary statement** Formed of a single sentence, this summary presents a brief, concise description of the role.
Why is this role needed?	**Mission** Within a maximum of three sentences this element describes the rational and context oft the role within the organisation.
Which actions should be performed?	**Main tasks** A list of inputs that can be considered as the content of jobs.
What skills are required?	**Professional/Technical & Transversal Skills** Each defined by a proficiency level, provide the overview of the skills, knowledge and attitudes required of the role.

Table 2: European steel sector professional role profiles template description

The European Steel Sector Professional Role Profiles offer a template that is of generic value and can in principle be applied to any other sector. Sharing the same format beyond sectors will contribute to increased transparency across organisations, countries and sectors. It also supports the creation of 'dual thinker' profiles combining Steel Sector specific roles with business and specific knowledge from other fields.

Against this backdrop and based on the skills categories, levels and definitions above a **job profile skills assessment template / professional role profile (description) template** was developed to define specific job profiles, identify their skills demands, evaluate and assess their current and future skills levels. The detailed skills definitions could be found in the annex (Skills Classifications and Definitions).

PROFILE TITLE	PROFILE NAME			
Summary State-ment				
Mission				
TASKS	Current		Future	
Main task/s	ESCO description (if applicable)		(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level (0 to 4)	Future Level (0 to 4)	Description of changes
Technical, subject related skills / knowledge				
Physical-manual skills	General equipment operation			
	General equipment repair and mechani-cal skills			
	Craft and technician skills			
	Gross motor skills and strength			
	Inspecting and monitoring skills			
SKILLS		Current Level (0 to 4)	Future Level (0 to 4)	Description of changes
Transversal skills				
Digital skills	Basic digital skills			
	Advanced data analysis and mathemati-cal skills			
	Cybersecurity			
	Use of complex digital communication tools			
	Advanced IT skills & Programming			
Green skills	Environmental awareness			
	Energy efficiency			
	Water conversation			
	Waste reduction and waste manage-ment			
	Resource reuse/recycling			
Social skills	Advanced communication and negotia-tion skills			
	Interpersonal skills and empathy			
	Leadership and managing others			
	Entrepreneurship and initiative taking			
	Adaptability and continuous learning			
	Teaching and training others			
Individual, per-sonal skills	Critical thinking & decision making			
	Personal experience			
	Adapt to change			
	Work autonomously			
	Active listening			
Methodological skills	Basic numeracy and communication			
	Basic data input and processing			
	Advanced literacy			
	Quantitative and statistical skills			
	Complex information processing and in-terpretation			
	Process analysis			
	Creativity			
	Complex problem solving			

Table 3: Job profile skills assessment template.

Assessment of the current and future skills for each job profile is done by five skill proficiency levels from an industrial perspective. Being in practice in several big steel companies these levels were taken and improved on the background of the skills classification:

- **0 = Novice:** Does not have knowledge and skills specific to the job role
- **1 = Basic Actor:** basic level of skills and knowledge, semi-skilled level, rudimentary knowledge and some basic skills.
  Can't perform the activities independently. Does not possess the proficiency level to perform the job role activities independently
- **2 = Practitioner:** solid skills, knowledge and ability, guidance needed to handle novel or more complex situations
  Can perform the activities with enough knowledge and skills but requires some guidance, with direct supervision and assistance, in unexpected or infrequent situations
- **3 = Expert:** advanced knowledge and ability, guides other professionals, applies skills in new or complex situations, develops new procedures or methods
  Can perform required activities with high level of knowledge and skills, without any guidance, assistance or direct supervision; can monitor, mentoring, advice others
- **4 = Master:** highly advanced skills, knowledge and abilities, proactively and personally capability building
  Can perform the activities showing the highest level of knowledge and skills, demonstrate initiative and adaptability to special problem situations and can lead and teach others in the activities

At this point, it is compulsory to give a clear definition of ESCO. ESCO is the European multilingual classification of Skills, Competences, Qualifications and Occupations. In other words, it is a dictionary that describes, identifies and classifies professional occupations, skills, and qualifications relevant for the labour market, education and training. It is directly linked to the International Standard Classification of Occupations (ISCO) which is a classification of occupation groups managed by the International Labor Organization (ILO), since the information and data in ESCO are based on an original work published by the ILO under the title "International Standard Classification of Occupations", ISCO-08.

The potentiality for equivalence between ESCO occupations and the professional job profiles in the steel sector was elaborated and opened the door to the automatization of the description of the European Steel Sector Professional Role Profiles taking the ESCO description of occupations as the basis. Therefore, DEUSTO University developed an excel-based software for ESSA that will allow partly automating the description of the different steel-related job profiles by the ESCO description.

Our future plan is to be able to introduce the current and future skills and the current and future levels that are not present in ESCO, interactively to the ESCO database. In this way, the work developed during the compilation of the profiles in the steel industry will feed the ESCO database, enriching it with new occupations and descriptions, and vice versa. Consequently, a common and automated database of professional profiles related with steel sector has been generated. It is interactive for continuous updating. Up to now, this automatic interrelation is restricted to technical, subject related skills and knowledge. ESSA is in discussion with the ESCO representatives to include also the transversal skills.

3.4 Next Steps

The job function and profile classification chosen for an incremental upskilling of all the job profiles in the production (and related maintenance) area of steel companies is leading to a huge range of different job titles across the Steel Sector professions. Jobs are unique but a similar title can be used to describe widely different jobs, conversely similar jobs can be described by different titles. This can be confusing and prevent clear understanding between different actors and stakeholders of the jobs described and its associated tasks and responsibilities. Therefore, standardisation, reduction and merger of similar profiles across the whole job family tree is required. For the demanded skills adjustments we need to reduce and cluster the number of job profiles in the family tree through finding common ground between as many of them as possible and then merging the ones with equivalence. A first step in this direction was taken through a first selection of representative pilot job profiles and the alignment of steel sector job profiles with the relevant *occupations in ESCO database.*

After a detailed analysis for the most representative occupations of the steel sector, there were not only sectoral but also more general VET occupations across different industry sectors in the final list. For the first pilot test of the skills assessment, nine job profiles were selected on the background of matching company job profiles with existing ESCO occupations and representative coverage of all major ISCO groups, by importance for the steel production, covering production and maintenance, most in-demand jobs and potential added value for other sectoral (industry) Blueprints. Additionally, the relative coverage of jobs/occupations differently affected by Industry 4.0 and digitalisation was considered. Finally, the following nine job profiles / occupations were selected, representing different production areas, organisational and skills levels:

1. **Metallurgical managers** coordinate and implement short and medium term metallurgical or steel-making production schedules, and coordinate the development, support and improvement of steel-making processes, and the reliability efforts of the maintenance and engineering departments. They also partner with ongoing remediation initiatives.
2. **Process engineers** apply engineering concepts in order to improve all kinds of production and manufacturing processes in terms of efficiency and productivity. They evaluate the variables and constraints present in given processes and present engineering solutions to optimise them.
3. **Maintenance and repair engineers** focus on the optimization of equipment, procedures, machineries and infrastructure. They ensure their maximum availability at minimum costs.
4. **Process engineering technicians/supervisors** work closely with engineers to evaluate the existing processes and configure manufacturing systems to reduce cost, improve sustainability and develop best practices within the production process.
5. **Production supervisors** coordinate, plan and direct manufacturing and production processes. They are responsible for reviewing production schedules or orders as well as dealing with staff in these production areas.
6. **Industrial electricians** install and maintain electricity cables and other electrical infrastructure in large industrial buildings. They perform inspections and repair defective parts of electrical systems to ensure efficiency.
7. **Metal processing plant operators** (including Continuous Casting Operator) monitor, operate, adjust and maintain single-function process machinery and equipment to process and convert mineral ores and refine, harden, roll and extrude metals.

8. **Metal working machine tool setters and operators** set and/or operate various machine tools, working to fine tolerances.
9. **Factory hands** assist machine operators and product assemblers. They clean the machines and the working areas. Factory hands make sure supplies and materials are replenished.

For these first pilot job profiles a checklist conducted as a questionnaire with these ESCO occupations and equivalent Steel Sector profiles have been developed and delivered to the main Steel Sector representatives, to assess current and future skill levels. The developed skills checklist and assessment template (see table 3 above) will be tested with the nine job profiles described above within a survey (available in English, German, Czech, Italian, Spanish, and French), explaining all the categories in a short definition. After this first test the template will be improved and new job profiles added. The results of this survey (already checked by a pre-test) will identify potential skills gaps at the *practical* company level, to be checked later in the design of the VET curricula (see next chapter), and generate feedback and improvement necessities and possibilities of the skills assessment checklist in general.

Figure 17: Questionnaire introduction (skills checklist)

As ESSA is conceptualised as iterative and cyclical, an update and upgrade of the results will be done so far in the next phase, that in order to:

Improve the already given identification of skills requirement and gaps based on new findings and insights.

Deliver an updated database of professional profiles descriptions related to the Steel Sector, interactive and that can be updated continuously and easily.

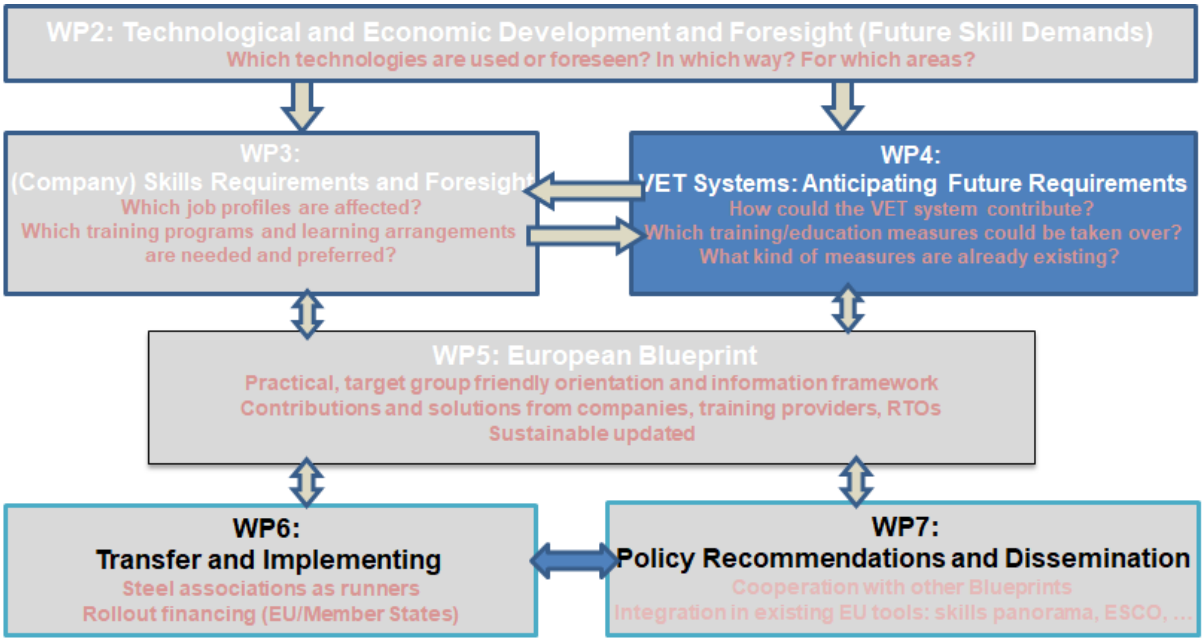
Turning skills into knowledge: providing key information for the connection and integration of key findings in VET systems.

Identify knowledge areas defined by ESCO, related to the selected skills used in job profile descriptions, leading to an update of the first version of the automated database that has been generated.

The report about the industrial skills requirements and foresight (Deliverable 3.2) will be updated continuously and an upgrade of the generated database will be carried on, aligned with the ESCO database as much as possible.

4 VET Systems Requirements (WP4)

Based on the technological and economic scenarios (WP2) and informed by the steel industry skills demands (WP3) the VET system analysis explores the possible and necessary contributions of the different systems in the member states, focusing specifically on five case study countries (Germany, Italy, Poland, Spain, United Kingdom) but commenting more widely with regard to regional patterns of skill formation.



4.1 Objectives

Based on the technological and economic developments, and in relation to the industry skills requirements that subsequently emerge, the focus turns to how Vocational Education and Training (VET) systems and frameworks at the national and EU level meet (and deliver) skills to the steel industry, and in this way how they are able to support the sector's technological transition to Industry 4.0. We also aim to identify where and to what extent companies attempt to close skills gaps through internal training provision. Hence, this chapter addresses questions related to technological development and emerging skills needs within the companies, but focuses specifically on the ways in which company training (formal and informal) and national VET systems are able to meet these needs and respond to new demands.

The anticipation of skills demands and their integration into VET provision are two of the most challenging and ambitious objectives of ESSA. The identification of skills needs enables appropriate training curricula to be built and strategies for the implementation of new training content across the sector to be developed. However, this requires a clear understanding of how different national VET systems - as systems of skill formation - work, and to what extent they are designed to deliver skills relevant to the sector in timely ways. To address this objective, it is important to acquire a clear understanding of VET governance in different systems and identify the key players and nodes within the system. The findings on these matters will inform the Blueprint recommendations.

As indicated, the research conducted in ESSA focuses on identifying and analysing the regulatory framework, functioning and programmes of five national VET systems (Germany, Italy, Poland, Spain,

and the United Kingdom), and on setting out the patterns of relations between national VET provision and steel companies in these case study countries. A further strand examines how EU-level frameworks (e.g. EQAVET, ECTS, ECVET, EQF, ESCO, etc.) fit with the sector. This is critical for understanding, for example, quality and mobility aspects of steelworkers' training and qualifications. Recognising the state of implementation of such frameworks in the five case study countries helps to understand how these can be leveraged for meeting the industry demands and to better support worker mobility. To support the European sector, it is important to provide accessible windows of opportunities for workers' mobility and encourage the exchange of information. This, in turn, requires that as far as possible national VET systems are harmonized and integrated in an overarching framework which guarantees the transparency of national vocational programmes and qualifications. Of course, the fundamental differences that exist between skill formation systems across Europe means that harmonizing systems in a more general way is not feasible (Clarke and Winch, 2006), but the aim here is to identify commonalities and differences within systems as far as they inform sector provision.

Finally, we aim to produce an occupation-skills matrix to correlate national VET provision with nine relevant steel industry occupational profiles (listed in the previous section). This will help to identify how different VET programmes address the changing composition of skills and knowledge for each profile, and where the skills gaps reside. A key issue, discussed later, is the extent to which programmes inform directly the occupational profiles identified.

This VET system analysis comprises the following tasks:

- Identification of National (Sector) VET Qualification and Skills (Regulatory) Frameworks for Steel
- Analysis of cross-European VET frameworks and standards for sector skills recognition
- Development of European sector skills VET framework
- Identification of mechanisms for application of sector skills VET frameworks.

4.2 Methodology

The research conducted is based on a multi-stage mixed method approach, combining an exploratory survey, desk research, and qualitative interviews and questionnaires. In a first stage, the exploratory survey was aimed at understanding the experience of partners with education and training as a basis for subsequent interviews. In a second stage, desk research and document analysis was useful to set up a picture of the field under investigation for each case study country and at the EU level. Finally, qualitative interviews and questionnaires have added additional dimensions, and helped to approach specific questions that had emerged from the desk research from a different angle, or in greater depth.

The five case study countries (DE, IT, PL, ES, UK) have been identified because of the specificity of their VET systems, as well as their place as key sites of production within the European steel industry.

Exploratory review and partners survey

An exploratory review of VET-related literature was carried out to identify the main scientific references and to establish a conceptual framework for carrying out the research. In parallel, an online survey was launched to start mapping partners' expertise in the field of vocational education and training and industry skills needs.

Desk research and document analysis

Once the main scientific references had been identified and a conceptual framework had been outlined, an extensive literature review and document analysis was carried out. This focused on the following areas and topics:

1. steel industry scenario at the national and European level
2. skills 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 to as a basis for the further stages of the research. The desk research had also been the foundation for the first iteration of the Deliverables (D4.1, D4.2, D4,3. D.4.4, D4.5) produced concerning VET system analysis and support.

Qualitative interviews and questionnaires

Further to the results of the exploratory survey and desk research, and thanks to the support of ESSA partners, qualitative interviews addressed to experts in the field of steel production and VET have been conducted remotely, given that it was not possible to travel because of COVID-19 restrictions. The planned fieldwork in the five case study countries had to be replaced by remote interviews conducted via online platforms such as Skype, Zoom, Microsoft Teams. Planned group interviews and workshops with workers and apprentices, as well as with experts and stakeholders, could not take place due to restrictions in mobility and social encounters in all the five case study countries. However, where regulations will allow this in the coming months, workshops/interviews will be considered to integrate and validate the acquired data.

In order to provide more options for participating in the research, in the understanding that more flexibility was needed to overcome the difficulties brought in by the pandemic, Cardiff University has also developed an online questionnaire for steel company representatives as a substitute for interviews where these have been difficult to arrange (e.g. because of language issues or scheduling problems). The questionnaire has been tailored on three categories of respondents: HR officers, Production Managers and Training Centre Managers. The online questionnaire has been used in particular to conduct research in the steel companies in Poland and to a lesser extent in Spain.

More generally, the interviews and questionnaires have been addressed to representatives of steel companies, employers' associations, workers' unions and VET experts. The qualitative data generated in this phase will be used to integrate, refine and consolidate the insights emerged from the initial desk research. This will result in the second iteration of the related Deliverables.

The table below summarises the reach of the empirical research activities so far (60 interviews/questionnaires). The numbers aggregate both interviews and questionnaires responses. Research activities are still ongoing and more interviews and/or questionnaires responses could be added by the end of the fieldwork (end of 2020) and in the future months, where data gaps emerge. 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 skills needs and national VET programmes that feed into the industry.

	DE	ES	IT	PL	UK	EU	TOTAL
Unions	1	1	2	2	2	1	8
VET	5	2	4	1	4	1	17
Steel industry	11	6	4	10	2	1	35
TOTAL	17	9	10	13	8	3	**60**

Table 4: Conducted interviews and questionnaire in the case study countries and at EU Level

4.3 Results so far

To date the first version of five Deliverables (D4.1, D4.2, D4,3. D.4.4, D4.5) is available, currently being updated and integrated with data derived from the interviews and questionnaires (second iteration). The research followed a two-step approach, moving from outlining the regulatory framework and functioning of the five case study VET systems and the EU relevant frameworks, to identifying specific programmes and qualifications in each of the chosen countries (to be analysed more in depth in relation to the identified nine steel industry professional profiles).

The essential features (see Table 5) of the case study country VET systems and the identification of the vocational and technical programmes relevant to the steel industry in the five case study countries (Table 6) are summarised below.

DE	ES	IT	PL	UK
Technology neutral provision	Established procedures for the recognition of prior learning	Recently established national catalogue of occupations and qualifications	Mechanisms for the recognition of prior learning in place	Plurality of providers
Solid dual system	Double VET route (education & employment)	National and regional VET provision (alternative paths)	System undergoing structural reforms - transitioning until 2022	Modular VET provision
Responsibility shared between competent Ministry and Länder	Responsibility shared between competent Ministries and Regions	Responsibility shared between competent Ministries and Regions	Responsibility shared between Ministries, Regional authorities and local authorities (*Powiat*)	Complex and fragmented governance: responsibility shared between central Government and Devolved Administrations, and national VET regulators
Referenced to EQF	Not referenced to EQF	Referenced to EQF	Referenced to EQF	Referenced to EQF
Occupation-based approach	Recently introduced dual VET arrangements	Recently introduced dual VET arrangements	Recently introduced dual VET arrangements	Reforms or reviews of parts of the systems currently ongoing in the 4 countries (England, Northern Ireland, Scotland, Wales)
National standards	Modular and based on Learning Outcomes	Post-secondary VET more connected to industry	Based on learning outcomes	VET mostly taken at EQF levels 3-4
Holistic approach to occupational competencies	National catalogue of occupational standards	3 types of apprenticeship programmes	National catalogue of occupations and associated qualifications	Narrower understanding of occupational standards (compared to DE)
Consensus-based regulation	Mobility between programmes	Mobility between programmes	Distinction between programme and qualification (certificate/diploma)	Distinguishing role of awarding bodies
Co-determination of qualifications' contents	Mainly school-based with practical focus	Mainly school-based at secondary level	Mainly school-based VET	Raising demand in apprenticeships

Table 5: Identification of essential features of the five case study countries' VET systems

Table 6 highlights some convergence in VET practices (particularly a shift to dual system of organisation in most countries), but national differences remain significant and relevant. From the point of view of ESSA, national differences could point both to effective practices and shortcomings, which could affect the provision of skills to the steel industry.

	DE	ES	IT	PL	UK
Secondary level (EQF2-4)	Vocational schools (*Berufsfachschule*) Apprenticeship (*Ausbildungsberufe*)	Basic VET (FP *basica*) Intermediate VET (FP *grado medio*) Apprenticeship	Technical schools (*istituto tecnico*) Vocational schools (*istituto professionale*) IeFP (*istruzione e formazione professionale*) Apprenticeship	Sectoral programmes (*szkoły branżowe I stopni*) Technical programmes (*technika*)	College-based VET (BTEC, NVQ, SVQ) T Levels Apprenticeships
Post-secondary level (EQF4-6)	Technical schools (*Fachschule*) Advanced vocational training (*Meister*) Apprenticeship (*Fortbildungsberufe*)	Higher VET (FP *grado superior*) Apprenticeship	Higher technical education and training (*istruzione e formazione tecnica superiore*) Higher technical school (*istituto tecnico superiore*) Apprenticeship	Vocational schools (*szkoły policealne*)	College-based higher VET (BTEC, NVQ, SVQ, HNC, HND) Higher apprenticeships

Table 6: Vocational and technical programmes (relevant to the steel industry in the five case study countries)

It is clear, for example, as indicated above, that differences between systems reduces the likelihood that harmonization is possible in relation to the addressing of skill needs. Indeed, different systems are geared to incorporate skill needs in different ways - particularly differences between the UK and elsewhere in Europe, but differences between our other case study countries are notable too. Such differences have long been noted within the academic literature (e.g. Busemeyer and Vossiek, 2016) and result in quite different patterns of skill formation and the way skills needs might be addressed. For example, Germany's greater involvement of social partners and its more regulated and holistic approach focused on occupations lends itself to broader based and incremental (and specific) skills development, which contrasts quite heavily with the UK's more fragmented system that is focused more on modular delivery and seemingly ad-hoc approach to skills needs. We note this from our interview data, which evidences that in the UK company needs are addressed in more direct and narrow ways with VET providers as and when needs become apparent. In Germany, however, the evidence suggests a broader and long-term consideration of the occupation and its development needs by a range of industry stakeholders. Other research on the steel industry confirms this particular pattern of skill formation (e.g. Evans and Stroud, 2014) and the importance of country context for the understanding of both skills needs and the insertion of new technologies (Stroud et al, 2020; Stroud and Weinel, 2020).

Thus, as companies are embedded in national contexts, any new training arrangement and up-skilling/reskilling proposal delivered by ESSA should consider specificity of the national VET system, as well as patterns of technological innovation (and 'greening'). A comparative overview will allow producing more tailored recommendations for the different steel regions and could help with foresight on how these can play out in the different contexts. In some regards this plays out at more local levels too, with differences in steel making technologies (e.g. EAF, BOF) requiring different skill and training needs within specific localities and this should be accounted for within ESSA (esp. for the rollout to the steel regions).

We further note the paramount importance of transversal skills within the context of Industry 4.0, with our evidence suggesting VET systems already equipped with programmes and arrangements that aim for a more holistic workforce development (e.g. longer programmes, balanced contents, co-determination and co-delivery, dual arrangements) appear to be better prepared to respond to current industry demands and economic challenges in this respect.

A last consideration is the extent to which national systems of VET shape formal and informal patterns of training provision at the company level. On this, we are perhaps more certain about arrangements for Initial VET or IVET (as national arrangements tend to reflect what is delivered for this stage at company level), but for Continuing VET or CVET arrangements tend to differ quite widely by company and there is some divergence within countries - for example, our evidence notes in Germany the different extent to which digital skills development within companies was embedded within working arrangements. Typically, we might also note that arrangements for CVET vary across the occupational hierarchy, with more qualified workers receiving more training opportunities (e.g. Ashton, 2004). ESSA will however, note the necessity for all grades of worker to be upskilled in line with sector developments and receive the required training.

Overall, it is important to understand what is currently delivered within the programmes identified if the meeting of skill needs is to be improved. This relates to both Table 5 and Table 6. Table 5 provides an overview of national systems and how they operate as skill formation systems and Table 6 identifies the relevant VET programmes for steelworkers (the nine important professional profiles) common across national systems (as far as harmonization according to ESCO will allow when configuring profiles against programmes), which works towards building an occupation/skill-needs/VET system matrix for the ESSA Blueprint and, in this way, improvements for delivering on identified skill needs.

Beyond the overview of the different systems, the main results concerning the VET systems framework so far (collected in Deliverables 4.1 to 4.5) can be summarised as follows:

Identification of common patterns in national VET systems

Our comparative research shows, in line with research conducted by Cedefop, that the five case study countries have recently undergone (or are currently undergoing) VET reforms devised by the responsible authorities to cope with the current industrial and labour market challenges. Most commonly, reforms aim to:

- activate dual training arrangements
- relaunch and strengthen apprenticeship schemes
- extend VET at the post-secondary level (EQF 4-6)
- increase flexibility (e.g., allow changing between VET programmes and moving to higher VET and higher education; establish modularity and learning outcomes approach; establish procedures for the recognition of prior learning)

- better integrate social partners in the design of qualifications and in the training provision
- establish national quality assurance systems in line with the EU requirements
- increase transparency and define national catalogues of qualifications
- plan systematic reviews of qualifications
- bridge cross-sectoral and occupation-specific skills and incorporate soft skills (T-shape approach).

Looking at this listing it becomes evident that the reforms are pretty much in line with the ESSA approach and results so far (as reported by the industry skills requirements above and the Blueprint outlines in the following chapter).

Companies' view on new skills needs

Researching VET systems and skills gaps requires also including the views of representatives of steel companies. This permitted a better understanding of the interrelation between companies and VET systems, and the extent to which companies' demands and expectations are met. This part of research merges with the research conducted on companies' skills requirements. The data collected support the approach defined by the industry skills requirements (WP3) with a strong focus on transversal skills.

Most of the interviewed companies' representatives argue for the need of a more holistic approach to training, requiring workers to possess wider and more adaptable skillsets. From this stems the necessity of adopting a **T-shaped approach** to skills provision (as described in chapter 3) above.

Social skills, and in particular **communication** skills, are deemed to become of great importance, as for the need to connect with different roles in a dynamic working environment and to mutually explain/understand specific and complex needs. The importance of cross-boundary communication within a modern steel firm was confirmed by different interviewees across the case study countries. A whole range of skills such as communication, assertiveness, teamwork, is becoming more and more valued. Enhancing **transversal skills**, in general, emerged as a strong target for several companies. Such skills have long been identified as important to the industry (see, for example, Stroud and Fairbrother, 2006), but have increased in importance with the emergence of Industry 4.0 technologies.

Digital skills will be of unquestionable importance for metal and machinery workers (as confirmed also by Cedefop's Skill Panorama), and need to be constantly updated, in line with technological advancements. The strategic importance of digital skills for the industry is confirmed by the interviews, but it was underlined that there is a need to build them on robust **foundational** and **methodological skills**, such as literacy, numeracy, comprehension and logic, which play a crucial role in fostering continuous learning. Indeed, whilst digital skills are of undoubted importance, the extent to which they are identified as primary skill needs varies from company to company.

The need for enhanced **transversal skills** goes along with the need for stronger and more advanced **technical or professional skills,** especially where these incorporate IT competencies. Furthermore, technical, digital and soft skills need to be complemented by practical knowledge picked up by on-the-job experience, which helps to understand the boundaries and the risks of the material working environment.

The need emerges for workers to adopt a more holistic and systemic view of the processes they deal with (overcoming narrow task-oriented learning), and for companies to foster a diffused and inclusive cultural change to accompany the re- or up-skilling of the workforce.

Also, a fast-changing environment and the need to tackle problems quickly and effectively put in evidence the need for **Lean Management skills**, to be developed at different qualification levels.

Where this demand seems to be likely associated with the penetration of industry 4.0 in different national contexts, it must be pointed out that the current European steel industry scenario appears quite uneven in terms of technological advancements and industrial composition. This highlights the need to frame these preliminary findings in terms of possible skills landscapes associated with an ideal-typical Steel Industry 4.0 scenario.

Identification of challenges and criticalities that need to be addressed

Rapidly changing industrial landscapes and labour markets require *not just timely but coherent and strategical responses*. The VET system comparative analysis shows a latent tension between fast responses and mid- to long-term incremental adaptation, as suggested above. This appears to be exemplified by the cases of the United Kingdom and Germany. Experts' interviews point out that 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.

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 higher degree of reusability, so limiting workers as well as businesses' resilience. The German concept of "vocational action competence" (*Handlungskompetenz*) and vocational principle (*Berufsprinzip*), instead, seem to point towards a more holistic vision of the occupation and its associated competencies. This clashes to some extent with the modularisation approach encouraged by the EU policies (Deissinger 2015). From this point of view, a crucial challenge for future VET would be defining guidelines for a non-fragmentary use of modularisation (see discussion below), as well as the optimal balance between transversal skills, on the one hand, and technical cross-sectoral and occupation-specific skills, on the other (see Busemeyer and Trampusch, 2012 for an overview of such debates).

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. A complex regulatory framework might also discourage the engagement of both social partners and learners. A challenge for European countries is to guarantee high-quality and internationally-transparent VET qualifications, at the same time rationalising the overall functioning of their system.

As pointed out earlier, it seems important to take into account the many differences still present in national VET systems (see table 5). While recent VET reforms appear to be based on a shared understanding of "good practices" in education and training provision (e.g. the implementation of dual training arrangements), it has to be underlined that the transfer of good practices is not a straight forward process and needs to be done in accordance with the specific characteristics of the local context (governance and VET side) and calibrated on the actual needs of the national and regional labour market (companies and skills side). This has to be especially considered for the national and steel region related rollout (see chapter 6).

Leveraging EU frameworks and guidelines

Flexibility has become an important requirement of VET paths. Flexible VET needs to consider the role of informal and non-formal learning and to establish mechanisms to incorporate this into VET

systems, thus offering learners the opportunity to shorten their paths through the recognition and validation of prior learning and the exemption of modules. Credit systems, as outlined by the ECVET Recommendation, are devised to support both modularisation and the acquisition of learning outcomes, and to facilitate mobility and transfer across different learning contexts.

Modularisation can support the creation of tailor-made curricula, that ideally respond to specific regional, sectoral or even individual needs. To different extents, most of the EU countries have introduced module-based qualifications in their VET programmes (in Germany and Italy modular structures are applied only to some qualifications, while countries like Poland and Spain have adopted a more comprehensive modular approach in line with the EU Recommendations).

Furthermore, in a scenario of increasing transnational mobility, transparency and cross-referencing of qualifications are crucial for the transferability of skills. The ESCO database provides an important referencing system by offering a common understanding of skills and occupations. Its complementarity to ISCO-08 establishes a hierarchical structure in terms of occupational groups that should make mapping jobs easier in different contexts. Using these referencing systems along with EQF and ISCED-F 2013 descriptors enhances the transparency and comparability of qualifications across different countries, thus potentially supporting talents mobility, or consistent upskilling and reskilling of the workforce in different national contexts (e.g. in the case of multinational steel companies).

As for digital skills and competencies, specific tools such as DigComp and the e-CF (already used for the industry related skills classification, see table 3) work as shared vocabularies and define useful proficiency benchmarks for companies, training providers, policy-makers, and learners.

VET system related findings at this stage of ESSA point to several benefits for the steel industry that would come from an effective implementation of the tools and frameworks described above:

- Increased flexibility of vocational paths
- Shortened distance between IVET and CVET and improvement of Lifelong Learning (it has to be noted here that CVET appears to be often highly fragmented in many countries and this undermines its effectiveness and recognisability as a part of the system)
- Easier recognition and transferability across countries of entire qualifications or specific learning/training modules
- Easier updating of the qualifications (e.g. adding digital and IT modules, or environmental regulation modules, on top of pre-existing qualifications)
- Possibility to ideally combine core modules (national, or even transnational) with additional ones (regional or sectoral). On a more abstract level, this could ideally open to the possibility of a European certified repertoire of sectoral vocational qualifications.

The emphasis on modularisation however requires a caveat. As mentioned earlier, the research conducted so far points to the need of a holistic approach to vocational training. Occupational qualifications need to provide thorough set of interrelated (technical and transversal) competencies in a broad occupational area in order 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 breaks down a holistic training, but rather in a way that favours and supports it.

Sector Skill-Set Matrix

Working on a Sector Skill-Set Matrix from a VET system perspective, designed to connect the (so far nine) steel industry professional profiles with relevant formal initial vocational training (IVET) provision available in the five case study countries (Germany, United Kingdom, Italy, Poland and Spain), this matrix (within the general objectives of ESSA) aims to perform several functions:

- Provide an overview to which extent skills provision in the five case study countries have been affected by European-level initiatives to harmonise national VET provisions and VET documentations.
- Link future skill needs (FSN) that are either task-, job-, qualification-based or unspecific to the 'best' avenue in any specific context to deliver the missing skills to those who need them.
- Link job profiles to vocational qualification programmes, i.e. apprenticeships programmes, across the five case study countries as far as this is possible and feasible.
- Identify existing skills gaps in the national programmes/qualifications and potential scope for new learning and training arrangements.

The Matrix can be of potential use for HR managers in companies who might need to assess the equivalence of occupational qualifications across Europe in case they hire workers who have received their qualifications elsewhere. Having an overview of steel-sector relevant occupational qualifications should also be of use to those who want to drive forward European initiatives to improve the quality and relevance of steel-sector relevant IVET programmes.

4.4 Next Steps

The remote fieldwork has produced a significant dataset made of interviews and questionnaires responses. This data will be processed using a computer-assisted qualitative data analysis software (Nvivo). This will allow for the identification of recurring cases and themes across the dataset that will feed into the VET system related deliverables. An in-depth analysis of a sample of programmes and qualifications linked with the nine steel professional profiles will be conducted in parallel in order to identify current provision, possible skills gaps, and scope for improvements (in contents and/or learning arrangements). These activities will lead to the integration and refining of the first version of Deliverables (second iteration of D4.1-D4.5). They will also provide the Blueprint development with precise and up-to-date information about the functioning of the five case study countries' VET systems, their governance and architecture, and the vocational programmes and qualification that serve the industry. Such information will be relevant for the further elaboration of the Blueprint (see next chapter), in particular in relation to the definition of an regional training ecosystem strategy (at the member state level and regional rollout).

The in-depth analysis of national programmes and qualifications linked with the nine steel professional profiles (listed earlier in the document) so far will also inform the design and compilation of the Sector Skill-Set Matrix (D4.4), which will be delivered with the second iteration - see above for issues related to the nine profiles and their integration within the matrix.

The nine steel professional profiles selected will be analysed in connection to some of the programmes listed above in Table 6. Our analysis will be on the extent to which the programmes identified deliver those skills deemed necessary (by industry) to meet the sector's current and future needs. In particular, for each programme (and relevant qualification) linked to an occupational profile, we will

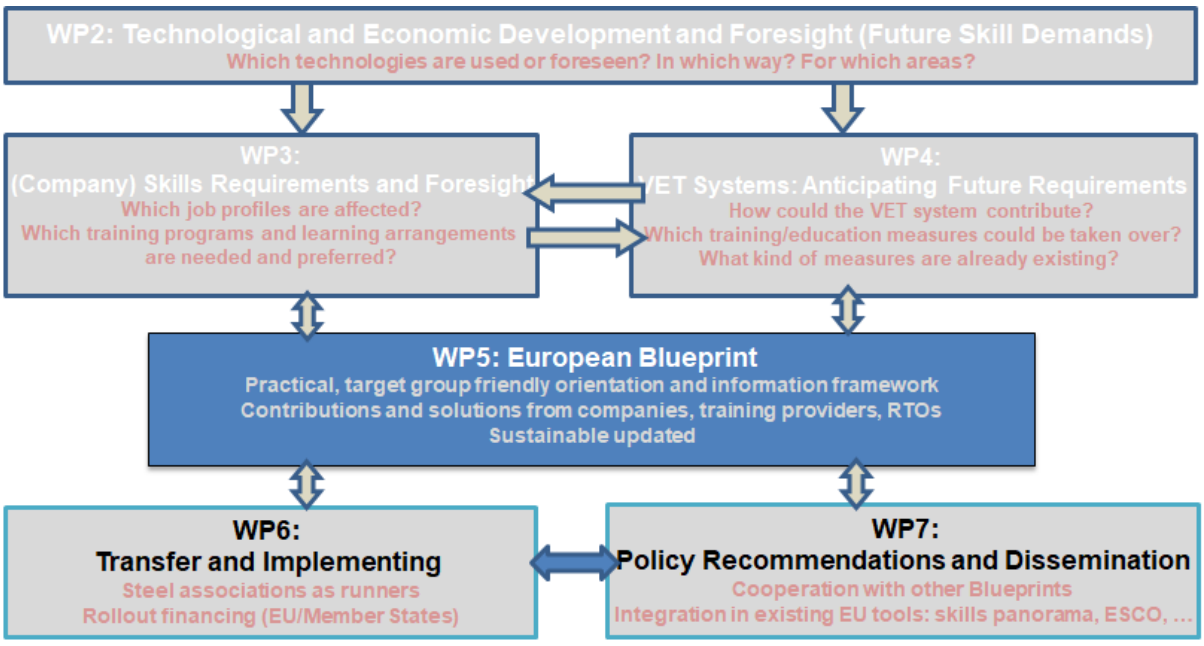
consider the duration of the programme, specific learning arrangements, composition of the curricula, balance between different types of skills (technical, digital, social, green etc.) and so on. The analysis will identify potential gaps in the design of the curricula or scope for the introduction of different learning arrangements and contents.

It should be noted that some difficulties with regard to this analysis need to be addressed. First, not all of the occupations link directly to a VET programme (e.g. Factory Hand, Production Supervisor). Second, because of the way CVET tends to be configured and the variety of practices therein, it is likely that IVET will be the principal focus. These two points are for discussion in the next stage of delivery during 2021 and, in particular, concern skills matrix coverage.

Concerning green skills there will be a close cooperation and exchange with the SPIRE-SAIS Blueprint "Skills Alliance for Industrial Symbiosis - Cross-sectoral Blueprint for a Sustainable Process Industry" (https://www.spire2030.eu/sais). As the Steel Industry is representing one of the ten energy intensive industry sectors in this cross-sectoral Blueprint tangible results also for ESSA are expected to be integrated in the further activities of ESSA.

5 European Blueprint Development (WP5)

The European Blueprint development is based on the results and inputs of the technological and economic developments and their impact on the steel companies' skills requirements and VET systems provisions. The Steel Sector Blueprint summarises and integrates these results in a practical, user friendly orientation, information, and support framework: **developed with the steel sector and for the steel sector**.



5.1 Objectives

The main objective of the project is to develop a Blueprint for a sustainable, *steel industry driven* and coordinated European Steel Skills Agenda and Strategy (ESSA) assuring an ongoing and short-termed implementation of new skills demands. This will be piloted by the development of related

scenarios, strategies, framework training modules and tools, and new training methods and arrangements: Assessment, strategies and measures to anticipate and secure a skilled workforce needed for a global competitive industry, ready to anticipate new skills demands and to allow pro-active practical activities meet the future requirements of the industry.

This *industry driven pro-active skills strategy* is reflecting the (recent and anticipated) technological and economic strands and built on the upcoming technological and economic developments (WP2), the requirements of the companies (WP3) and their integration in and support by the VET systems (WP4).

Based on these results the Blueprint activities:

- Identify in proactive, rather than reactive, ways the skills needs and demands of the industry, considering 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 education and training institutions;
- Improve and update training more short-termed and with high quality by new training programs, measures and arrangements (using new digital possibilities) as well as programs for train the trainer (as key elements for the new skills agenda);
- Identify and promote successful sectoral upskilling schemes (incl. exchange of existing tools, best/good practice exchange, knowledge) and efficient management of knowledge;
- Improve the image and 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.

The results of these objectives are leading to a comprehensive Blueprint developed first as a prototype, tested and improved to a final version end of 2022. The Blueprint definition and framework serve as an input and ground for the implementation and transfer of the ESSA Blueprint and the policy recommendations, exploitation and dissemination activities.

Strategies for the implementation of measures to meet defined skill needs are built on the sector skills framework and improvement of sector occupations and job profiles. Defining, revising and creating new and upgraded occupational profiles – to fit with emerging and diminishing skill needs are the ground for:

- Development of training activities and modules, including training the trainers, to be integrated into VET provision at national and sector level (incl. interrelation to existing EU tools like EQF, ECVET, ESCO, etc.). This includes the development of (a) training courses for up- and reskilling existing profiles, (b) new occupational profiles or parts of it, (d) new leadership and work 4.0, (e) train the trainer, improving training providers, (f) new training methods and arrangements, taking into account new possibilities of digital learning and support (social media, moodle, virtual labs, online learning, …) and workers participation (e.g. workplace innovation, but also by using digital tools like tablets, smart phones, laptops, etc.).
- Development of strategies to overcome central human resources challenges and to 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 as well as strategies increasing the workforce mobility and diversity (e.g. increasing the attractiveness of the steel industry for women).

5.2 Methodology

Based on the results of the entire activities in the first two years an integrative development, design, implementation, piloting of the industry driven European Blueprint and first concepts for a rollout on the company and national level took place. Due to the iterative cyclical concept of ESSA a first prototype development took place leading to a first piloting of the Blueprint Prototype in 2021 followed by an upgrade and finalisation of the Blueprint in 2022. At this stage defining and identifying sector benchmarks for skills development and training programmes/curricula, but also a cultural change of the whole company to industry 4.0 will be included.

Assessment of the blueprint and implementation of the established European Steel Skills Alliance (ESSA) will be within the dissemination, exploitation, and rollout activities. This includes feedback and improvement by the steel associations and social partners, the Advisory and Policy Stakeholder Group (strategizing for necessary political support measures and the means for mobilising and integrating stakeholders and policy makers of the EU and national level to meet Blueprint aims and objectives).

5.3 Results so far

This chapter is describing the first Prototype of the Blueprint. It is taken from and summarising the related Deliverable D5.2 "Prototype of the Blueprint New Skills Agenda Steel", available at the ESSA homepage.

The structure and work programme of ESSA (see figure 1, and the illustration at the beginning of this chapter) in relation to the preceding work packages (WP2,3,4) is reflected in the general Blueprint outline (see figure 18 below):

1. Current and future **technological and economic developments** new skills demands are reflected
2. Leading to **skills adjustment** based on related skills and job profile classifications and assessments, to be aligned to existing VET occupations if and where possible
3. **Strategies and measures** will be generated to ensure a continuous and sustainable skills assessment and adjustment by the steel industry for the steel industry:
    - European Steel Technology and Skills Foresight Observatory (ESSA ETF): coordination of the technological foresight and skills needs on regular monitoring tools, continuous updating of the skills, job profile, and occupation databases
    - Training offers and learning arrangements will be made available via a common European Online Training Eco-System Platform (ESSA OTS) as well as Regional Training Eco-Systems (ESSA RTS)
    - Pilot measures and tests will be launched in the future, using existing funding tools on the European (RFCS, Horizon Europe, Erasmus+, ESTEP tasks, and others), national and regional level (ESF, EFRE, …) (initiated and coordinated by the Foresight Observatory)
    - Incentives will complement activities by generating awards, online fora, best practice exchange and others (e.g. as part or integrated in the activities of the Foresight Observatory)

- A new division of responsibilities for ensuring the update of learning has to be established between companies/industry - VET systems - individuals, leading to new social practices for lifelong learning.

4. To sustainably run the Blueprint new **alliances and governance** structures have to be integrated in existing sector structures, assigning leadership for specific elements of the Blueprint on the European and national/regional level as well as on the level of cooperation in between associations, companies, training providers and other stakeholder groups.
5. European Open Coordination will **roll-out the Blueprint** concentrating on steel regions, including VET system support of the member states, and in a common action with other sectoral industry Blueprints (automotive, construction, advanced manufacturing, and others) as far as is feasible and possible.

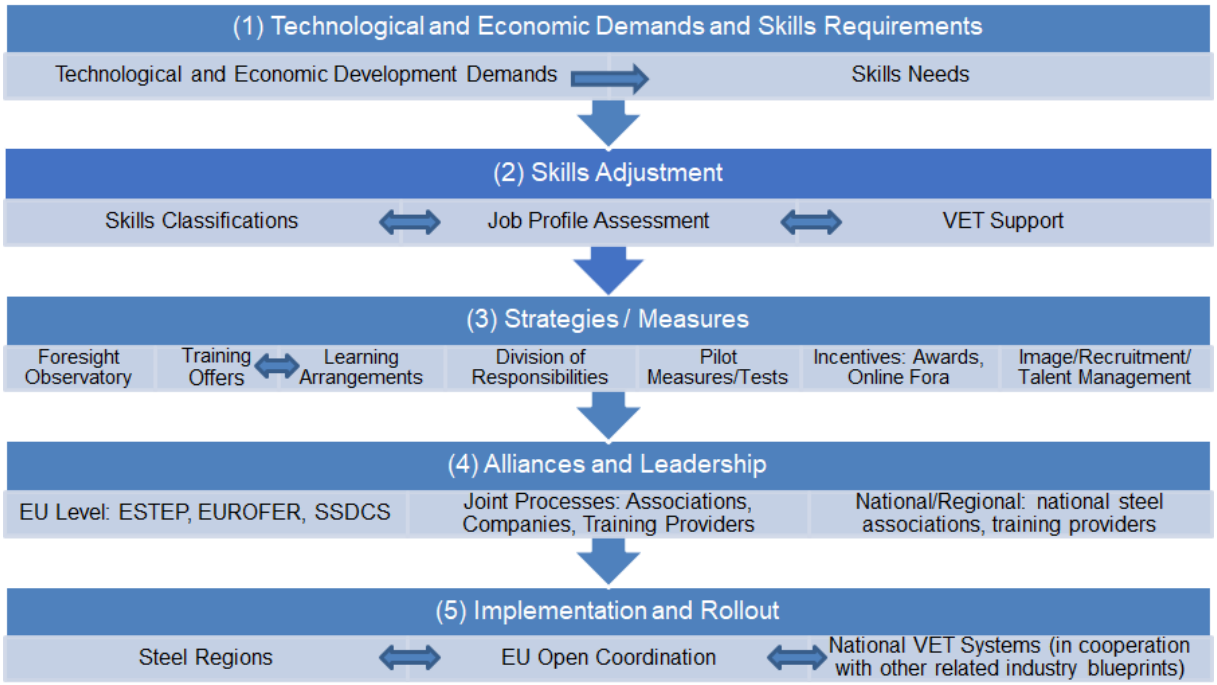


Figure 18: General Blueprint Outline

The holistic and industry driven approach of the Blueprint for (1) **Technology and Economy Driven Skills Adjustment** (based on the results of WP2,3,4) led to a demand and supply flow chart. In a first (demand) cluster technology (and economy) are the genuine driver of new applications (implemented with specific company objectives) and leading to organisation implications. A second (supply) cluster is dedicated to the given needs by (a) the assessment of the affected job profiles and production areas (incl. maintenance) as well as the affected industry occupations (of the VET system) and (b) by related training and VET system offers (via curricula of initial and continuous VET). Last but not least the ground for a better industry orientation and basic digital skills has to be uptaken as early as possible by pre-VET education (Kindergarten, primary and secondary schools), especially concerning image and recruiting campaigns from an early stage on.

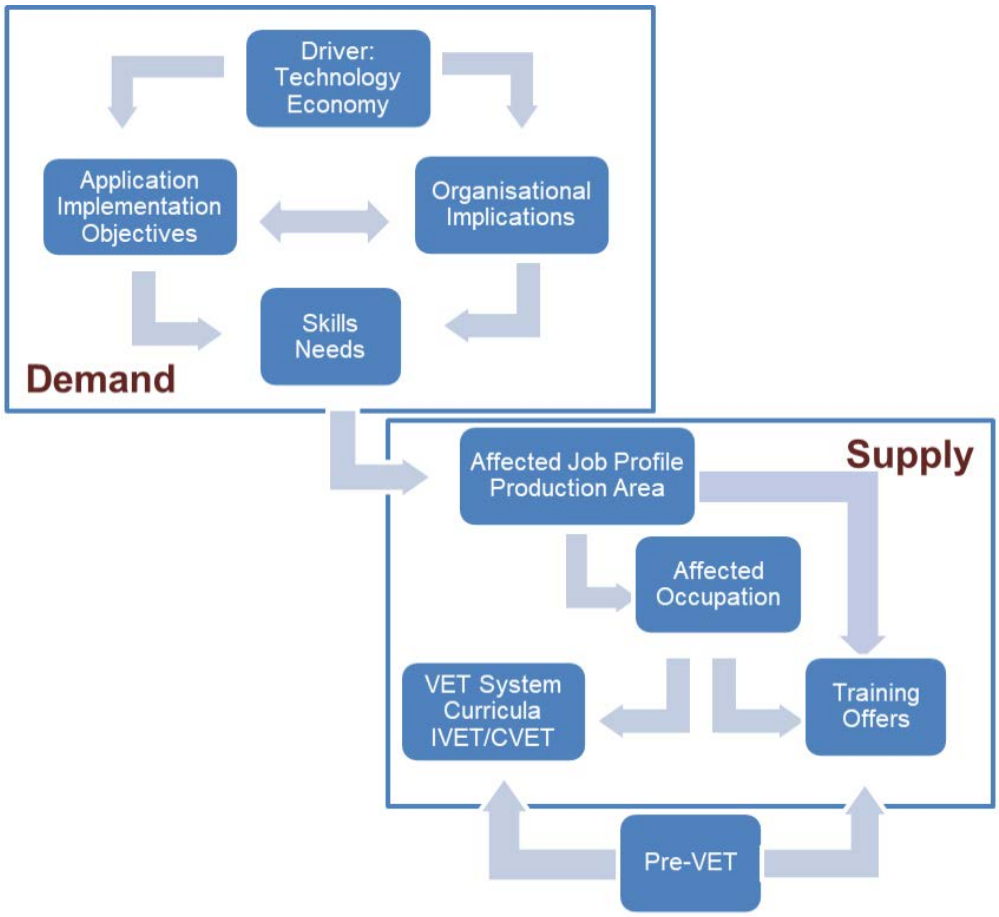


Figure 19: Industry and technology driven skills adjustment

Strategies and measures (2) based on ESSA results so far and inspired by the Steel Sector Careers project will give a steadily upgraded answer to future skills requirements reflecting the ongoing technological and economic development in the steel sector. The two core elements are

- The **E**uropean Steel **T**echnology and Skills **F**oresight Observatory (**ESSA ETF**) (demand side)
- **O**nline **T**raining Eco**s**ystem (**ESSA OTS**) and **R**egional Skills and **T**raining Eco**s**ystems (**ESSA RTS**) (supply side).

5.3.1 European Steel Technology and Skills Foresight Observatory (ESSA ETF)

As stated by the Steel Sector Careers Blueprint most companies appear to **lack a systematic process** for assessing and forecasting skills needs. Therefore, ESSA will establish the European Foresight Observatory (ESSA ETF) (already recommended by the Steel Sector Careers Blueprint) bundling all the necessary activities to **monitor and evaluate** regularly:

- Technological and economic development
- Industry skills requirements
- and VET Systems alignment and support of industry demanded future skills.

Central part of the ESSA Foresight Observatory will a regular (annual or bi-annual) **foresight survey**: ESSA European Steel Technology and Skills Foresight Panel (**ESSA ETP**), run by the Foresight Observatory (ESSA ETF). The survey will consist of a standard set of questions to monitor the recent demands repeated more or less in every issue and added by a important topics of the year. The panel

survey will combine and elaborate the already developed tools (technological and economic development survey, job profile assessment template, VET institution interviews, training offers) into one monitoring and assessment instrument. It is planned to add to this panel an additional Delphi Round of selected experts focussing on necessary implications for the steel industry concerning the main results of the survey. To integrate interdisciplinary perspectives and assessments the main stakeholder groups will be included:

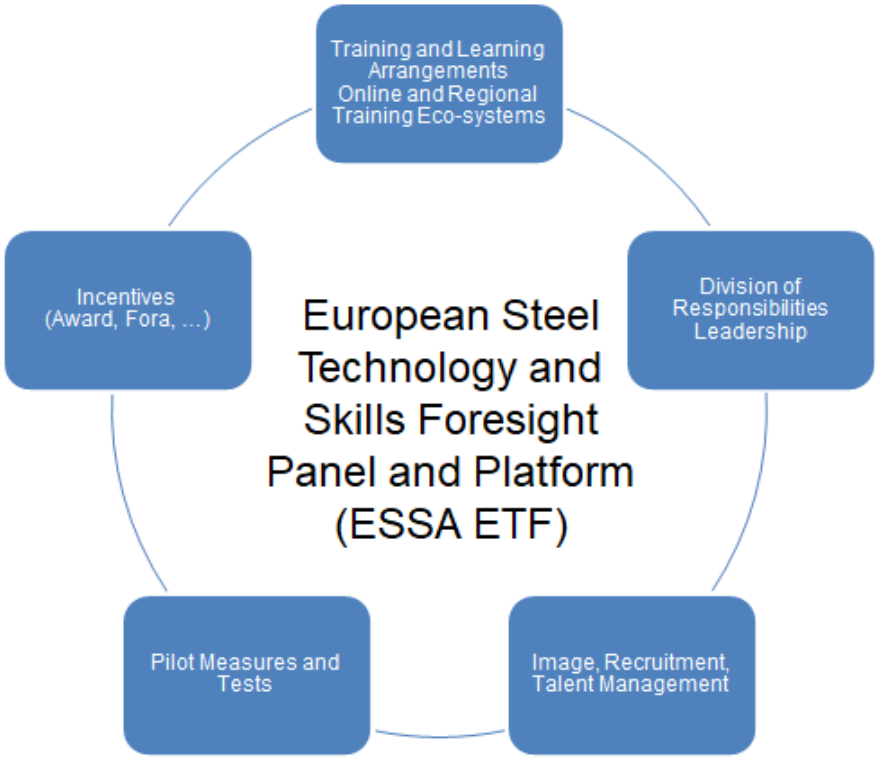
- technicians and HR people of the companies, training providers, RTOs and universities, associations and social partners
- steel producing and processing large companies and SMEs.

Based on the regularly updated results of the ESSA Foresight Panel (ESSA ETP) the ESSA Foresight Observatory will coordinate the continuous refinement of all the other relevant measures and activities planned on the European level:

- Training Offers and Learning Arrangements (Online and Regional Training Eco-systems, Train the trainer programs)
- Pilot Measures and Tests
- Incentives: Awards, Online Fora
- Division of Responsibilities / Leadership
- Image/Recruitment/Talent Management campaigns and recommendations
- Policy recommendations.

The Observatory will initiate and coordinate **pilot measures and tests** - supported, funded or framed by EU Programmes (such as Erasmus+, SPIRE, Horizon Europe) and steel sector specific programmes (such as RFCS) or platform activities (such as ESTEP, SSDCS with support of the social partners EUROFER and industriALL).

Incentives such as a Steel VET Award for best practices or Online Fora for "Hot Topics" could be hosted by the Observatory, together with ESTEP and the social partners EUROFER and industriALL.



5.3.2 Training Eco-Systems

Figure 20: European Steel Technology and Skills Foresight Observatory (ESSA ETF)

ESSA discussions so far stress both virtual and on-the-job learning, in the best way combined with each other. Therefore, the European perspective of ESSA intends to focus on the European level at an **Online Training Eco-system** (digital platform) and on the level of steel regions by national/regional specific **Regional Skills and Training Eco-System** (regional networking). Both systems are complementary and could be combined by adding specific advantages to each other (such as combining online and regional on-site training modules that could be integrated in a broader training program of the companies and VET providers and schools):

- virtual / online: independence of time and space, integration of relevant modules in company and individual learning paths, ...
- on-site / workplace related: real working experience, interactive learning, ...

Based on the worldsteel and SteelUniversity online training infrastructure ESSA is developing an Online Training Eco-System aiming at continuously integrating all the relevant ESSA actors and findings: associations, companies, training providers, industry skill requirements, other Blueprints, VET system requirements, EU tools, and the individual learner (see following figure).

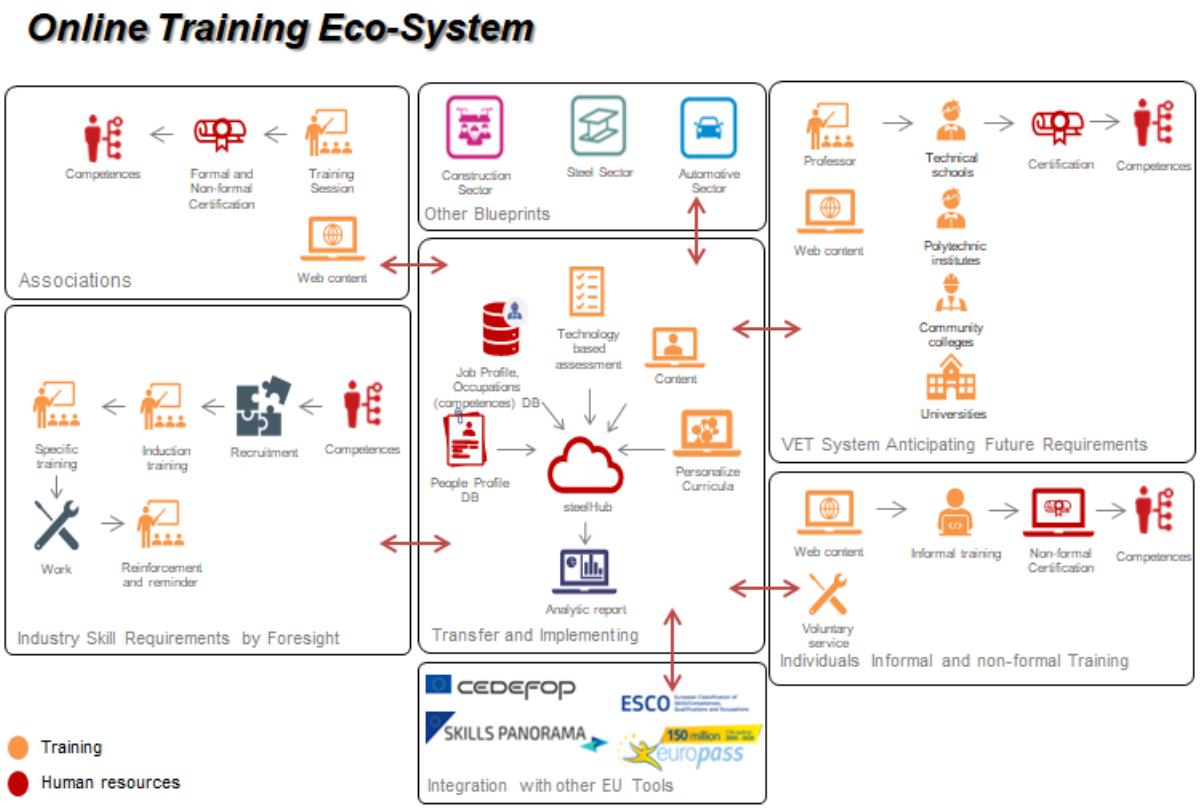


Figure 21: Online Training Eco-System (ESSA OTS)

The steelHub as centre of the online eco-system (see figure below) is engaging all the relevant and willing stakeholders and will continuously integrate and update job profiles and competences as well as a people (learner) profile database (human resources databases). Technology based assessment, different contents and personalised curricula will feed the steelHub and give a basis for analytical reports. The systematisation considers the topics, the expected level of the audience (basic, advanced) and the linguistic problem (translation is important for reaching a broader audience, esp. for lower skills levels). Courses will be described in a comparable way and customer-oriented. General training courses but also modules for specific technology demands will be developed further.

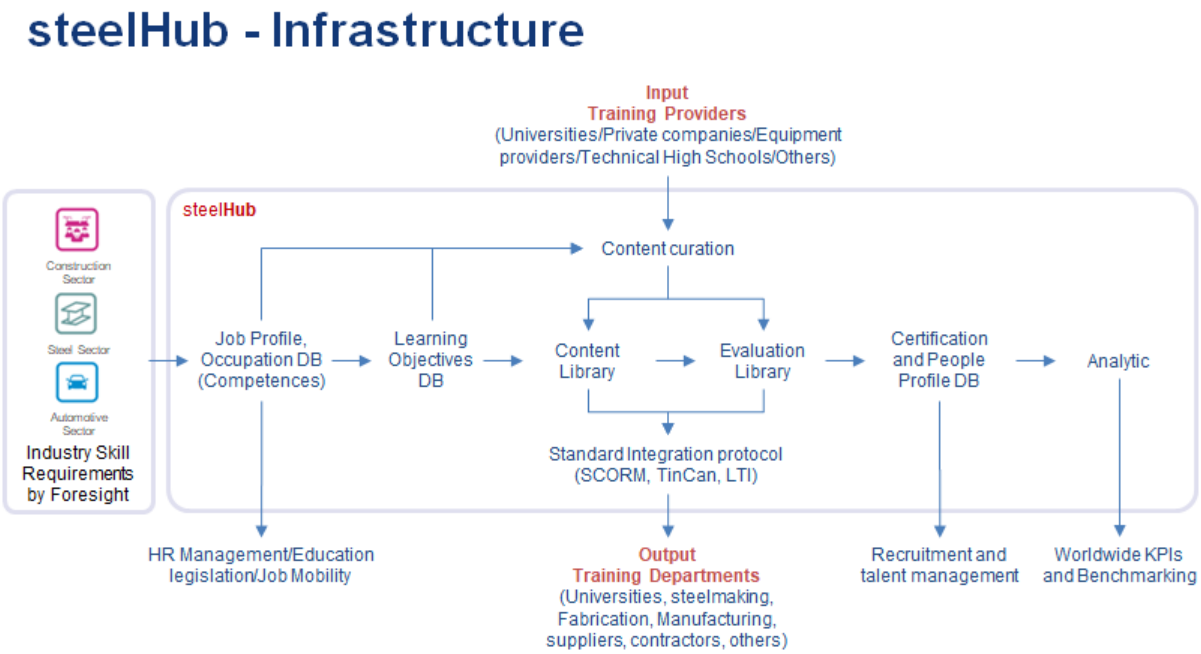


Figure 22: steelHub infrastructure

5.3.3 Regional Skills and Training Ecosystem (ESSA RTS)

The **Online** Training Eco-System (ESSA OTS) will be complemented by a **Regional** Skills and Training Eco-System (ESSA RTS) approach. This is important because it sets the focus on the "real" place where people live, learn and work. It includes not only the important company training and learning activities including work-based learning but also the integration of VET institutions, policy, research and science, and civil society activities within an ecosystem considering the responsibility, competences and activities for VET within a region. Especially in its rollout phase ESSA will focus on the European Steel Regions giving an input for already existing and to be extended networking for new skills, recruitment and image of the steel industry in the region, connecting them to the European Blueprint. Within the rollout activities it is also foreseen to join forces with other sectoral (process industry) Blueprints to harness synergies and joint strategies, avoiding separate addressing and integration of the same actors.

5.3.4 Additional Targeted Activities

Taking advantage of and within the Foresight Observatory and the Training Ecosystems infrastructure and activities ESSA is giving special attention to:

- Train the trainer activities
- Recruitment and image of the steel industry
- Talent management.

Train the trainers

New tools and means for extending the workforce needs to close identified gaps are closely connected with training responsible trainers and teachers/trainers in the different existing and new VET system approaches:

On one hand, new strategies and guidelines are developed in order to get the trainers (internal or external) closer to steel workers, and therefore reach a greater assimilation of the taught lessons.

On the other hand, digital transformation leads to new process responsibilities and therefore to new leadership: middle managers as "trainers" of their subordinates (new leadership), reverse mentoring and peer training of workers, including new roles and skills (related to teaching activity).

Train the trainer modules will be part of the online and regional skills and training eco-systems. Regarding the train the trainers' approach, we are considering for instance active learning methodologies which have been proven as more efficient than traditional "content transfer" methods. These methodologies provide learning based on tasks, problems, projects, challenges, case studies, etc., aiming at engaging and motivating the involved learners (referred as learner-centred methodologies). Problem Based Learning (PBL) and Project-based Learning (PjBL) are methods widely used to enhance "self-directed learning" skills, by changing the usual lecturer role of teachers towards a mentoring role.

Trainer/teacher **networking** and trainer/teacher **visits in companies** might extend the good practice exchange and improve the update of practical knowledge about new production technologies and work-based learning. In line with the dual VET approach this is one step further to the "vocationalisation of schooling". Also new leadership training should be done under the perspective of training and supervising the operators/workers because the role of the managers is more and more changing to coaching and supervising also the skills adjustments of their staff (see e.g. eLLa4.0 project: http://www.sfs.tu-dortmund.de/cms/en/projects/eLLa4_0.html). This includes a change of the perspective from "physical" or classical internal or external teachers responsible for transfer of knowledge to the "role" of trainer as part of the management, experienced workers etc.

The requirements, demands, and good practice extracted from the ESSA results so far are serving the ground for (new) train the trainer arrangements (dual or "hybrid teachers", peer training and learning by trained workers training their colleagues on the job, new leadership including the role of trainer/mentor/coach/facilitator). Peer training or mentorship (as a two-way process between older and younger employees) and continuous education will be integrated in the ESSA portfolio not only because of aging workforce but as an important way for up-/reskilling the workforce.

Image and Recruitment

The age structure in most European steel-producing companies is such that more than 20% of the actual workforce will have left the industry in the period 2005-2015, and close to 30% will leave up to 2025. The industry thus needs to be able to attract young and creative talents – developing mobility within and across careers is one aspect of this - but should also focus more broadly on recruiting talented individuals of all ages (lifelong learning is an important dimension) and encourage inward migration to address skill shortages. To this end and based on the useful results, strategies and materials delivered by the Steel Sector Careers Blueprint, ESSA is integrating strategies for promoting the employment of young people in the sector through the reinforcement and updating of apprenticeship schemes as part of youth-oriented recruitment processes, and strategising for active training and lifelong learning with the aim of attracting, developing and retaining talent.

The image of the Steel Industry is still a major challenge for recruiting and retaining a high skilled workforce, currently emphasised also by the Steel Sector Careers Blueprint. However, the Blueprint emphasised that students and job-seekers having had already had contact or experiences with the steel sector rate the image more positive. But however, large-scale industry job losses, shift working,

low salaries for low skilled work, and environmental impact are still remaining arguments against a job in the Steel Industry. This has to be reflected in image and recruitment campaigns and talent management strategies. Additionally, more students than before are undertaking higher education instead of VET, after graduation they do not see in the steel sector a suitable employer matching their qualification level. Finally, more students, especially female ones, would be needed in STEM subjects to supply the needed skills for manufacturing industries, including the steel industry.

Therefore, digital and green transformation by new Industry 4.0 technologies could be a chance to change the image of the steel industry and to attract (young) talents - from within and beyond the EU region - with digital affinity. Employer branding in a digital changing world could focus on future-oriented skills and leadership competencies in a digital changing surrounding within multifunctional workplaces for controllers, process mechanics, and craftsmen. The briefing note of Cedefop "Not just new jobs: digital Innovation supports careers" (https://www.cedefop.europa.eu/en/publications-and-resources/publications/9143) underlines this by showing some good practices that digitalisation is attracting and supporting talented people. So, digitalisation is a relevant strategy for the Steel Industry to attract (and retain) talented people.

To overcome recruiting obstacles the Steel Industry has to become an attractive employer of choice by presenting (**digital and green**) career paths and ensure future viability via an innovative digital and green steel production: digital optimisation and monitoring, new technologies for energy efficiency and CO_2 reduction and substitution (like hydrogen, industrial symbiosis and circular economy). This new image of a clean and green steel industry is underlined by the European "Clean Steel Partnership" (https://www.estep.eu/assets/Uploads/ec-rtd-he-partnerships-for-clean-steel-low-carbon-steelmaking.pdf) and the "Green Steel" initiative (https://www.estep.eu/green-steel-for-europe/) of the European Steel Technology Platform (ESTEP). Steel has to be advertised as an important and necessary material for society and economy (see Steel Sector Careers posters) with and for new innovative products, being 100 percent recyclable.

Figure 23: Green Steel and Clean Steel Partnership

Additionally, beneath the global and especially the European orientation the relevance as a **regional employer** has to be highlightened by the importance for jobs and social responsibility for the region (also as a relevant player for improving education and training in the region, esp. within a Regional Training Eco-System). Therefore, steel companies have to deal with activities that binds directly people from schools, internships and universities. It has to be clarified that steel jobs have sufficient starting points for people with diverse interests but could also directly address specific target groups (e.g. increasing diversity by migrants, refugees, women; but also, those who would never study and are locally inflexible, early school leavers, disadvantaged people, to integrate them not only into the company but also into society). This has to include continuous cooperation with (steel) universities (e.g. specific steel research programs, dual study) and VET schools (e.g. internship, apprenticeships, in-house training for teachers) in the region, influencing new job orientation of young people (overcoming stereotypes of women and man and negative influences from parents and peer groups).

The Steel Sector Careers Blueprint already developed a series of campaign posters illustrating the digital and green transformation of the Steel Industry within renewable industries, automotive, construction, domestic appliances, electronics, and engineering. The campaign focus on showing how steelmaking is linked to many downstream industries (e.g. automotive, construction, electronics) and a majority of products that characterise people's daily life (e.g. home appliances) to increase audiences' connections with the steel industry. The communication materials (newsletter, factsheet, posters, brochure, infosheet) of the Steel Sector Careers Blueprint campaign "More Opportunities than you can imagine" are available for download in various languages (https://ec.europa.eu/docsroom/documents/37463).

Beside digitalisation also image improving activities concerning environmental issues and **community engagement** in the regional/local environment are of high importance. Within corporate social responsibility activities and regional development steel companies could support civil society at the regional/local level. For instance ArcelorMittal Poland (AMP) is continuously active in community engagement (see AMP Sustainability Report 2019, https://amp2019.reportonline.com.au/documents/AMP_2019_Sustainability_report.pdf). Within up to 100 community projects with local NGOs, associations, schools, universities, health care and cultural organisations, AMP is engaged in three steel regions of Poland, contributing to solutions for a broad range of societal areas and challenges (beside environment: education, support of disadvantaged groups, safety, sports and culture), dedicated also to the related Sustainable Development Goals.

Talent Management

As the European steel industry is in a digital and green transition people are needed to drive these changes and ensure their success – the steelworkers of the future. Especially the recruitment and retention of young qualified talents will mark the operations of the coming years, but the industry should also be open to recruiting talented people of all ages. Especially ESTEP Focus Group People is caring within its Research Agenda for the Workforce of the Future.

Therefore, ESTEP Focus Group 'People' together with EUROFER launched an EU-wide survey in 2015 answered by 268 talents identified by steel companies estimating their values, ambitions and needs (see Echterhoff/Schröder 2015). The survey points out clearly that the talents attach importance to personal career development and progression. Talents ask for new company culture and leadership style adapted to their needs as well as support in managerial competencies. To manage skill shortages in the future, it is important to support female employees and their career and to develop related work-life-balance models (for men and women).

As the survey shows, the European steel companies are already in a good position for these demands and they have diverse instruments in place to improve practice. However, the change of values and the vision of how the steel companies will work have to find their way into the organizations. Companies have to work on topics like corporate culture to attract young talents. Existing resources in large companies ought to focus on learning, on development of talents or talent management as a whole. Therefore, a comprehensive set of measures is necessary for a great variety of needed competences (ESSA will take care of this in the further Online and Regional Training Ecosystems. Understanding change as a chance to react and adjust the industry to the talents' needs is a matter of survival in the steel industry competing with other industries.

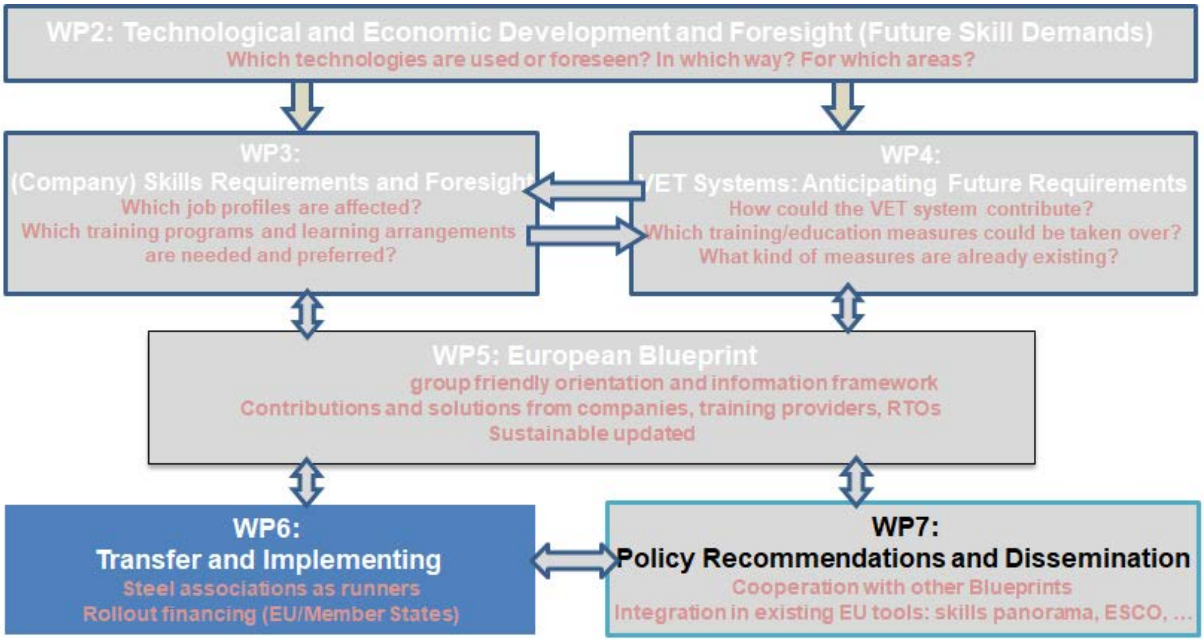
5.4 Next Steps

Next step of the ESSA Blueprint development is its pilot implementation (see next chapter on transfer and implementation). Within this test phase we will check out the necessary parameters for a sustainable integration of existing European and national/regional structures, establishing interrelated Alliances and Leadership on these levels, fostering joint Blueprint activities and setting the ground for a national/regional rollout. Furthermore, we will examine in how far the pilot training tools, measures and arrangements are working and if they have to be improved or adjusted. Within this test environment also additional offers will be checked, esp. train the trainer modules, and integrated further in the **steelHub** of the Online Training Eco-System (ESSA OTS). In parallel we will check the connection of online ESSA OTS tools and measures (esp. train the trainer modules) with on the job, on-site training in companies and VET schools of the Regional Training Eco-Systems (ESSA RTS). For collecting good practices as representative examples of the different approaches and measures we will collect recent and incentive future online and on-site training modules, including train the trainer measures in the ESSA steelHub database, also for onsite use of companies and VET schools.

The update of the Blueprint will also comprise new technological and economic developments (WP2), related new industry skills demands and requirements (WP3), and recognition of further VET system support possibilities (iterative improvement phase).

Beside the already established cooperation with ESCO, the Blueprint will engage with other European tools: such as ECQA (European Certification and Qualification Association) for certification of steel related skills and training modules with in the ESSA OTS and RTS ecosystems, the Skills Panorama to exchange our results with the broader VET and industry community, and Europass to collect learning outcomes for the individual learner.

6 Transfer and Implementation of the Blueprint (WP6)



Building out of the outcomes of the previous chapters (WPs 2, 3, and 4) and their transmission into the Blueprint Prototype (WP5) transfer and implementation plans, strategies and actions will be developed in close cooperation with dissemination activities and policy recommendations (WP7). The European Blueprint has to be implemented and transferred especially when the prototype of it is ready (end of 2020). Therefore, the transfer and implementation activities will officially start in 2021. However, during the first two years some outlines were already elaborated. Roll-out (and dissemination activities, see next chapter) run from the very outset of the project and through the whole project life-cycle to ensure relevant, applicable, visible and reflected results. All project partners are involved with their access to the European steel sector.

6.1 Objectives

Implementation and transfer actions at both EU and Member State level (focusing on the Steel Regions) involve all ESSA partners. Steel companies, associations, training providers and VET system institutions are in place concerning the preparation of company and national Blueprint roll-outs. Collaboration is and will be further established with other blueprint developing industry sectors: such as Automotive (DRIVES https://www.project-drives.eu/en/home), Construction (http://skills4am.eu/theproject.html), Additive Manufacturing (http://skills4am.eu/theproject.html), Skills 4 Smart TCLF Industries 2030 (S4TCLF http://www.s4tclfblueprint.eu/), SPIRE-SAIS Industrial Symbiosis (https://www.spire2030.eu/sais) and others.

Transfer and implementation have to be targeted to the respected audience and national contexts, esp. by considering the differences in national VET systems (see chapter 4). Suitable Key Performance Indicators (KPIs) for stakeholders' involvement are used in order to monitor success and adjustment needs continuously in respect of implementation of Blueprint goals and to adjust the agenda and strategy in time to upcoming new developments and environments.

6.2 Methodology

Methodologically transfer and implementation activities are planned as follows:

- Piloting and sustainable implementation of the Blueprint framework within the companies and its training providers: The developed strategies, training tools and methods will be piloted in the involved steel companies, supported by their training providers. This will be done twice after the Blueprint prototype and with the preliminary final version, to test and improve the solutions and to look at the conditions for a sustainable ongoing implementation.
- Implementation strategy for gaining political support, mobilizing human resources and engaging stakeholders for the Blueprint and Skills Alliance: As the present education programmes aim mainly at supplying people with *ad hoc* competencies, a communication and involvement strategy will be developed in order to attract highly skilled people who can train the new generations and disseminate a steel culture. In order to mobilize highly skilled people, the most suitable learning technologies, supports and tools will be tested and included in educational and training programmes. National associations will be involved in order to provide information on the project to policy makers in their own countries, in order to gain political support in each country, while ESTEP / EUROFER will play the same role at EU level. Strategies will also be elaborated aiming at engaging the main stakeholders for Blueprint and Skills Alliance and at creating a network of competencies supporting the educational program by eventually sharing e.g. skilled teachers, young trainees and successful practices.
- Development of mechanisms for monitoring Blueprint implementation beyond the funding period and maintaining Skills Alliance: On the basis of the KPIs and strategies developed, mechanisms and detailed procedures will be defined in order to monitor the Blueprint implementation beyond the funding period. Protocols and framework agreements will be defined in order to maintain the Skills Alliance after the project completion, by exploiting the links and interactions with national VET systems and industrial partners. For instance, planning and agreements on specific programs for training periods and exchange of researchers and high-level technical personnel will be extended beyond the project duration and procedures for continuing such activities will be formalized. The Focus Group People of the European Steel Technology Platform (dealing with social and human resources-related issues and, among its goals, aiming at attracting and securing qualified people toward the steel sector) is foreseen for coordination and monitoring after the project completion, integrated in the planned European Observatory.
- Development of an implementation and transfer plan for Blueprint strategy: A detailed implementation and transfer plan for the Blueprint strategy will be elaborated with the national steel associations, with support of all the partners. Different implementation actions will be scheduled depending on the target audience and expected outcome of the dissemination action (e.g. involvement of new companies in the Skills Alliance, sensitization of educational institutions, such as high-schools and universities, information and involvement of policymakers at national and EU level). This transfer plan might be improved and continued after the project completion.
- Establish mechanisms for sector skills framework roll-out and maintenance for the longevity of the sector skills framework and its continued updating and utilisation, integrated in the Foresight Observatory activities. The establishment of an ESSA committee – mainly incorporated in existing committees (e.g. ESTEP WG People, SSDC Steel Training Group, EUROFER Social Affairs Committee) - is an approach to be tested.

The Rollout activities focusing on the steel regions level will include:

- Education entities and training bodies in steel industry regions
- Steel experts, practitioners and engineers attending the job role-based certification and job role-based training
- Decision-makers at local, regional, national and European level
- Press and media at regional, national and European level
- Other industry sectors involved in the Sector Skills Alliance Blueprint development
- The general public.

Process and result oriented Key Performance Indicators (KPIs) monitor the stakeholder's involvement and endorsement of the Blueprint.

6.3 Results so far

The work so far has been focused on deepening the aspects of national and regional outreach, in particular on establishing mechanisms for sector skills framework roll-out and maintenance. As a first step a European overview of recruitment events was integrated in the ESSA homepage, related to different education levels (college, university, PhD graduated).

However, the Blueprint and its activities have to be adjusted to the national and regional bases, considering that each country has own regulations and VET systems which are different among the EU countries.

Against this background, ESSA concerns a European - National - Regional Implementation and Rollout structure. In order to provide an overview on EU level about the national outreach, a list of steel member states as well as a list of the steel associations for each country has been provided, in order to involve them further in the process:

- On the European level ESTEP, EUROFER, and industriALL will play a central role for the transfer and implementation of the Blueprint.
- The national steel associations will be in place to support the transfer and implementation within their countries, informing their members and ensuring the link to the steel regions in their countries.
- The steel region level is of high importance for adjusting, modifying and further develop the European Blueprint in practice, due to the specific demands and actors in the different steel regions. It is planned to establish Regional Training Eco-systems in line and connected with the Online Training System on the European level.

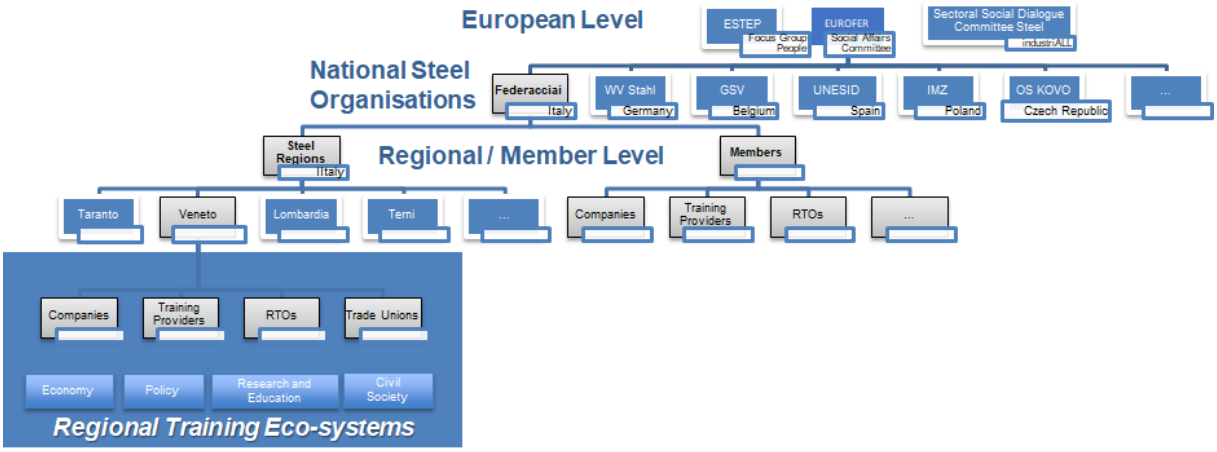


Figure 24: European - national - regional rollout structure of ESSA

The importance of fostering alliances and leadership on EU, national and regional levels, by including different stakeholders, such as associations, companies, training providers, unions have to be highlighted. The collaboration of these stakeholders is one of the key aspects to be considered in the rollout.

On the **European** level ESSA will be linked with the European Commission current and planned actions and frameworks: The Digital Education Action Plan, Cedefop's work on skills, the Pact for skills, the Blueprint for Sectoral Cooperation (focusing on the sectors put forth by the new EU industrial strategy), the New Skills Agenda 2020 published by the Commission and its planned European Education Area Communication. All these initiatives of the Commission are connected with the full toolbox of the EU, including the EU semester (with country-specific recommendations to facilitate skills uptake), European funds (European Social Fund, European Regional Development Fund, Erasmus+, InvestEU Just Transition Fund, etc.) and the European Social Dialogue.

The rollout to the national and regional level will be coordinated, supported and implemented by the ESSA Foresight Observatory in collaboration with the European steel associations and platforms (ESTEP, EUROFER, SSDCS, and industriALL). Especially the existing national steel associations and unions will be involved in the rollout activities. Within the member states there will be a focus on steel regions (steel industry clusters). These clusters will setup different specific (depending on the main regional employment, education and training, and social demands) Regional Skills Eco-systems connected with the steelHub (Online Training Eco-system). With these main steel regions in Europe the ESSA Blueprint will support and be combined with national/regional skills approaches. A key element is the integration of companies, VET institutions, science, policy and social partners (esp. unions) at the regional level within the eco-system structure and governance.

It has been underlined the importance of communication of ESSA results to the associations, by presenting what the project is doing and what the next steps are in order to be part of the social dialogue. In addition, concerning the Regional Skills Ecosystems, specific regions with specific programs that can be added value for the regional actors should be considered.

The **national VET Systems** will be addressed in cooperation with other process industry related Blueprints (such as Construction, Automotive, Manufacturing, Textile, and others). Therefore, a common strategy should be prepared to rollout the results, offers and demands of different sectoral Industry Blueprints to the national VET systems.

To collect and describe the main steel **regions** a template (see table 7) was developed identify the main stakeholders and players to set up a Regional Training Eco-system of steel companies, training providers, RTOs and trade unions. This first collection will be completed by relevant policy makers and public VET institutions as well as civil society not-for-profit or non-governmental organisations. To be clear, ESSA will only set a first frame for a regional rollout, the adjustment, modification and improvement to the regional circumstances have to be done by regional projects (e.g. funded by ESF or EFRE). Within **Regional Dialogues** the ESSA Blueprint Framework could be used to initiate new or improve existing Regional Training Eco-systems, checking own possibilities and needed support from the national and EU level.

Regions	Region A	Region B	Region C	Region D	Region E	Region …
Companies						
Training Providers with a national scope						
Training Providers with a local scope						
RTO with a national scope						
RTO with a local scope						
Trade Unions with a national scope						
Trade Unions with a local scope						

Table 7: Regional implementation and rollout: country steel regions information

A first identification of steel regions and related stakeholders was done with the support of the national steel federations for Italy and Poland. Although some regions do only have one steel company placed these are big companies with a lot of employees and relevant for the (regional) labour market to a high degree. While Italy shows a concentration of steel regions in the North, in Poland the centre is in the South.

The main regions in **Italy** (representing 61 companies, 22 training providers, 1 RTO) are:

- Lombardia (38 steel companies)
- Friuli Venezia Giulia (4)
- Toscana (3)
- Emilia Romagna (3)
- Veneto (7)
- Umbria (1)
- Valle D'Aosta (1)
- Puglia (1)
- Piemonte (2)
- Basilicata (1)

In **Poland** (with 24 companies, 20 training providers, 1 RTO, and 3 unions) ESSA will focus on:

- Silesia (Śląskie Province) (16 steel companies)
- Malopolska (Małopolskie Province) (3)
- Opolskie Province (2)
- Mazowsze (Mazowieckie Province) (1)
- Świętokrzyskie Province (1)
- Podkarpackie Province (1)

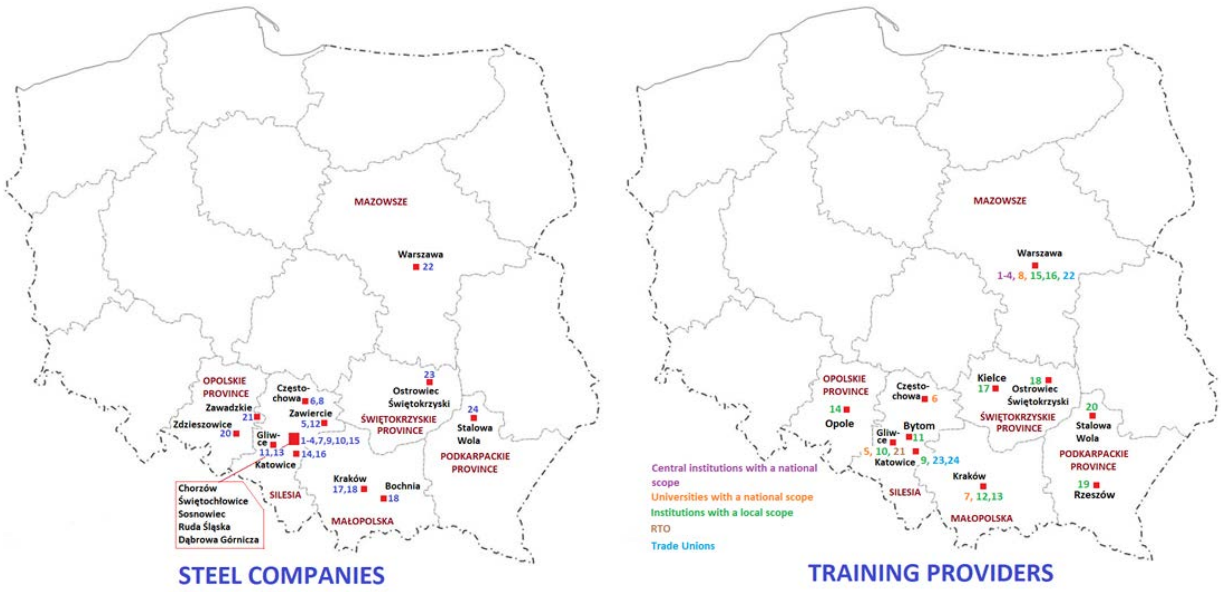


Figure 25: Steel regions (example Poland)

If existing in the selected **steel regions** ESSA will collaborate with the European **Centres of Vocational Excellence** (CoVEs) (https://ec.europa.eu/social/main.jsp?catId=1501&langId=en), the **European Smart Specialisation Platform** (https://s3platform.jrc.ec.europa.eu/) and the European Cluster Collaboration Platform (https://www.clustercollaboration.eu/).

6.4 Next Steps

ESSA delivers human capital solutions, allowing for a European framework on education and training standards, related to the steel industry. In line with the dissemination activities (see next chapter, WP7), each partner is responsible for rolling out the progress of the project and its results in its own sphere of partners and networks. This was and will be done via European, national and local events to share best practices, progress reports, public communications using social networks tools (website, webinar, LinkedIn, YouTube, Twitter), as well as through the identified and tested roll-out mechanisms during the first implementation phase 2021. During the next phase of ESSA, the national and regional roll-out strategy will be prepared together with the relevant national associations, steel companies and training providers. Within a workshop with national and regional VET institutions not only the strategy but also the implementation process will be developed further, setting the ground for a national / regional adaptation and roll-out after the end of the project. European and national financial resources (e.g. EFRE or ESF) have to be identified to implement, adopt and adjust the Blueprint to the

national framework and conditions. Concerning the national-regional implementation and rollout, information on steel regions of the main countries involved in ESSA will be provided, following the scheme of the Italian and Polish information already listed.

First matrixes will be further developed to collect the training needs and offers from the ESSA partners being integrated in the Online Training Ecosystem as an exchange platform. In line with the ESSA Training Ecosystems (esp. the steelHub) rollout training providers will provide training offers, considering the rights of their contents (within a business model to be developed). In addition, the expected level of the audience (basic, advanced) and linguistic problems will be considered. Courses should be customer-oriented, considering which levels are affected, such as general training courses but also modules for specific technology demands. Our idea is to integrate this offers as much as possible into training platform of the steelHub within the Online Training Eco-system.

Concerning the national and regional rollout activities some ideas might be taken up from the survey Vision for a "Skills for Industry Strategy" (European Commission 2019b), which will be critically discussed and reviewed during the implementation phase of the ESSA Blueprint Prototype:

Leadership and Governance:

- ESSA leadership is on the European level defined by The European Steel Technology and Skills Foresight Observatory (ESSA ETF) (demand side) and on the national and regional level by the ESSA Regional Training Ecosystems (ESSA RTS) (supply side). On both levels Eco-system Coordinators have to be appointed, to coordinate the development and running of the European and Regional Training Ecosystems. These persons have to be accepted by the stakeholders and actors (public, private, VET institutions, civil society, and research and innovation) to lead for the definition and implementation of skills strategies, ensuring also a close cooperation between the different skills eco-systems. ESSA will establish European and Regional Training or Skills Ecosystems Alliances: "Aligning the efforts of all leaders involved to ensure the setting-up of relevant partnerships with key stakeholders and the development and implementation of a comprehensive and holistic territorial skills strategy".
- The European and Regional Training Ecosystems should be considered as "Steel Industry Lifelong Learning Centres" concentrating "on the provision of high-tech T-shaped skills and be flexible in the provision of their courses. They would allow learners to go back to school throughout their working life without having to deal with the requirements and eligibility criteria demanded by the traditional ..." VET institutions.
- ESSA provides "new partnership models" between companies, training providers, research and innovation, European and national associations and social partnership, policy, and civil society organisations. Industry driven and led new learning arrangements and infrastructures ESSA will "provide learners with the opportunity to gain new skills through practical exercises and the active testing of new technologies/systems."

Skills Strategy:

- European and Regional Skills Strategies should encourage the European Steel Regions to "... develop comprehensive territorial skills strategies including measurable objectives, commensurate resources and clear deadlines. These skills strategies should be developed in line with the territory's economic, industrial, smart specialisation and innovation strategies."
- "Cross-border collaboration: Considering the rapid transformation of ... (the steel industry by digital and green transformation) and global value chains as well as demographic changes, increased

cross-border collaboration is necessary to expand on existing synergies between regions (on the European level) and facilitate the active implementation of large-scale upskilling and reskilling strategies".

- Talent Management already in place should be encouraged and improved considering the "detection among women: EU, national and regional efforts should pay special attention to targeting hidden talents and demographics that until today have received less support. Female talent, especially, should be increasingly encouraged and supported in its development of high-tech T-shaped skills (combining both technical and soft (or transversal) skills)."

Funding:

- "One-stop-shop: With the rising diversity of funding schemes available, the introduction of a one-stop-shop, providing stakeholders with a clear view on all the funds available for their skilling needs is recommended."
- "Development of a specific branding: A specific branding (e.g. 'Skills Funds') should be introduced at the city, regional, national and EU-level to promote the funding mechanisms available and their complementarity under a dedicated umbrella structure."

Incentives:

- "Individual Lifelong Learning Accounts: "Individual lifelong learning accounts" ... co-financed by contributions from employees and employers as well as public authorities ... would provide individuals with the opportunity to build up a lump sum of money that they could use to finance their trainings and continued education, in case they lose their job or want to acquire new skills and/or transition to a new position/field.
- Incentivise Vocational Education and Training (VET) Upskilling: The creation of new VET programmes and online training opportunities needs to be supported to design trainings that allow participants to acquire new skills. At the same time, incentives should be offered to extend the amount of training available to employees from a couple days a year to, for example, a full-month of intensive training."
- Incentives for e-learning and remote learning tools to encourage the professional upskilling in a sustainable way for companies, not only from the economic point of view.

Communication and Image Campaigns:

- Image and Skills Adjustment Campaigns "under a common branding should be launched in close cooperation with Member States, social partners and key stakeholders to increase awareness on upskilling and reskilling solutions as well as funding mechanisms". These campaigns should also be combined with recruitment and image campaigns to improve the image of the Steel Industry and to attract talents for the digital and green transition.

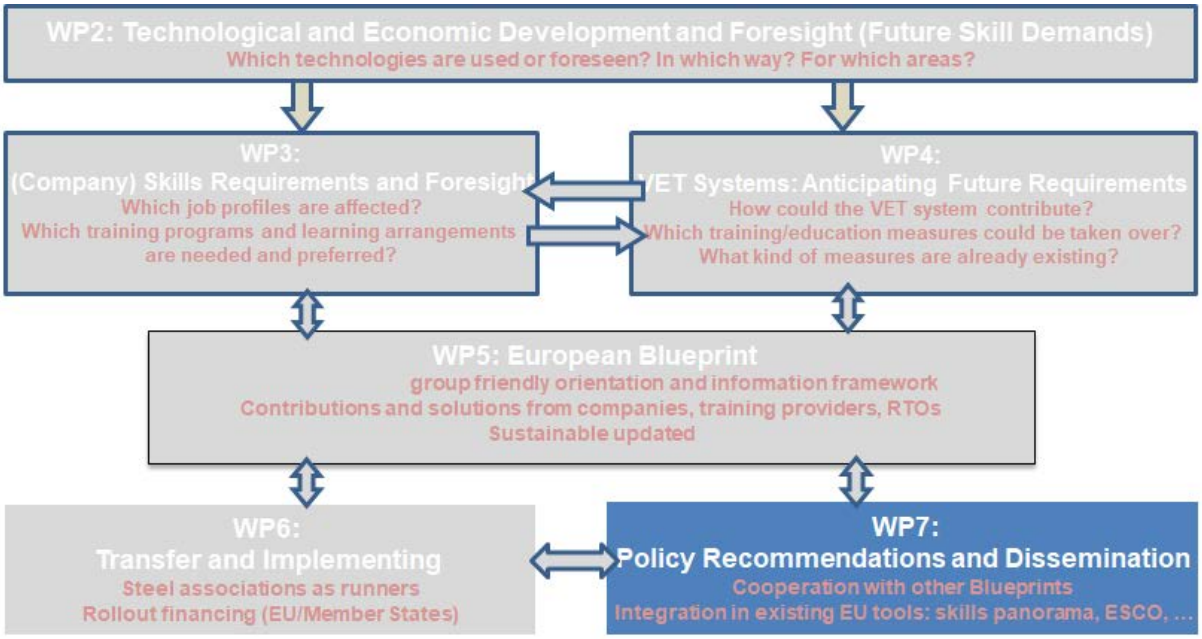
VET System and Industry Cooperation:

- "Quality criteria for VET in line with market needs" should be defined in line with a closer cooperation of steel companies, private training providers, and VET schools (leading to a better alignment of theoretical and practical knowledge in a dual system, trainer exchanges, and others), including and referring to European certification and acknowledgement tools. Also "the harmonisation of VET education across the EU would further benefit from the expansion and reinforcement of the European Credit System for Vocational Education and Training (ECVET)", EQAVET,

Europass, and others. VET schools and "training providers need to be given the opportunity to easily and rapidly change the structure and content of the courses offered and receive the necessary accreditation."

7 Policy Recommendations and Dissemination (WP7)

Policy recommendations and dissemination activities are informed by the results of all the former ESSA activities (work packages results) described so far. This includes besides the distribution and proceeding of results in the steel sector also the cooperation with policy makers, other sectoral Blueprints as well as the integration of ESSA results in the existing EU tools and platforms (such as Skills Panorama, CEDEFOP, ESCO, and others).



7.1 Objectives

Based on the ESSA results and activities a dissemination strategy was developed and related activities were and will be conducted and monitored during the whole project duration and beyond. Additionally, based on the impressions of the activities carried out in the different areas (work packages) and according to the Blueprint framework, policy recommendations will be defined and structured basically in form of practical guidelines. Having this said, it becomes evident that there is a close **connection of dissemination and rollout strategies and activities**.

The ESSA approach includes the analysis and compliance of the recommendations with the different legislative frameworks at national and European level. This will allow to exactly identify the policy makers and stakeholders (which are not already part of the ESSA consortium) and to address the defined guidelines in an effective and targeted way.

Main objectives of this work package are:

- To spread and discuss the ESSA findings in a broader sense in the whole steel sector but also within related industries and environments (e.g. within the SPIRE public-private partnership of energy intensive industries);

- To identify, implement, secure and promote necessary political support measures by mobilising and integrating stakeholders and policy makers of the EU and national level;
- To secure the roll-out of the Blueprint in the steel relevant member states;
- To improve the public image of steel industry as a modern, high-tech, digital, sustainable and green industry.

Concerning dissemination (and the rollout activities) we obtain to:

- Raise awareness;
- Extend the impact;
- Engage stakeholders and target groups;
- Share solutions and know how;
- Influence policy and practice;
- Develop new partnerships and alliances.

7.2 Methodology

Dissemination and policy recommendations are placed by the "Blueprint for a sustainable, steel industry driven and coordinated European steel skills agenda and strategy for an ongoing and short-termed implementation of new skills demands" as the main ESSA "branding". Dissemination and policy recommendations of the European Steel Skills Agenda and Alliance for the Steel Sector and EU institutions and national/regional policy makers was and will be defined and done (a) based on the main findings of the ESSA activities (described so far) and (b) considering the perspective of the targeted stakeholder groups. A set of recommendations and dissemination activities are and will be defined in order to enhance the cross-border approach involving relevant national, regional and local players, mobilising and integrating stakeholders toward Blueprint aims and objectives. Recommendations will be defined to stress the cooperation among them, each one with its own peculiarity and mission.

- Key target groups – the main focus of **dissemination** activities - are:
- Education and training institutions: align offered VET skills sets, reach mutual added value by cross-fertilisation of education and training programs, complementing curricula mutually with skill offers.
- Learners / students: support teachers and other staff of education and training institutions in the above activities.
- Companies: focus on job role-based certification and job role-based training.
- Workers: support companies in the above activities.
- Policy-makers: ensure there is no administrative, legal or any other barriers for the implementation of the strategy at national and regional levels.
- Associations and social partners: encourage education and training providers, companies and their peers (e.g. social partners at lower level) to uptake the blueprint.

Secondary target groups:

- General public: showing the attractiveness of the steel sectors' future technical development; looking attractive to young people or those willing to change activity by upskilling engagement.
- Press and media
- Academics

- Stakeholders of other sectors related to the steel industry

Political support will be essential to assure an effective adoption of the still to be defined **policy recommendations** and for the rollout of ESSA to the steel regions. The strategy will be focused to involve the main European and national stakeholders according to their institutional mission or field of interest. Dedicated events (e.g. meetings or seminars) and publications will be made to present the Blueprint results and to share the most suitable measures to give political and technical support to policy makers and stakeholders in the member states.

The impact of technological and economic developments (mainly dedicated to Industry 4.0 technologies and visions) aligned with respected skills demands and training support will be also analysed also in order to individuate the working positions more susceptible of intervention. The use of examples, taken from the reality of the Steel industry working conditions, or maybe case studies focused on the most representative situation will be encouraged and the importance of actions to be taken for the benefit of the whole society will be highlighted.

To accomplish the goals of the blueprint the political support is essential. This includes that the legislative context, both at European and at National level, must be considered with particular reference to the compliance of the policy recommendations with European and national legislative framework. The aim is to ensure that the main rights of the workers (i.e. health and safety at work, equal opportunities for women and men, protection against discrimination based on sex, race, religion, age, disability and sexual orientation, etc.) are respected.

Another important aspect to be covered is related to the working conditions contained in the labour laws (part-time work, fixed-term contracts, working hours, employment of young people, informing and consulting employees, etc.) and in the companies due to new working conditions (e.g. homeworking, work-life balance, remote working and learning. The items to be considered are then several from binding legal instruments (regulations, directives and decisions) to non-binding instruments (resolutions, opinions), company related programs, up to other instruments (EU institutions' internal regulations, EU action programmes, etc.).

However, policy recommendations will be realised in form of practical guidelines organized in a final version.

7.3 Results so far

"A good dissemination plan will share the concrete results of the project; not just inform people that the project has taken place" (Erasmusnet.org)

At this stage of the project's activities the dissemination started already shortly before the official project start and is going on while the policy recommendations are in a stand-by phase (waiting for the relevant ESSA result, esp. the Blueprint Prototype). A dissemination strategy was developed and implemented to spread the project results. A suitable approach will be chosen to transfer the recommendations to policy makers, industry associations, social partners, and national Vocation Education and Training institutions.

The dissemination strategy comprises a mix of dissemination activities to achieve project visibility, the contents of which are geared towards the intended audience:

- The (public) ESSA website (www.estep.eu/essa) is part of the homepage of the European Steel Technology Platform (ESTEP) to ensure sustainable run after the project duration. The website reports the project's progress and results with news and newsletters, deliverables and event information (esp. list of current recruitment events).
- Project leaflet both in paper and in electronic form were published in English, Polish, French, Italian, Spanish, and Czech. Videos and simulations to illustrate main outcomes are considered for the final results.
- ESSA approach and results were and will be presented in seminars, conference, and other events, due to the accessibility to them by the consortium (and associated partners) with a focus on involving stakeholders and policy makers (e.g. the Sectoral Social Dialogue Steel, the Social Affairs Committee of Eurofer, ESTEP Support and Working Groups, European Steel Day).
- An intermediary (May 2021) and final conference (December 2022) will present the results to the steel sector and interested public. A final workshop will be organized to present the final results obtained focused on the policy recommendations with inviting interlocutors belonging to the political, industrial, research and academia world.
- Scientific publications, contributions to conferences, publications in magazines are done and will be further elaborated.

The partnership includes a complementary mix of strategic partners, including all the relevant stakeholder groups of the European Steel Industry. Not only for dissemination but transfer and exploitation all partners collaborate in the dissemination activities according to the type of organisation (industry, academia, steel association, etc.) by taking advantage from the networks they are engaged in, coordinated by a communication officer also in charge of social media posts. Most of the main steel producing Member States are represented directly in the partnership, missing ones are directly involved by the global steel companies (esp. ArcelorMittal, Celsa Group), EUROFER (and IndustriALL as associated partner). Implementing a new Skills Alliance Strategy and Blueprint is the main driver of the ESSA consortium and dissemination and promotion measures.

A particular attention has been paid to the development of a dedicated section concerning the Recruitment Events, which is continuously updated at the ESSA website with upcoming (and past) events.

ESSA website (www.estep.eu/essa) has been set-up at the beginning of the project within the ESTEP homepage to ensure sustainability. It is and frequently updated with relevant project internal and external news, in order to create an interactive collaboration among the partners, stakeholders and policy makers. A specific section of the project website is devoted to the list of documents generated by the project, with a pdf version, including the ESSA newsletters. Digital newsletters (but also printable) have been published to disseminate the project results of the different deliverables.

There is also a "hidden" dissemination result concerning the wide knowledge that the project has achieved in Europe thanks to all the work done, considering the high amount of person, professionals, teachers, VET providers, national and regional public and private institution and stakeholders contacted at different level and interviewed along all the work done (and to do in the future).

Furthermore, the strictly cooperation with the "Steel Sector Careers" Blueprint has led to a wide dissemination with a multiplying effect on the ESSA project knowledge due also to the participation of partners and persons also cooperating in both projects.

A lot of dissemination activities spread the news about ESSA, but since spring 2020 the COVID-19 pandemic has completely blocked many dissemination events, meetings, workshops and other relevant occasions to spread the ESSA results and achievement. The dissemination strategy and the events already planned starting from the first months of 2020 have been re-organized as on-line events or postponed. ESSA partners obtained from other on-line events relevant inputs for the Blueprint (e.g. the Steel Sector Careers final conference, ESTEP seminars). However, the ESSA consortium has preferred to postpone some events (e.g. Intermediary Conference, ESTEP Workshop) considering the characteristics of the event; e.g. because of the need of alliance building, personal exchanges and commitments and the need to meet people in person to discuss in the most effective, creative, interactive and dynamic way the ESSA results and future activities.

The used methodology led to:

- A pro-active, targeted and direct dissemination and exploitation strategy, aimed specifically at decision makers and HR stakeholders of the steel industry, but also aimed to connect the project related to affiliated sectors (e.g. Automotive, Construction, Advanced Manufacturing), are implemented.
- A common visual identity of the project (logo) and related branding and marketing strategy.
- Raising awareness in the steel sector and beyond (other industry sectors, employment agencies, VET and employment institutions, and others), sensitising and engaging key stakeholders.
- Engaging existing networks and platforms (e.g. SSDCS, ESTEP, European Steel Day, EUROFER, Sector Skills Councils, the national steel platforms, IndustriALL, etc.) for feedback, inputs, dissemination and exploitation in a continuous way. These platforms are the arena for maintaining the Blueprint profile and disseminating the message to all companies and sector stakeholders/decision-makers at the local, regional, national and European level.
- Continuing dialogue with policy makers to facilitate rollout of the blueprint.
- Influencing policy and extending impact: ESSA got already an award as a project with highest social impact from University of Deusto (see table below).

The Label Deusto Research Social Impact recognises research projects that demonstrate a potential social impact through: • the transforming action and social impact for the people, entities, the environment and the society in general in alignment with the Sustainable Development Goals, the European policy priorities and/or the Basque Country RIS3 Strategy (or other relevant policies linked to the main project theme); • the involvement, at different levels, of non-academic agents; • the project's contribution to the knowledge field beyond the scientific impact, giving evidence of adoption, uptake and exploitation of the results by the relevant stakeholders, and of dissemination of project results to the target group(s)	

Table 8: DEUSTO Social Impact Award

7.4 Next Steps

The already started dissemination activities will go on with continuous content and result updates as well with a user-friendly improvement based on the given layout of the ESTEP homepage (a new version of the ESTEP Homepage is planned, offering more layout and communication possibilities also for the ESSA part). New Newsletters will summarise new results of ESSA, activities on social media accounts will improve (Twitter: #EssaProject, LinkedIn: https://www.linkedin.com/in/essa-project-37900518g/).

The Mid-term Conference was postponed due to Covid 19 and will take place at the thyssenkrupp Steel Europe Bildungszentrum und Ausbildungswerkstatt (Training Centre) in Duisburg (27/28 May 2021), hopefully face to face on-site.

Based on the Blueprint Prototype and the ESSA results so far policy recommendations will be defined as described above, promoting political support and securing national rollout (with WP6), in compliance with the legislative frameworks (European and Member States). This concerns also the integration of ESSA results in existing EU tools and platforms (such as Skills Panorama, CEDEFOP, ESCO, and others) and national/regional VET systems. Other important step is a closer collaboration with other sectoral Blueprints specially to join forces for the rollout activities to the Member States and regions (see WP6).

As already mentioned in the beginning of this chapter, dissemination measures are also preparing the ground for the successful **Rollout** of the Blueprint to Member State and regional levels (in cooperation with the transfer and implementation activities, see previous chapter). Exploitation, however, will focus on rolling out the blueprint in the steel regions of the partner countries and beyond. The exploitation strategy is structured similarly as dissemination with a double aim: (1) transferring the strategy to national and regional decision makers; (2) convincing and integrating end-users in the social innovation development process (esp. companies, education and training providers and workers/ learners) to implement new strategy measures. The exploitation strategy focuses on two stages and its main elements:

- Exploitation during the project (action plan for the rollout) is starting in implementation phase in 2021 with a focus on the partner countries represented by the project team. Each type of partner (e.g. companies, education and training providers, social partners) will perform their exploitation activities for:
    - Testing (piloting) of the Blueprint
    - Integrating, by using complementary frameworks such ECQA, the selected job profiles and roles into the skills, exam, and certification portals
    - Including the training materials into online or other existing training portals
    - Certifying trainers and training bodies (from the European ECVET network)
    - Offering, via certified trainers and training bodies, job role training on the market
    - Dialogue with policy makers to facilitate roll of the blueprint
- Exploitation after the project to other countries with a focus on other main steel producing member states (beyond those represented by the project) for:
    - Drafting and adjusting sustainability plan
    - Lobbying for additional financial support by other supporters or donors
    - Exploiting existing networks (identified above) to multiple the results based on good practices collected during and after the project.

Dissemination and exploitation will be constantly monitored and evaluated, findings will be used to improve the activities both during and after the project. This will be done by a list of quantitative and qualitative exploitation and dissemination **Key Performance Indicators** (linked to relevant results and outcomes sustainability and impact). Concerning dissemination and exploitation process-oriented KPIs are focusing on stakeholders' involvement as results oriented KPIs are related to the project (longer term) impacts. Additional KPIs assess whether the project has reached its results (outcomes): the extent to which ESSA partners and stakeholders endorse the European Steel Alliance and Strategy (Blueprint) in the selected partner (case study) countries.

8 Summary and Next Steps

Screening (technological) innovative projects (mainly H2020 and RFCS) and combining theoretical excellence with practical knowledge and experience has produced new insights for (digital) skills development: Company based job profiles and job families as well as a template to assess future skills demands against the background of existing job profiles (based on T-shape skills) are combined with the occupational profiles of the ESCO database and its future development against transversal skills – aiming at a common skills understanding across the EU steel related Member States and aligned as much as possible with their VET systems.

Reflecting the existing lack of forecasting for skill demands leads to reactive (i.e. not systematic) training strategies. There is, however, a need to adjust to digital and green skills demands, with the ESSA foresight showing that there is a clear shift towards Industry 4.0 and the transition to the green economy and decarbonisation. These trends affect the structure, tools and technologies and hierarchies in organisations, thus changing tasks and, in turn, influencing the type of skills that will be needed. In the short and medium term, these trends tend to create skills gaps and mismatches as there are lags between the introduction of an innovation and the creation of measures to up/re-skill the workforce in line with what the innovation requires, including within formal VET delivery.

The final conference of the Steel Sector Careers Blueprint stressed that the existing policy framework is aimed at supporting growth and employment in Europe and includes various instruments to foster investments in technologies and in the workforce. Skills, especially, play an important role in the recovery plan that is currently being prepared to counter economic slowdown and unemployment (exacerbated by the pandemic situation). Digitalisation, automation and decarbonisation are the main trends currently affecting the steel sector and leading to changes in skills needs, but also constitute opportunities to improve the image of the sector and showcase its modernisation achievements by becoming digitalised and green.

The first two year of ESSA focused on the background examination (relevant technological and economic development (WP2), industry skills requirements (WP3) and related VET system conditions (WP4)) serving the ground for the development of the first Blueprint Prototype (WP5), including first outlines for its implementation and rollout (WP6 and WP7).

(WP2) The steel industry is evolving towards industry 4.0 starting from a high level of automation. Regarding the evolution or incremental adjustment, the challenge of digitalization concerns the integration of all systems (sensors, automation, and IT systems) and all production units in different dimensions (horizontal, vertical and transversal). In this context, the steel industry's expectations from digitalization focus on quality, flexibility and productivity through the optimization and the interactions of the individual production units. Economic aspects include not only the reduction operational

costs, i.e. energy/row materials consumption reduction, but also the introduction of new business models and organizational structures.

The impact on the workforce mainly concerns the requirement of horizontal, transversal soft-skills, such as collaboration, communication and autonomy, as well as the need of continuous learning in an interdisciplinary perspective (and environment). The concrete impact of digitalization on the low skilled workers and the effect on employment remains open to further discussion.

(WP3) In close relation to the technological development and VET system requirements company related skills needs (current & future) and redefinition of professional profiles which are directly related to steel production, including maintenance led to an approach and strategy of mainly incremental up- and re-skilling of existing jobs. However, displacement and deskilling of some jobs should remain under observation. Starting not with formal and static occupational profiles but with an overview of existing job profiles oriented at functions and tasks in the production areas, company-based job profiles and job families and a template to assess future skills demands against the background of existing and occupational profiles (focused on T-shape skills) were elaborated in close relation with the ESCO database and its future development against transversal skills.

A European Steel Sector Profile Family Tree was generated (representing a valid view of the steel job profiles which can be used to facilitate navigation and demonstrate relationships between them). Finally, 26 main families (Level 1) and (in total more than 200) professional role profiles (Level 2) were listed. To reduce complexity a first set of nine representative job profiles / occupations were selected for a detailed (current and future) skills assessment: (1) Metallurgical Managers, (2) Process Engineers, (3) Maintenance and Repair Engineers, (4) Process Engineering Technicians/Supervisors, (5) Production Supervisors, (6) Industrial Electricians, (7) Metal Processing Plant Operators (including Continuous Casting Operator selected for a pilot online training tool), (8) Metal Working Machine Tool Setters and Operators, (9) Factory Hands.

These profiles are differently affected by Industry 4.0 and digitalisation, representing matching company job profiles with existing ESCO occupations, representatively covering all major ISCO groups as well as taking the importance for the steel production and maintenance, most in-demand jobs and potential added value for other sectoral (industry) Blueprints into account.

The European Steel Sector Professional Role Profiles aimed at the construction of a common standardised Skills Assessment Checklist. Thus, the template for assessing technical and transversal skills in comparison of the "Steel Professional Role Profiles" comparing its current status and future demands was developed taking ESCO as a reference and considering European ICT Professional Role Profiles. A general set of skills (technical, digital, green, individual/personal, social, and methodological) was defined based on the T-shaped skills approach for the "steel professional role profile assessment" template.

An excel-based automated database of professional profiles related to steel sector is integrating ESCO occupations. In close collaboration with ESCO it will be continuously upgraded (e.g. by the results of the first assessment survey and its selected job profiles).

(WP4) Expertise on national VET systems' organization and functioning was gathered in close alignment with the ESSA results concerning the technological and industry requirements. Agreement was reached to focus on formal qualifications (mainly IVET) related with production and maintenance occupational profiles. As a background for the Blueprint implementation and rollout, regulation and provision of VET systems in five case study countries (UK (market orientated), Germany (dual system),

Spain (company orientated), Italy (regional) and Poland (centralised)) and about the main European frameworks and tools related to VET were analysed. Results of surveys and interviews combined insights from the research literature with practical experiences.

The comparative analysis of the VET systems of the five case study countries is generating insights on the overall functioning of national VET systems and the main currently running vocational and technical programmes that provide skilled workers to the industry (e.g. in line with the nine selected steel professional profiles for the first test phase). A first strand of reported national VET regulatory frameworks and their relation with the steel industry (see Deliverable D4.1) describes the functioning of the different national systems, their recent reforms (patterns of convergence) and the currently available steel industry-related programmes as well as potential scope for improvements (in terms of skills gaps or learning arrangements). Additionally, the most relevant cross-European frameworks and standards for sector skills recognition (see Deliverable D4.2) at the EU level and the state of adoption of these by the five case study countries show how an optimal implementation and combination of such frameworks and tools could support the industry in terms of favouring cross-national skills recognition, skills and qualifications mapping and benchmarking, as well as talents mobility.

Conceptual work on a Sector Skill-Set Matrix has been started with a framework of job profiles, skills profiles and qualification profiles for the five case study countries. The main functions that the matrix is designed to fulfil are: a) mapping how European VET tools and frameworks are utilised in the 5 case study countries, b) mapping future skills gaps in current VET programmes/qualification in relation to steel industry job profiles. Work has also started on identifying an appropriate database to store the framework data, which can be developed further and utilised by industry stakeholders in interactive ways.

Overall, in summary, the essential features of the case study country VET systems have been categorised and the identification of the vocational and technical programmes relevant to the steel industry is underway. On the former, we note a clear convergence in VET practices, but national differences remain significant and relevant. This presents key challenges and criticalities that need to be addressed – with companies embedded in national contexts, any new training arrangements and ESSA proposals need to account of the specificity of the national VET system, particularly in relation to patterns of technological innovation and 'greening'.

The company representatives interviewed argue for a more holistic approach to training, requiring workers to possess wider and more adaptable skillsets. The need is for enhanced transversal skills, which goes along with a demand for stronger and more advanced technical or professional skills. This supports a T-shaped approach to skills provision, particularly with social skills and digital skills, based on strong foundational and methodological skills, stated to be of high importance. Further, in the leveraging of EU frameworks and guidelines, clear benefits for the steel industry would flow from the effective implementation of the range of tools and frameworks available, particularly for enhancing flexibility of workers and VET systems.

(WP5) A first Blueprint prototype was outlined on the background of the ESSA results so far. The Prototype is reflecting the structure and main elements of ESSA integrating developed tools and approaches with a focus on (a) incremental adjustment of skills in production and maintenance, (b) job profile description and assessment from an industry perspective, (c) in relation to existing VET systems and their possible support. Core of the Blueprint so far are (a) the **E**uropean Steel **T**echnology

and Skills **F**oresight Observatory (**ESSA ETF**) (demand side), (b) a European **O**nline **T**raining Eco**s**ystem (**ESSA OTS**) as well as **R**egional Skills and **T**raining Eco**s**ystems (**ESSA RTS**) planned for the rollout (supply side).

The **holistic and industry driven approach** of the Blueprint comprises (1) technological and economic demands and skills requirements, (2) industry driven skills adjustment, (3) strategies and measures, (4) alliances and leadership, and finally (5) implementation and rollout. Reflecting the activities of the first two years of the ESSA project the focus of the Prototype is on the first three elements while leadership and alliances in line with implementation and rollout are in the centre of the next two years. However, the coming test phase will lead to important information to improve, modify and update the current Blueprint as well as its background (1 - 3) so far.

The European Steel Technology and Skills Foresight Observatory (ESSA ETF) is planned as a central coordination unit, to be integrated in existing European Steel Sector structures (e.g. as a task of the ESTEP Focus Group People). The observatory will bundle all the necessary activities to (a) **monitor and evaluate** regularly technological and economic developments and related industry skills requirements and (b) to ensure the alignment and support of the Online and Regional Training Eco-systems. Central part of the ESSA Foresight Observatory will be a regular (annual or bi-annual) **foresight survey**: ESSA European Steel Technology and Skills Foresight Panel (ESSA ETP). Additional tasks comprise pilot measures and tests, incentives (such as Awards, Online Fora), dividing responsibilities and leadership, formulate policy recommendation and reclaiming policy support, and not at least launching and conducting campaigns concerning esp. image, recruitment, and Talent Management.

The steelHub of the Online Training Eco-system is integrating inputs and exchange (a) of associations, companies, individual learners and training providers, (b) (current and future) industry skill requirements, (c) EU tools and institutions (such as ESCO, EUROPASS, Skills Panorama, CEDEFOP), (d) VET system institutions and anticipating future VET system requirements, (e) other sectoral Blueprints, and last but not least (f) individual informal and non-formal learning. First training programs and formats have started: Continuous Casting Operator, steelTalks, and Steel Challenges. Central training courses (worldsteel) within the training schemes of companies were made and discussed with some interested pilot companies.

(WP6) First considerations for the Blueprint implementation led to an interrelated and connected European - National - Regional Implementation and Rollout structure. In order to provide an overview on EU level about the national outreach, a list of steel member states as well as a list of the steel associations for each country has been provided. Based on a template for describing the national steel companies, training providers, and research institution active in the steel sector, ESSA started to define relevant steel regions for the rollout of the Blueprint. Selected steel regions will be chosen for the set-up of Regional Training and Skills Eco-systems. One important selection criterion for the ESSA steel regions is the potential collaborating with European **Centres of Vocational Excellence** (CoVEs), the **European Smart Specialisation Regions,** and regions of the **European Cluster Collaboration**.

Other activities will concern the company and training provider training offers and demands to be integrated in the online and regional training ecosystems with a matrix sorted by (a) by **demand** of technologies, their application and organisational implication, the related skills needs and the affected job profiles and occupations, and (b) by related training offers (**supply**). Additionally, possible dissemination actions and target profiles to enrol, aiming to attract talents for the steel sector, are continuously updated at the ESSA website in continuation of some events extrapolated already by the Steel Sector Careers Blueprint.

(WP7) ESSA **dissemination** activities of all the partners ensure the distribution of results to the stakeholders and companies of the steel sector (via the usual measures, such as webpage, leaflets in different languages, thematic newsletters, and social media activities), but also the collaboration with other Blueprints and sectors. Workshops and events (in the pandemic year mostly in a remote way) are not only practised for spreading the ESSA results but strategically used to discuss ESSA results and integrate the current discussion on digital skills demands. First publications in journals mention the ESSA concept and further articles will spread the current and future ESSA results.

Policy recommendation will be developed during the following implementation phase, based on the results of the Blueprint implementation phase and the extensive outlines of the Steel Sector Careers Blueprint.

Concerning the **cooperation with other sectoral Blueprints** already mentioned, a close cooperation with the **SPIRE-SAIS** Blueprint has already started - not only because steel is one of the ten energy intensive industry sectors embedded but more important because of its focus on green skills: new skills for industrial symbiosis and energy efficiency.

Additionally, it has to be mentioned that the current **pandemic** is expected to delay strategic investments and, consequently, there will be a delay in investing in skills improvements and adjustments. However, in principle this time of short-time work could be used to train the workforce and prepare it for the changes that will take place in the future due to digitalisation, automation and decarbonisation. The Covid-19 crisis shows first of all the evident relevance of digital skills and new learning and communication arrangements for everyone. Some technologies, which are now used in the COVID-19 situation might be also established more often afterwards: remote coordination or remote team working / E-Learning / smart working - this might also be important for e.g. multinational companies and might have an impact on the economic side. More teamwork and greater awareness for digital development and skills is appearing. worldsteel / steel university has now a jump in online learners - number of trained people has grown three times. New digital ways of learning and delivering training appeared: digital skills for communication / self-learning tools - huge numbers of participants in E-learning tools in companies, e.g. online-training, self-learning of a huge number of apprentices. The impact of self-isolation implications for the flexibility of teams is not known so far. Precise rules for (the usage of) digital technologies might get more important in the future, e.g. remote maintenance, leading - again - to new digital skills. It should also be noted that the economic pressure on the industry from COVID-19 may result in job losses and the exit of valuable skills from an industry that already struggles to recruit and retain skilled individuals.

Annex

References

Ashton, D. (2004) 'The impact of organisational structure and practices on learning in the workplace', International Journal of Training and Development, 8:1, 43-53.

Bughin, J., Hazan, E., Lund, S., Dahlström, P., Wiesinger, A., and Subramaniam, A. (2018) 'Skill Shift. Automation and the future of the workforce'. Mckinsey Global Institute. Discussion paper.

Busemeyer, M. and Trampusch, C. (2012) The Political Economy of Collective Skills Formation, Oxford: OUP. chpt 1, pp 3-40.

Busemeyer, M. and Vossiek, J. (2016) 'Global convergence or path dependency? Skill formation regimes in the globalized economy', in K. Mundy, A. Green, B. Lingard and A. Verger (eds) The Handbook of Global Education Policy, Chichester: John Wiley & Sons, pp145-161.

Clarke, L and Winch, C (2006) 'A European skills framework? – but what are skills? Anglo-Saxon versus German concepts', Journal of Education and Work, 19(3): 255-269.

Deissinger, T. (2015). International education policy: Its influence on the conception of VET and the VET system in Germany. Research in Comparative and International Education, 10(4), 607-621.

Echterhoff, V.; Schröder, A. (2015): Retaining Talents in the European Steel Industry; ESTEP publication, https://www.estep.eu/assets/Uploads/ESTEP-WG5-Report-TalentSurvey.pdf

Evans, C. and Stroud, D. 2014. Greening steel work: varieties of capitalism and the 'greening' of skills. Journal of Education and Work 29(3), pp. 263-283. (10.1080/13639080.2014.907487)

European Commission (ed.) (2019a) 'Blueprint for sectoral cooperation on skills: towards an EU strategy addressing the skills needs of the steel Sector: European vision on steel-related skills of today and tomorrow. Study carried out by White Research, INTRASOFT International, Rina consulting - Centro Sviluppo Materiali S. p. A. and Valeu Consulting for the European Commission.

European Commission (ed.) (2019b). 'Skills for Smart Industrial Specialisation and Digital Transformation'. Final Report. Brussels

European Commission (2020). Blueprint for sectoral cooperation on skills: towards an EU strategy addressing the skills needs of the steel sector, Publications Office of the European Union, Luxemburg

Grundke R., Squicciarini M., Jamet S., and Kalamova, M. (2017) 'Having the right mix: the role of skill undles for comparative advantage and industry performance in GVCs'. OECD Science, echnology and Industry Working Papers, OECD Publishing, Paris

Howaldt, J. (2019) 'New pathways to social change - creating impact through social innovation research'. In: fteval Journal for Research and Technology Policy Evaluation, Band: Issue 48/2019, S. 37-48

Karacay G. (2018) 'Talent Development for Industry 4.0. In Industry 4.0: Managing the Digital Transformation', 2nd ed.; Ustundag A., Cevikcan E., Eds; Springer Series in Advanced Manufacturing, Publisher: Springer International Publishing, Switzerland, 2018, pp. 123-135.

Kohlgrüber, M.; Schröder, A. (2019) 'Innovation reloaded - The social character of digitalisation in industry'; In: Howaldt, Jürgen; Kaletka, Christoph; Schröder, Antonius; Zirngiebl, Marthe (Hrsg.): Atlas of social innovation: 2nd volume: a world of new practices; S. 201; München: oekom.

Kohlgrüber, M.; Schröder, A.; Bayón Yusta, F.; Arteaga Ayarza, A. (2019): A new innovation paradigm - combining technological and social innovation; In: Matériaux & Techniques, Band: 107,1/2019; https://www.mattech-journal.org/articles/mattech/abs/2019/01/mt180041/mt180041.html

Porter, Michael E. and Class van der Linde (1995) 'Towards a New Conception of the Environment-Competitiveness Relationship', Journal of Economic Perspectives 9:97–118.

Stroud, D. and Fairbrother, P. (2006) 'Workplace Learning: Dilemmas for the European Steel Industry', Journal of Education and Work, 19:5, 455-480.

Stroud, D. and Weinel, M. 2020. 'A safer, faster, leaner workplace? Technical-maintenance worker perspectives on digital drone technology 'effects' in the European steel industry'. New Technology, Work and Employment (10.1111/ntwe.12174)

Stroud, D., Evans, C. and Weinel, M. 2020. 'Innovating for energy efficiency: digital gamification in the European steel industry'. European Journal of Industrial Relations 26(4), pp. 419-437. (10.1177/0959680120951707)

List of Figures

List of Tables

List of abbreviations

AI	Artificial Intelligence
BAT	Best Available Techniques
BF	Blast Furnace
BTEC	Business and Technology Education Council
CAD	Computer Aided Design
CCU	Carbon Capture, Storage and Usage
CDA	Carbon Direct Avoidance
CEDEFOP	European Centre for the Development of Vocational Training
COCOP	Coordinating Optimisation of COmplex Industrial Processes
COSME	Competitiveness of Enterprises and Small and Medium-sized Enterprises
CPS	Cyber-physical system
CV	Curriculum Vitae
CVET	Continuing vocational education and training
DB	Database
DG	Directorate-General
DigComp	Digital Competence Framework
DRIVES	Development and Research on Innovation Vocational Education Skills
e-CF	European e-Competence Framework
EACEA	Education, Audiovisual and Culture Executive Agency
EAF	Electric Arc Furnace
EASME	Executive Agency for Small and Medium-sized Enterprises
EC	European Commission
ECQA	European Certification and Qualification Association
ECTS	European Credit Transfer System
ECVET	European Credit System for Vocational Education and Training
EFRE	European Regional Development Fund
EFSI	European fund for strategic investments
EGAF	European Global Adjustment Fund
eLLa4.0	excellent Leadership and Labour 4.0
EQAVET	European Quality Assurance in Vocational Education and Training
EQF	European Qualifications Framework

ESCO	European Skills, Competences, Qualifications and Occupations
ESF	European Social Fund
ESIF	European structural and investment funds
ESSA	European Steel Skills Agenda
ESSA ETF	European Steel Technology and Skills Foresight Observatory
ESSA OTS	Online Training Ecosystem
ESSA RTS	Regional Training Ecosystem
ESSC	European Sectoral Skills Council
ESTEP	European Steel Technology Platform
EU	European Union
EUROFER	European Steel Association
Facts4Workers	FACTorieS for WORKERS
FoF	Factories of the Future
FSN	Future skill needs
GT-VET	Greening Technical-Vocational Education and Training
HNC	Higher National Certificate
HND	Higher National Diploma
HR	Human Resources
I2M	Intelligent Integrated Manufacturing
ICT	Information and communications technology
ILO	International Labour Organization
IoS	Internet-of-Services
IoT	Internet-of-Things
ISCED	International Standard Classification of Education
ISCO	International Standard Classification of Occupations
IT	Information Technology
IVET	Initial Vocational Education and Training
KET	Key Enabling Technology
KPI	Key Performance Indicator
MES	Manufacturing Execution System
ML	Machine learning
NVQ	National Vocational Qualification

OPEX	Operational expenditures
PBL	Problem-based Learning
PDM	Product Data Management
PjBL	Project-based Learning
pre-VET	pre Vocational Education and Training
R&D	Research & Development
RFCS	Research Fund for Coal and Steel
ROBOHARSH	Robotic workstation in harsh environmental conditions to improve safety in the steel industry
RTO	Research and Technology Organisations
S4TCLF	Skills4Smart Textile, Clothing, Leather, and Footwear
SAC	Social Affairs Committee
SCORM	Sharable Content Object Reference Model
SME	Small and medium-sized enterprises
SPIRE	Sustainable Process Industry through Resource and Energy Efficiency
SPIRE-SAIS	Skills Alliance for Industrial Symbiosis – Cross-sectoral Blueprint for a Sustainable Process Industry
SRA	Strategic Research Agenda
SSC	Steel Sector Careers
SSDCS	Sectoral Social Dialogue Committee on Steel
STEM	Science, technology, engineering, and mathematics
SVQ	Scalable Vector Graphics
TCLF	Textile, Clothing, Leather, and Footwear
TVET	Technical and Vocational Education and Training
UNIFE	Union des Industries Ferroviaires Européennes
VET	Vocational Education and Training
WG	Working group
WP	Work package

Skills Classification and Definitions

Job profiles

Metallurgical managers coordinate and implement short and medium term metallurgical or steel-making production schedules, and coordinate the development, support and improvement of steel-making processes, and the reliability efforts of the maintenance and engineering departments. They also partner with ongoing remediation initiatives.

Process engineers apply engineering concepts in order to improve all kinds of production and manufacturing processes in terms of efficiency and productivity. They evaluate the variables and constraints present in given processes and present engineering solutions to optimise them.

Maintenance and repair engineers focus on the optimization of equipment, procedures, machineries and infrastructure. They ensure their maximum availability at minimum costs.

Process engineering technicians/ supervisors work closely with engineers to evaluate the existing processes and configure manufacturing systems to reduce cost, improve sustainability and develop best practices within the production process.

Production supervisors coordinate, plan and direct manufacturing and production processes. They are responsible for reviewing production schedules or orders as well as dealing with staff in these production areas.

Industrial electricians install and maintain electricity cables and other electrical infrastructure in large industrial buildings. They perform inspections and repair defective parts of electrical systems to ensure efficiency.

Metal processing plant operators monitor, operate, adjust and maintain single-function process machinery and equipment to process and convert mineral ores and refine, harden, roll and extrude metals.

Factory hands assist machine operators and product assemblers. They clean the machines and the working areas. Factory hands make sure supplies and materials are replenished.

Metal working machine tool setters and operators set and/or operate various machine tools, working to fine tolerances.

Skill categories

Technical skills: use and manipulate materials, tools, equipment, and artefacts as well as manage operations and functions in order to achieve particular outcomes.

> **Physical and manual skills:** use physical tools, operations and functions, work with hands.

Transversal skills: high transferability across different jobs and sectors, relevant to a broad range of occupations and economic sectors, often referred as core skills, basic skills or soft skills.

> **Digital skills:** use digital devices, communication applications, and networks to access and manage information; be critical and reflective towards the information available and its responsible use.

Green skills: adapt products, services and processes to climate change and the related environmental requirements and regulations (such as low carbon emission regulation), improve living in, develop and support a sustainable and resource-efficient society.

Social skills: enable people to cultivate their relationships and work with others to achieve goals together, facilitate interaction and communication with others both verbally and non-verbally, through gestures, body language and our personal appearance.

I**ndividual-personal skills:** inner abilities or skills of an individual, soft skills which are not easy to teach (although not impossible), possessed by a person deemed to be their strengths or weaknesses.

Methodological skills: process, interpret and evaluate different types of data (including documentary and other qualitative sources as well as statistical data) procedurally, explain the respective roles and interaction between evidence and explanations, identify and critically assess causal claims, and analyse the problems using various perspectives.

Physical and manual skills:

General equipment operation: handle and operate heavy or medium equipment, knowledge of production procedures, physical stamina and strength, ability to read blueprints, schematics and manuals, and others.

General equipment repair and mechanical skills: repairing and maintaining function and/or cleanliness of equipment and machinery including preventive maintenance, installation, reading comprehension (for manuals and blueprints), suitable equipment selection, operation monitoring.

Craft and technician skills: understanding and assimilating the total technology of a craft and its application in any craft situation so as to produce effective and satisfying results - directly related to specific pieces of practical knowledge (techniques of working, jointing, fixing and finishing materials, both traditional and modern, use of tools and appliances in working, jointing, fixing and finishing, resourcefulness etc.).

Gross motor skills and strength: mobilise one's capacities and complete whole-body movements, including physical strength, muscular flexibility and stamina.

Inspecting and monitoring skills: observe and record the production or management activities regularly through gathering information on all aspects in order to check everything is correct or legal.

Digital skills:

Basic digital skills: Skills in a day-to-day professional or personal context: (1) digital foundation skills, such as using a browser, connecting to the internet, (2) communicating, collaborating through email/social media and sharing contents, (3) finding, handling and storing digital information and content securely, (4) managing transactions online to purchase goods and services, (5) finding solutions to problems using digital tools and online services, (6) data storage/sharing, updating and keeping passwords secure, and taking precautions against viruses.

Advanced data analysis and mathematical skills: apply statistical and/or logical techniques systematically in order to describe and illustrate, condense and recap, and evaluate data. Advanced data analysis can be carried out using advanced excel skills (PivotTable, VBA program

development), Structured Query Language (SQL) queries, data visualization, statistical programming languages, Artificial Intelligence.

Cybersecurity: protect and defend IT systems, network, digital information, and every asset that form part of an IT infrastructure in an organization. Some of the abilities used for cybersecurity are IT fundamentals, understanding architecture, administration and operating systems, database knowledge, Coding skills—C, C++, Java, Python, Ruby, Perl, PHP.

Use of complex digital communication tools: manage any piece of software or platform that is used to facilitate internal and external communication (e.g. workflow, project management, instant messaging, social intranet & internal communication, video conferencing software).

Advanced IT skills & Programming: using Internet and email, computers, word processing, graphics, analytics and multimedia, and spreadsheets and databases and ability to program/code.

Green skills:

Environmental awareness: understand how behaviour impacts environment, including environmental concerns alongside others (such performance and safety) in taking decisions, including in the choice of processes and technologies.

Energy efficiency: perform a more efficient, conservative use of energy in the production plant, including understanding of energy use, attaining goals of energy efficiency assessments, identification of potential energy efficiency opportunities, installing appropriate monitoring equipment and developing analysis systems.

Water conservation: perform a more efficient, conservative use of water in the production plant, including monitoring sites, negotiating with regulatory authorities and professionals in this area, advising about possible water conservation solutions, keeping up to date with changes in legislation/EU directives.

Waste reduction and waste management: use less material and energy to minimize waste generation and preserve natural resources, preventing materials from ending up as waste before they reach the recycling stage. Skills required to collect, transport, dispose or recycle and monitor waste.

Resource reuse/recycling: reprocess discarded waste materials for reuse, which involves collection, sorting, processing, and conversion into raw materials which can be used in the production of new products; maintaining inventory of recyclable materials, planning and managing the separation of recyclable materials for storage and shipment, recovering recyclable materials and inspecting and disposing of unrecyclable materials etc.

Social skills:

Advanced communication and negotiation skills: guide communication between oneself and another or a group to achieve goals and outcomes. This includes confidence, using and reading body language and nonverbal cues (eye contact, facial expressions, hand, arm gestures, posture), verbal and presentation skills, teamwork skills, persuasion skills, enthusiasm, patience, improvisation. Qualities that allow two or more parties to reach a compromise or an

agreement avoiding any kind of argument and dispute. Possessing communication, persuasion, planning, strategizing and cooperating skills is the first step to becoming a strong negotiator.

Interpersonal skills and empathy: behaviours and tactics a person uses to interact with others effectively in daily life, including a wide range of skills such as communication skills (such as active listening, effective speaking), emotional skills (the ability to control and manage your emotions), negotiation and persuasion skills, collaboration, conflict resolution, ability to recognize emotions in others, and to understand other people's perspectives on a situation.

Leadership and managing others: guiding initiatives and organizing other people toward the achievement of a shared goal, managing others.

Entrepreneurship and initiative taking: turn ideas into action, support individuals in the workplace, being aware of the context of work, being creative, being able to seize innovation and opportunities, take risks and plan and manage projects in order to achieve objectives.

Adaptability and continuous learning: being able to quickly respond to changing trends, innovation, destabilization, industry shifts, and so forth; expanding skills and skill-sets on an ongoing basis in response to a changing environment and new developments through increasing knowledge.

Teaching and training others: help to develop other person's subject knowledge and maybe even their mind and personality.

I**ndividual-personal skills:**

Critical thinking & decision making: analyse information objectively, use logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems, make a reasoned judgment/logical decision.

Personal experience: The level of experience gained by an employee throughout her/his career by carrying out the same or similar tasks to those required by their current position.

Adapt to change: quality of being able to change or be changed in order to deal successfully with new situations, changing trends, innovation, destabilization, industry shifts, and so forth.

Work autonomously: achieve results with no supervision or with limited supervision, ability to work both independently and as a member of a team, to make independent decisions and solve problems on your own. It also demands self-motivation, confidence and time management.

Active listening: giving full attention to a speaker, taking time to understand their message, comprehend the information and respond thoughtfully (asking questions as appropriate, and not interrupting at inappropriate times).

Methodological skills:

Basic numeracy and communication: manage simple arithmetic (even if using a calculator) and have a good understanding of some basic mathematical concepts such as percentages, fractions, measurements, decimals etc.; express ideas and views clearly, confidently and concisely in speech, writing and body language - involving listening, speaking, writing, observing and empathising

Basic data input and processing: enter the collected data into an input device in order to convert it into a machine-readable form and to get the input data transformed into a more meaningful form (information) in the CPU (central processing unit).

Advanced literacy: understand and comprehend things that are read and similarly to be able to be understood by others using the written word in increasingly diverse ways and facing with increasingly diverse audiences.

Quantitative and statistical skills: handle data and use numerical evidence systematically, understand and interpret data and findings related to budgeting, mathematics, statistical analysis, probability, software applications, operations management and other areas of business strategy and management.

Complex information processing and interpretation: get complex raw data transformed into a meaningful form (information) in the CPU (central processing unit) and evaluate the output.

Process analysis: carry out a systematic review of all steps and procedures followed to perform a given activity, understanding how processes operate, and to determine potential targets for process improvement and increase efficiency.

Creativity: think about a task or a problem in a new or different way, use imagination to generate new ideas, look at things from a unique perspective, solve complex problems or find interesting ways to approach tasks.

Complex problem solving: handle difficult or unexpected situations in the workplace as well as complex business challenges, determine the source of a novel, ill-defined problem and finding an effective solution in complex, real-world settings.

ESSA Skills Assessment (Survey)

This questionnaire is designed to identify the current and future skills needs in steel jobs and to define their importance for the European steel sector.

Your participation in this survey is voluntary. You may choose not to participate, to withdraw prematurely or - if technically enabled - to omit single questions. The duration of your participation depends on the selected job profiles. Each job profile section is expected to last 10 minutes. Your data will be treated confidentially and evaluated anonymously.

Thank you very much for your valuable time and contribution.

This survey was developed as a part of the sectoral blueprint European Steel Skills Agenda (ESSA) (project number: 600886-EPP-1-2018-1-DE-EPPKA2-SSA-B, project website). Please contact Antonius Schröder (antonius.schroeder@tu-dortmund.de) for further information about the project or the survey.

Section A: Previous experiences

A1. Please take a look at the generic job profiles listed below. Do you know jobs from your daily work which fit to these profiles and for which you have specific knowledge regarding skill requirements and skill development?

Please click on the green question marks if you do not know the meaning of a job profile name.

	Yes, I have knowledge.	**No, I do not have knowledge.**
Metallurgical manager		
Process engineer		
Maintenance and repair engineer		
Process engineering supervisor		
Production supervisor		
Industrial electrician		
Metal processing plant operator		
Factory Hand		
Metal working machine tool setters and operators		

Section B: Job Profile related technological developments

B1. The following section is about technological developments affecting jobs within the job profile today and in the future. In your experience: To what extent are the following technologies relevant to these jobs today and how relevant will they be in the near future (in 3 years)?

	Current relevance				**Future relevance**			
	Not relevant at all	Somewhat relevant	Quite relevant	Highly relevant	Not relevant at all	Somewhat relevant	Quite relevant	Highly relevant
New generations of sensors								
Big Data and Analytics								
Machine Learning								
Artificial Intelligence (AI)								
Internet-of-Things (IoT)								
Internet-of-Services								
Mechatronics and Advanced Robotics								
Cloud Computing								
Cybersecurity								
Additive Manufacturing								
Predictive Maintenance								
Virtual/Augmented Reality								

B2. Please explain: What kind of change do you expect regarding these technologies within this job profile?

Section C: Job profile related skills development

Considering the technological and organisational changes within the job profile: With regard to the following skills categories (technical, digital, green, social, individual personal and methodological), please evaluate the currently required skill levels (0 = Novice, 1 = Awareness/Basic Actor, 2 = Practitioner, 3 = Expert, 4 = Master) and how these are expected to change in the foreseeable future (within 3 years).

C1. Technical, subject-related skills

	Current skill level					**Future skill level (3 years)**				
	0	1	2	3	4	0	1	2	3	4
General equipment operation										
General equipment repair and mechanical skills										
Craft and technician skills										
Gross motor skills and strength										
Inspecting and monitoring skills										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C2. Please explain: What kind of change do you expect regarding technical skills?

General equipment operation	
General equipment repair and mechanical skills	
Craft and technician skills	
Gross motor skills and strength	
Inspecting and monitoring skills	

C3. Digital skills

	Current skill level					Future skill level (3 years)				
	0	1	2	3	4	0	1	2	3	4
Basic digital skills										
Advanced data analysis and mathematical skills										
Cybersecurity										
Use of complex digital communication tools										
Advanced IT skills & Programming										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C4. Please explain: What kind of change do you expect regarding digital skills?

Basic digital skills	
Advanced data analysis and mathematical skills	
Cybersecurity	
Use of complex digital communication tools	
Advanced IT skills & Programming	

C5. Green skills

	Current skill level					Future skill level (3 years)				
	0	1	2	3	4	0	1	2	3	4
Environmental awareness										
Energy efficiency										
Water conversation										
Waste reduction and waste management										
Resource reuse/recycling										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C6. Please explain: What kind of change do you expect regarding green skills?

Environmental awareness	
Energy efficiency	
Water conversation	
Waste reduction and waste management	
Resource reuse/recycling	

C7. Social skills

	Current skill level					**Future skill level (3 years)**				
	0	1	2	3	4	0	1	2	3	4
Advanced communication and negotiation skills										
Interpersonal skills and empathy										
Leadership and managing others										
Entrepreneurship and initiative taking										
Adaptability and continuous learning										
Teaching and training others										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C8. Please explain: What kind of change do you expect regarding social skills?

Advanced communication and negotiation skills	
Interpersonal skills and empathy	
Leadership and managing others	
Entrepreneurship and initiative taking	
Adaptability and continuous learning	
Teaching and training others	

C9. Individual personal skills

	Current skill level					Future skill level (3 years)				
	0	1	2	3	4	0	1	2	3	4
Critical thinking and decision making										
Personal experience										
Adapt to change										
Work autonomously										
Active listening										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C10. Please explain: What kind of change do you expect regarding individual personal skills?

Critical thinking and decision making	
Personal experience	
Adapt to change	
Work autonomously	
Active listening	

C11. Methodological skills

	Current skill level					Future skill level (3 years)				
	0	1	2	3	4	0	1	2	3	4
Basic numeracy and communication										
Basic data input and processing										
Advanced literacy										
Quantitative and statistical skills										
Complex information processing and interpretation										
Process analysis										
Creativity										
Complex problem solving										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

C12. Please explain: What kind of change do you expect regarding individual personal skills?

Basic numeracy and communication	
Basic data input and processing	
Advanced literacy	
Quantitative and statistical skills	
Complex information processing and interpretation	
Process analysis	
Creativity	
Complex problem solving	

Section D: Job profile related additional skills

D1. Do you know any other current/future skills needed for <…> jobs which are not mentioned in the questionnaire?

Yes
No

D2. Please name the further skills you mentioned.

Additional skill 1	
Additional skill 2	
Additional skill 3	
Additional skill 4	
Additional skill 5	
Additional skill 6	
Additional skill 7	

D3. Please evaluate the currently required levels of the skills you mentioned and how these are expected to change in the foreseeable future (within 3 years).

	Current skill level					Future skill level (3 years)				
	0	1	2	3	4	0	1	2	3	4
<Additional skill 1>										
<Additional skill 2>										
<Additional skill 3>										
<Additional skill 4>										
<Additional skill 5>										
<Additional skill 6>										
<Additional skill 7>										

0 = Novice, 1 = Awareness/Basic Actor, 2= Practioner, 3 = Expert, 4 = Master

Section E: Type of organisation

E1. Which department do you work for in your company?

Technical department
Machine operation
Management
Human resources / training
Other: _____

E2. How many employees are working in your company?

1-10
11-50
51-100
101-250
251-1000
More than 100

E3. What kind of production route does your company use?

Blast Furnace (BF)
Electric Arc Furnace (EAF)
Processing Industry

Section F: Evaluation

This survey is a pilot and aims to detect skill demands within the steel industry. Please help us to improve the tool by answering the following questions.

F1. Please evaluate whether you agree with the following statements.

	Strongly disagree	Disagree	Undecided	Agree	Strongly agree
I have understood which jobs were specifically meant by the job profile names.					
I have understood what technologies were meant by the technology names.					
I have understood what the different skill categories meant.					
I have understood what the different skill levels meant.					
I had no problems evaluating the current skill levels in the various job profiles.					
I had no problems evaluating the future skill levels in the various job profiles.					

F2. How useful is this questionnaire for identifying steel sector skill developments?

not at all useful
slightly useful
moderately useful
very useful
extremely useful

F3. Do you have any further comments and suggestions about this tool?

How could it be improved?

Section G: E-Mail and organisation

We would like to inform about the results of the survey and invite you to participate in further surveys in the future. If you agree on a voluntary basis, please enter your e-mail address and the name of your organisation. Your data will be treated confidentially and will only be used for the stated purposes. You can request the deletion of your personal data at any time by writing an e-mail to antonius.schroeder@tu-dortmund.de.

G1. Please indicate your email address.

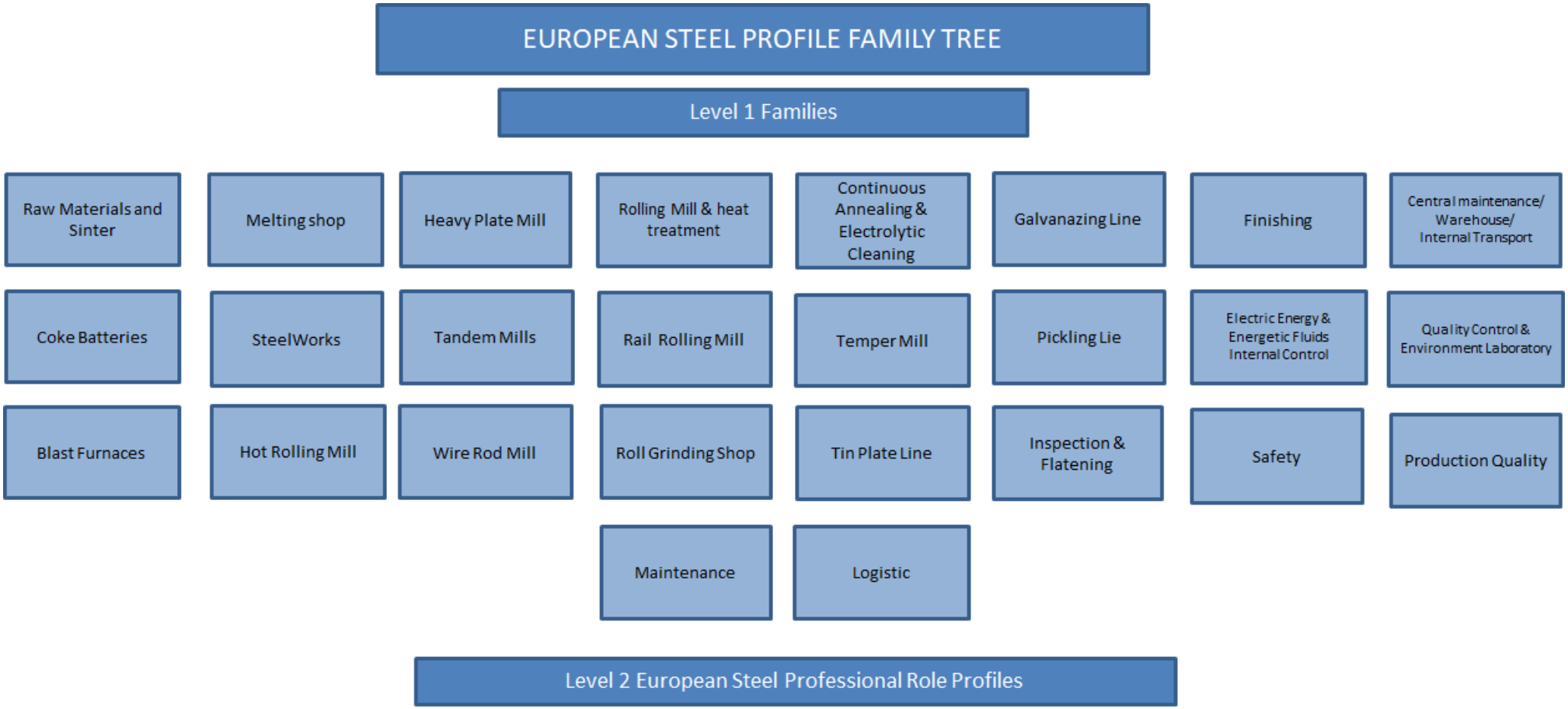
G2. Please indicate the organisation you represent.

Thank you very much for your contribution!

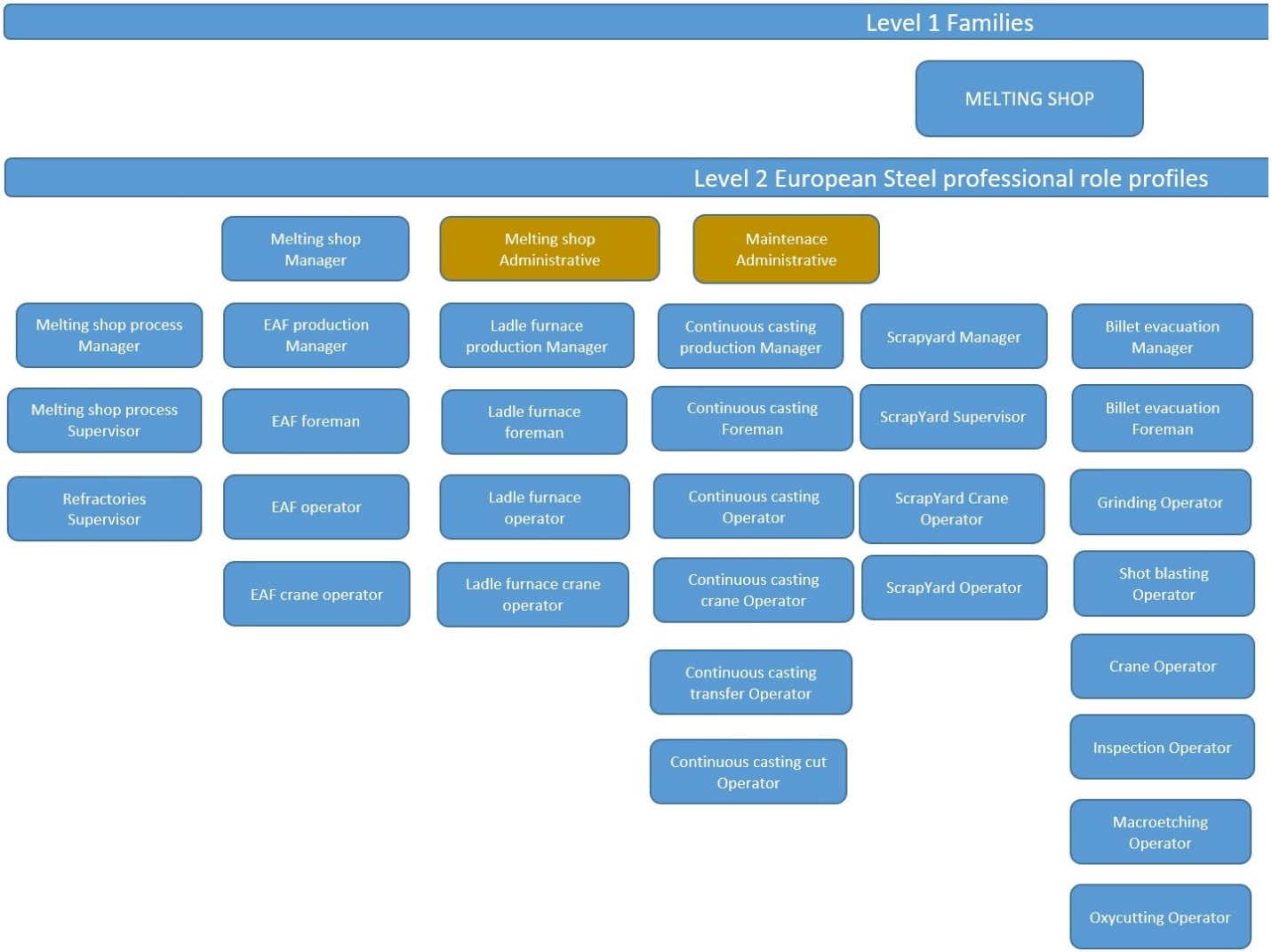
This survey was developed as a part of the sectoral blueprint European Steel Skills Agenda (ESSA) (project number: 600886-EPP-1-2018-1-DE-EPPKA2-SSA-B, project website). Please contact Antonius Schröder (antonius.schroeder@tu-dortmund.de) for further information about the project or the survey.

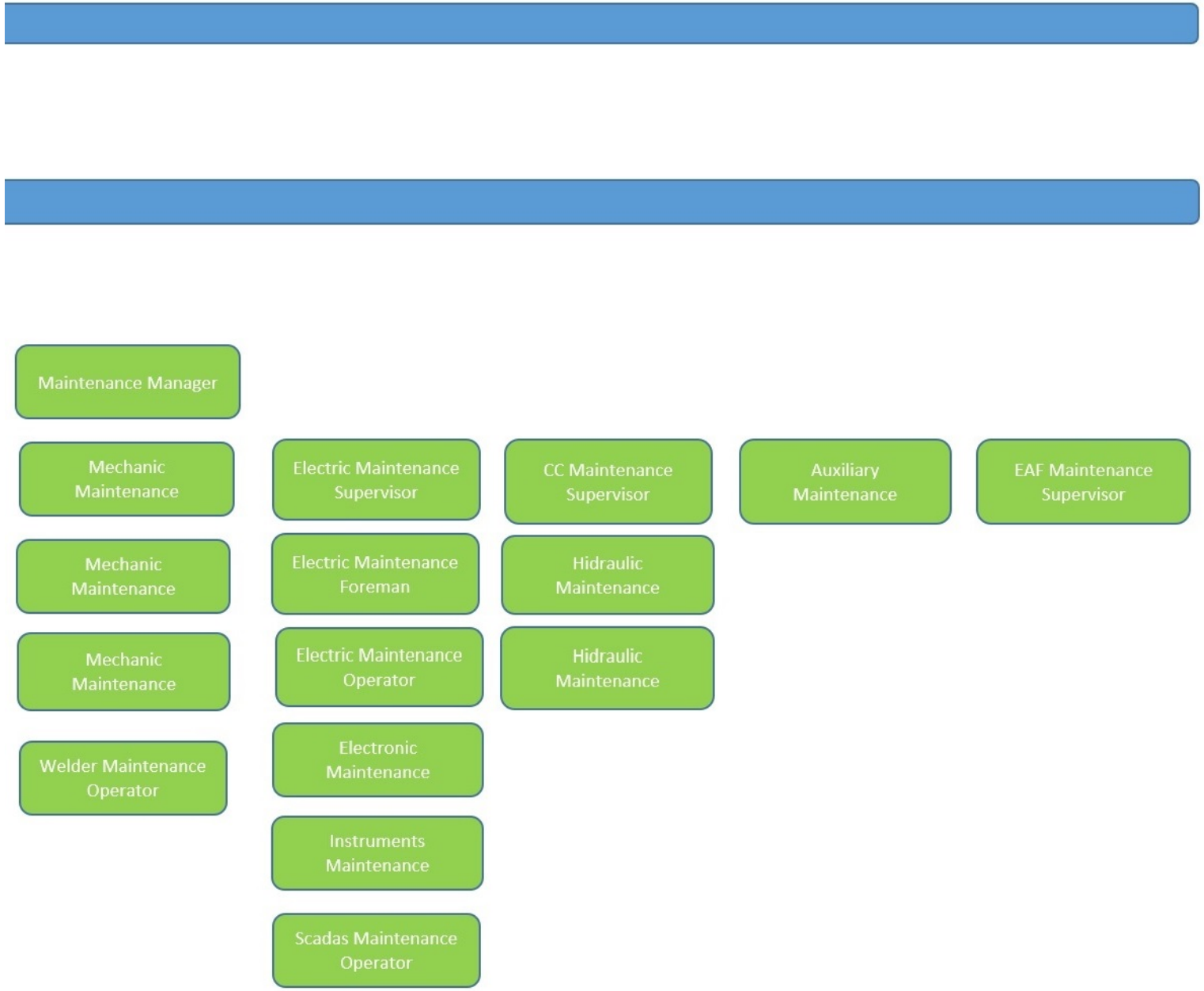
European Steel Sector Family Trees and Profiles

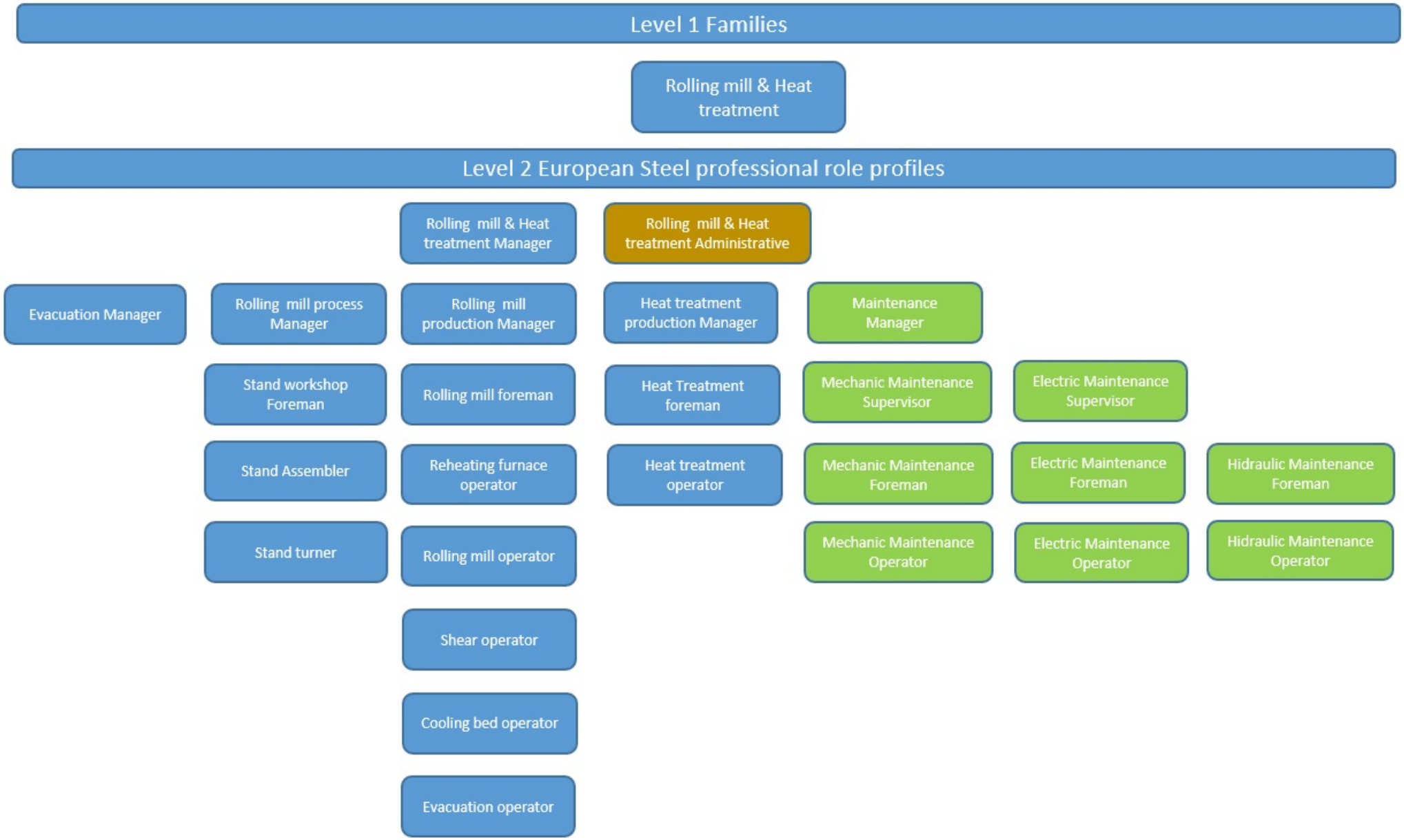
Level 1 "Families"

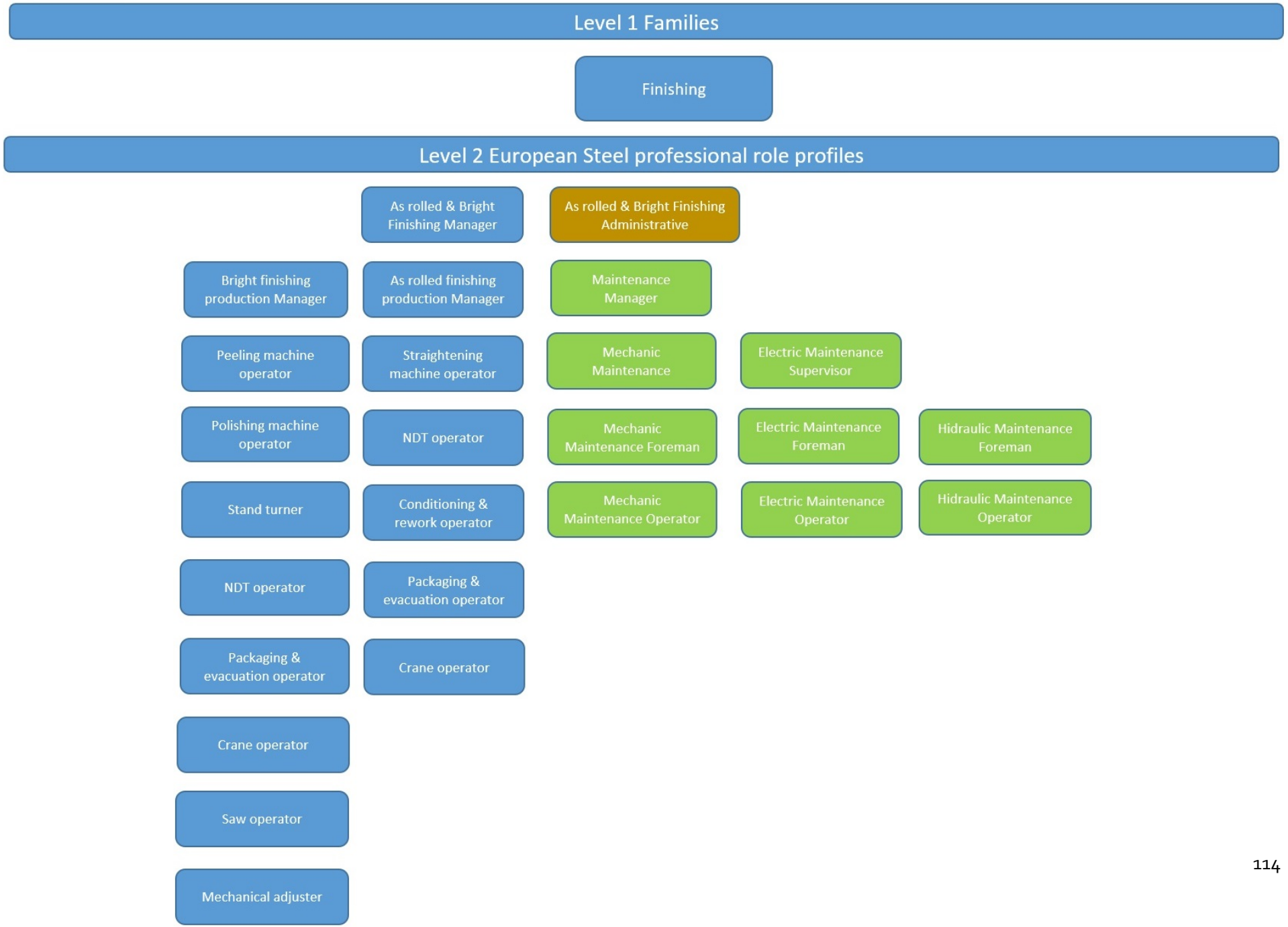


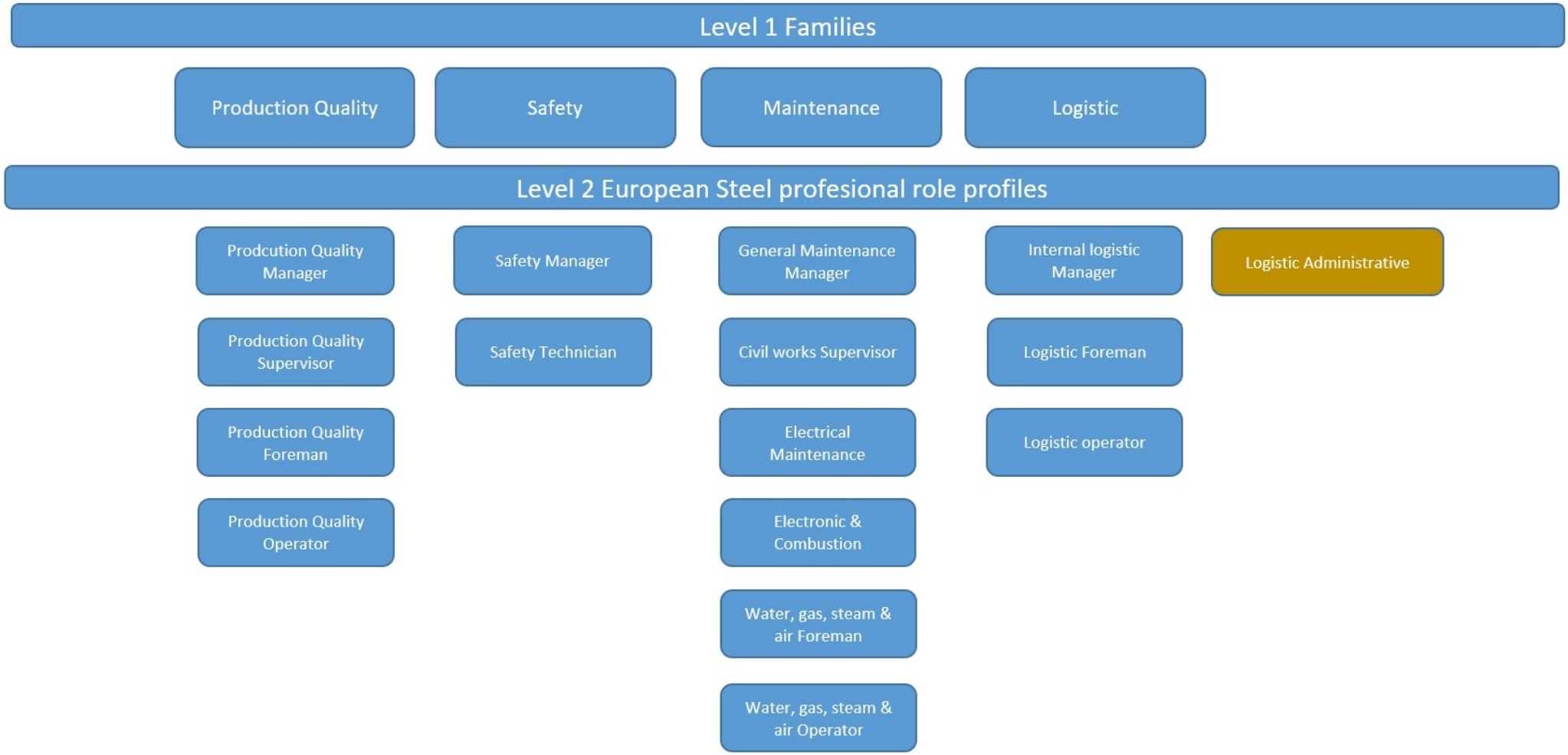
Level 2 "Professional Role Profiles" (blue: production, orange: administration, green: maintenance)

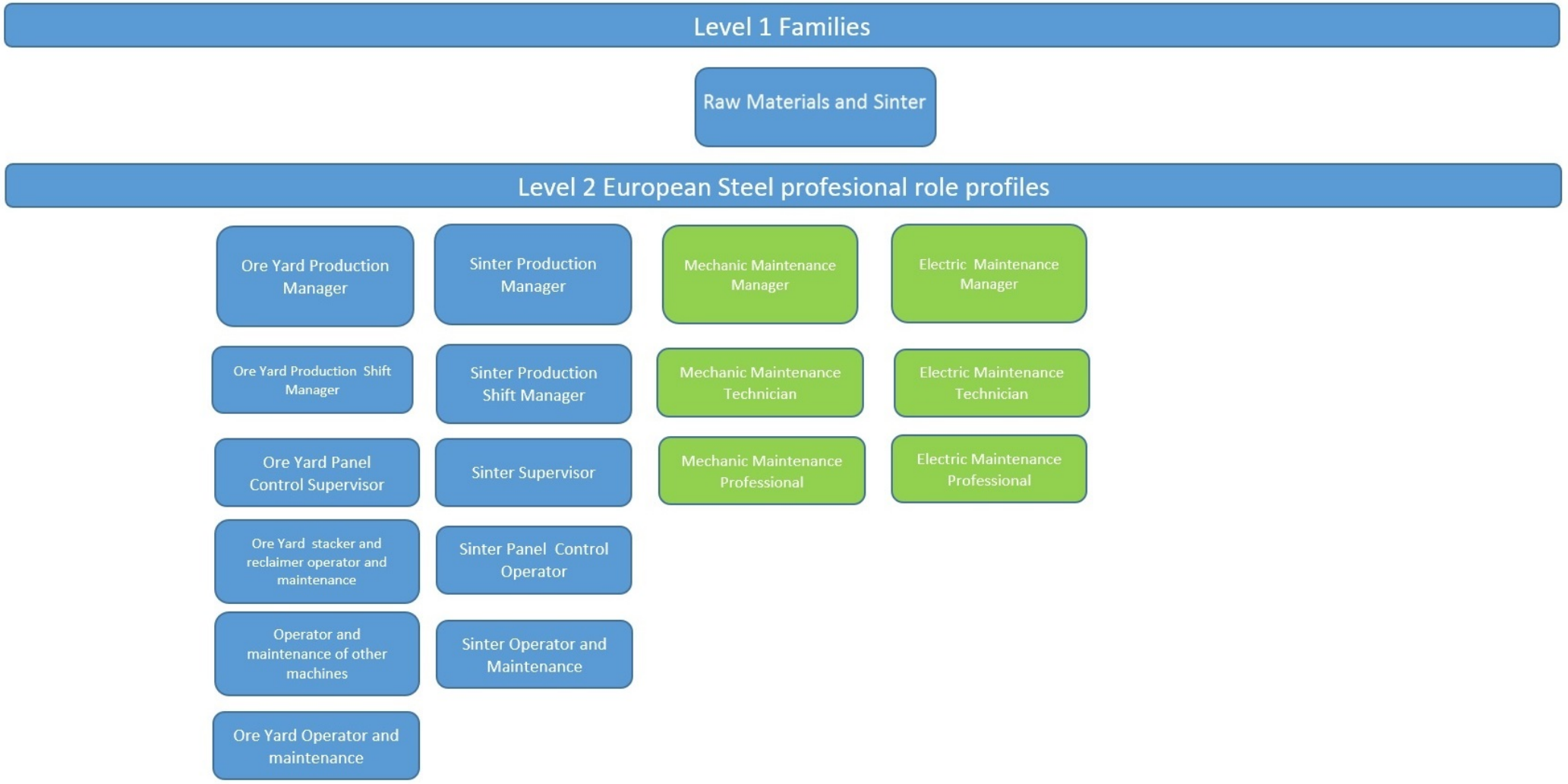


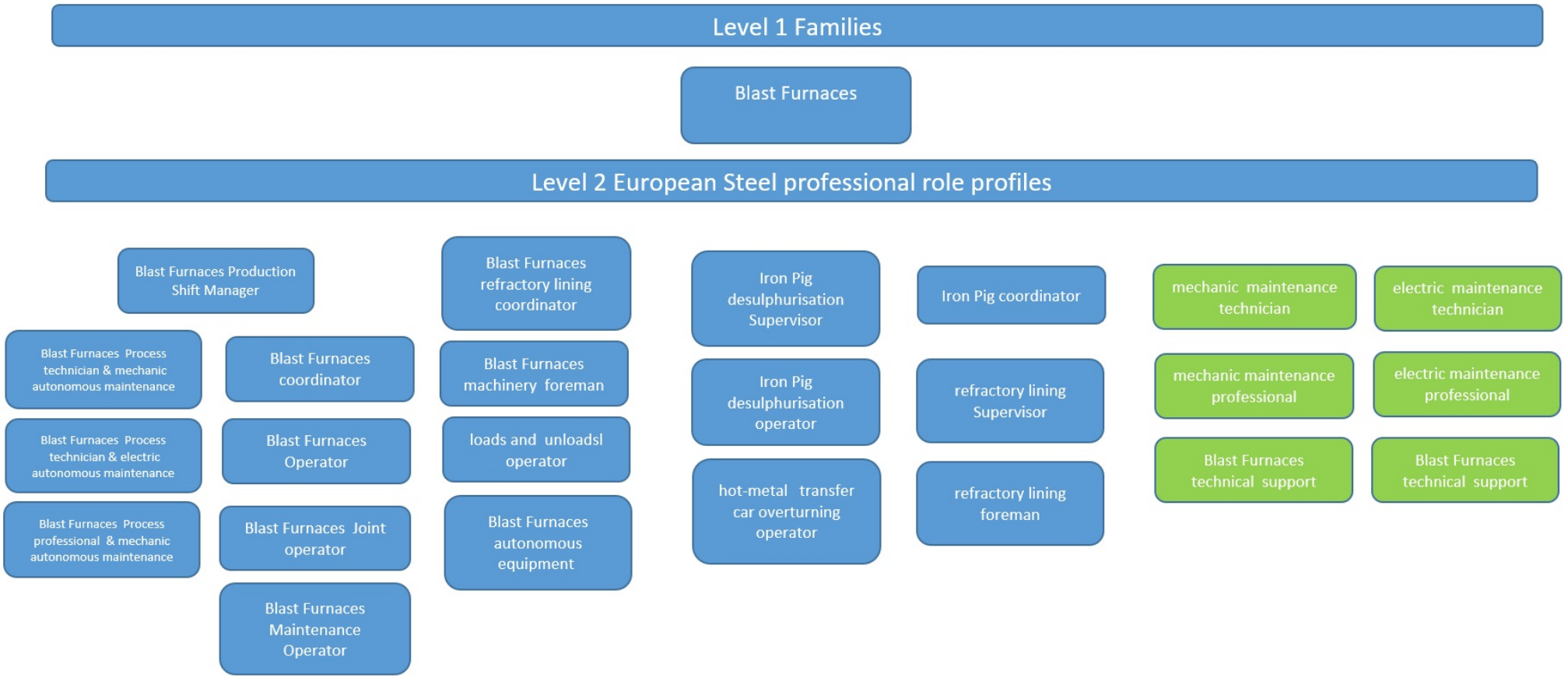

Maintenance Manager
Mechanic Maintenance
Mechanic Maintenance
Mechanic Maintenance
Welder Maintenance Operator
Electric Maintenance Supervisor
Electric Maintenance Foreman
Electric Maintenance Operator
Electronic Maintenance
Instruments Maintenance
Scadas Maintenance Operator
CC Maintenance Supervisor
Hidraulic Maintenance
Hidraulic Maintenance
Auxiliary Maintenance
EAF Maintenance Supervisor

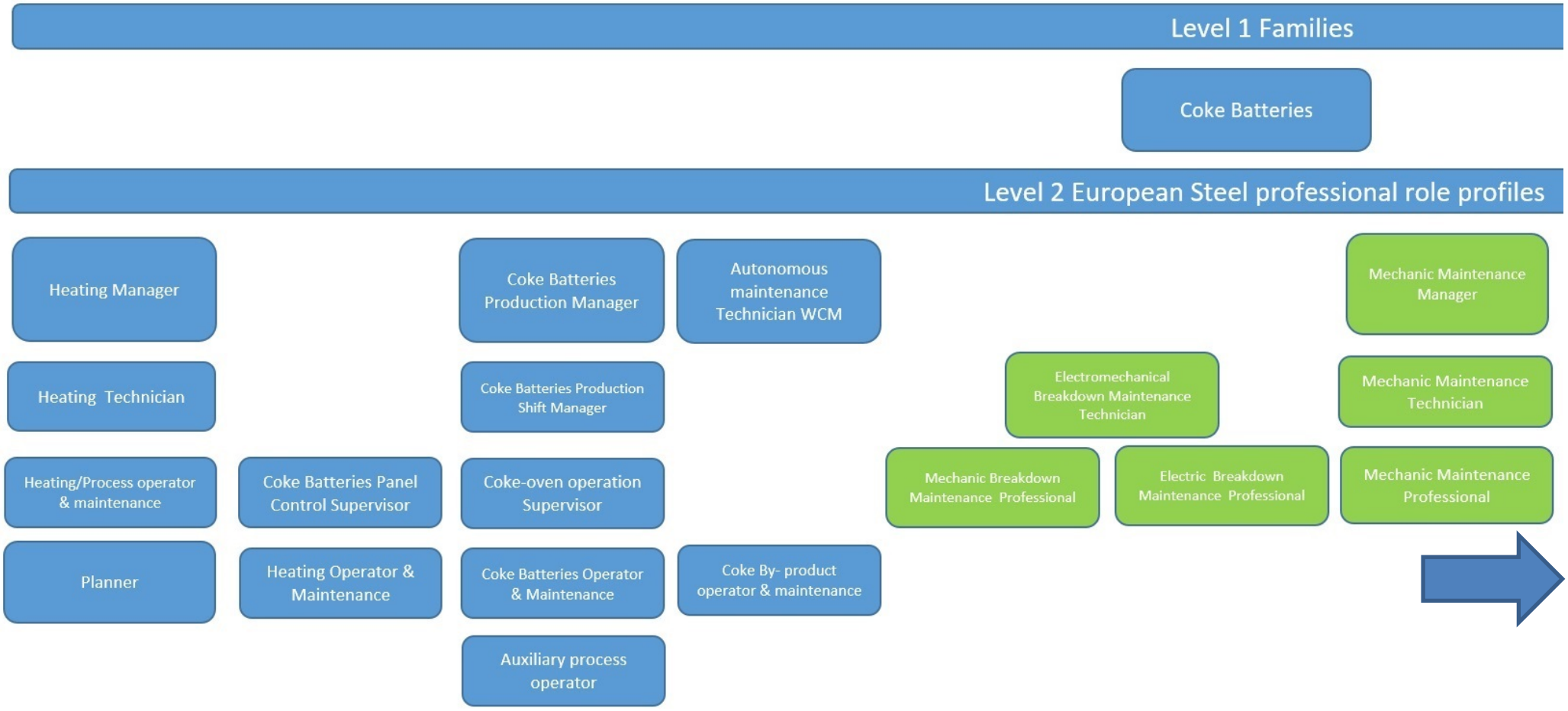

Level 1 Families
Rolling mill & Heat treatment
Level 2 European Steel professional role profiles
Rolling mill & Heat treatment Manager
Rolling mill & Heat treatment Administrative
Evacuation Manager
Rolling mill process Manager
Rolling mill production Manager
Heat treatment production Manager
Maintenance Manager
Stand workshop Foreman
Rolling mill foreman
Heat Treatment foreman
Mechanic Maintenance Supervisor
Electric Maintenance Supervisor
Stand Assembler
Reheating furnace operator
Heat treatment operator
Mechanic Maintenance Foreman
Electric Maintenance Foreman
Hidraulic Maintenance Foreman
Stand turner
Rolling mill operator
Mechanic Maintenance Operator
Electric Maintenance Operator
Hidraulic Maintenance Operator
Shear operator
Cooling bed operator
Evacuation operator

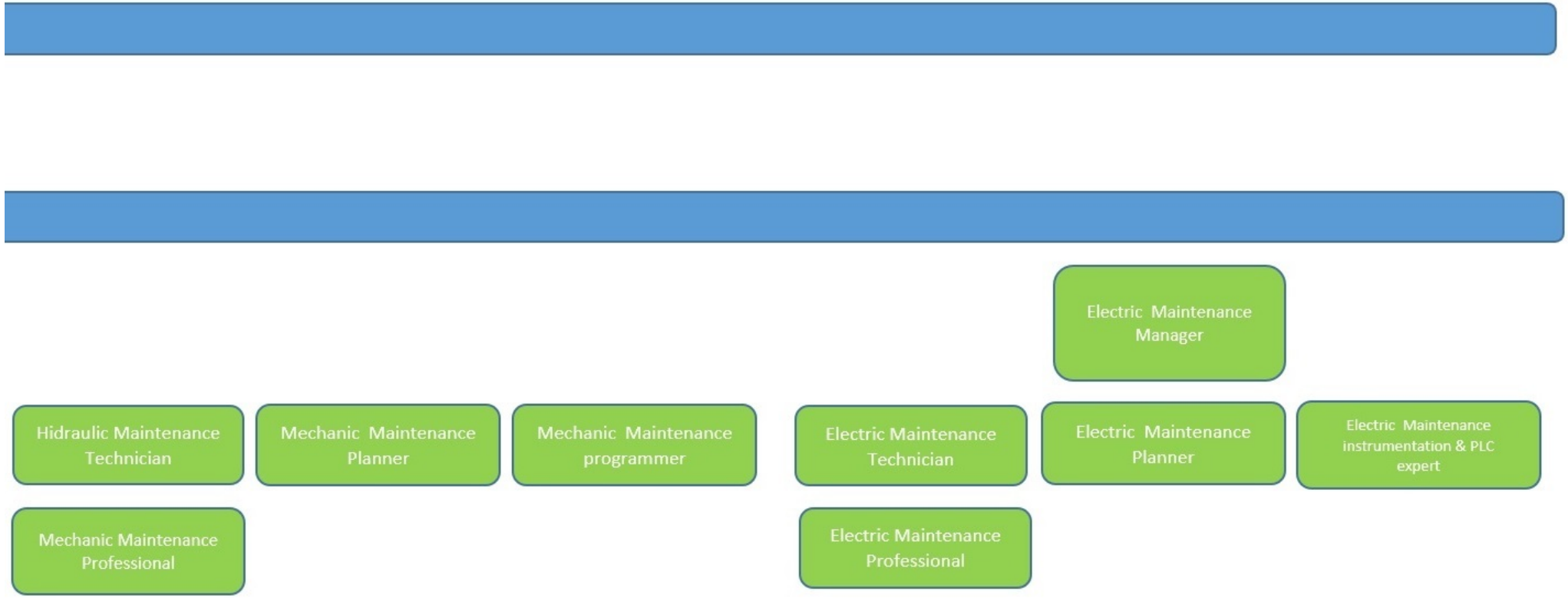

Level 1 Families
Finishing
Level 2 European Steel professional role profiles
As rolled & Bright Finishing Manager
As rolled & Bright Finishing Administrative
Bright finishing production Manager
As rolled finishing production Manager
Maintenance Manager
Peeling machine operator
Straightening machine operator
Mechanic Maintenance
Electric Maintenance Supervisor
Polishing machine operator
NDT operator
Mechanic Maintenance Foreman
Electric Maintenance Foreman
Hidraulic Maintenance Foreman
Stand turner
Conditioning & rework operator
Mechanic Maintenance Operator
Electric Maintenance Operator
Hidraulic Maintenance Operator
NDT operator
Packaging & evacuation operator
Packaging & evacuation operator
Crane operator
Crane operator
Saw operator
Mechanical adjuster

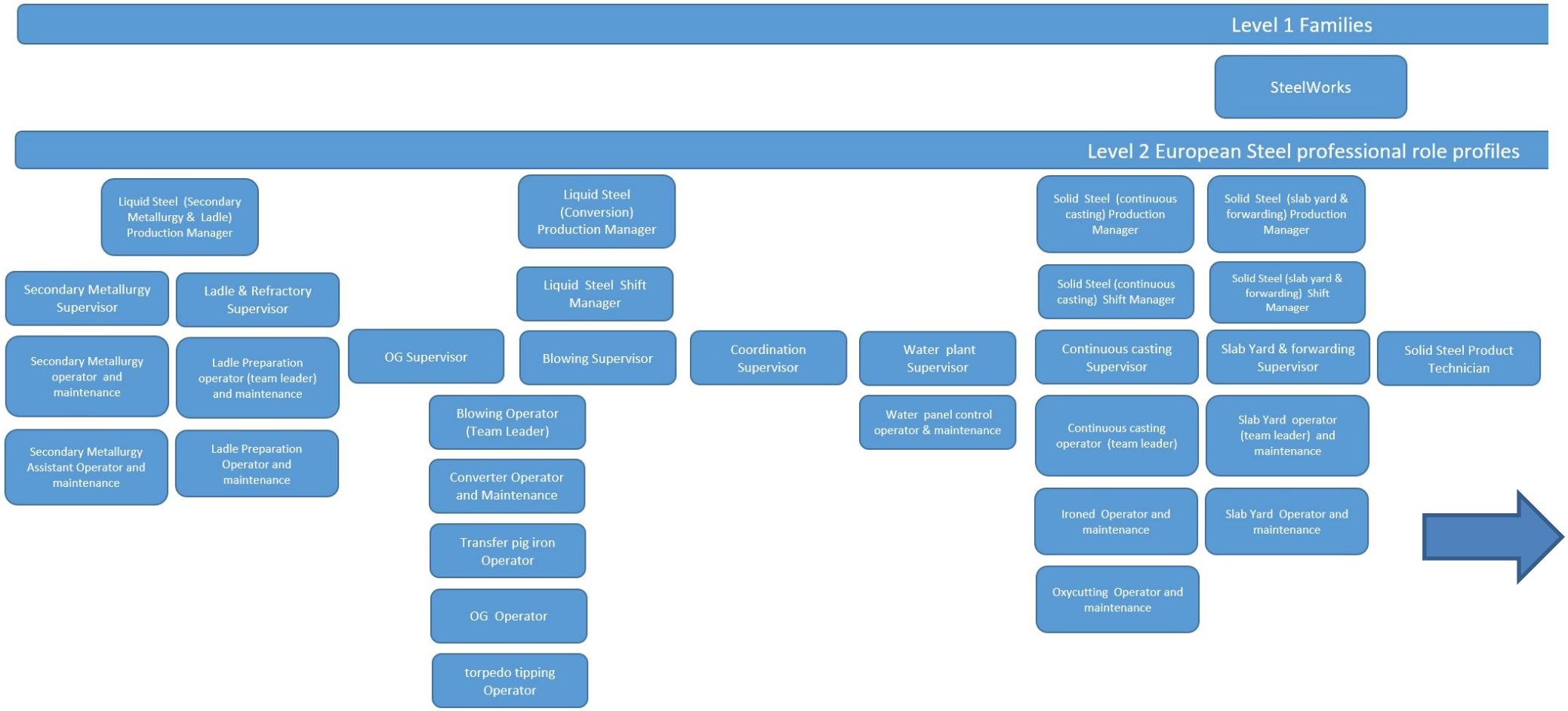

Level 1 Families
Production Quality
Safety
Maintenance
Logistic
Level 2 European Steel profesional role profiles
Prodcution Quality Manager
Production Quality Supervisor
Production Quality Foreman
Production Quality Operator
Safety Manager
Safety Technician
General Maintenance Manager
Civil works Supervisor
Electrical Maintenance
Electronic & Combustion
Water, gas, steam & air Foreman
Water, gas, steam & air Operator
Internal logistic Manager
Logistic Foreman
Logistic operator
Logistic Administrative

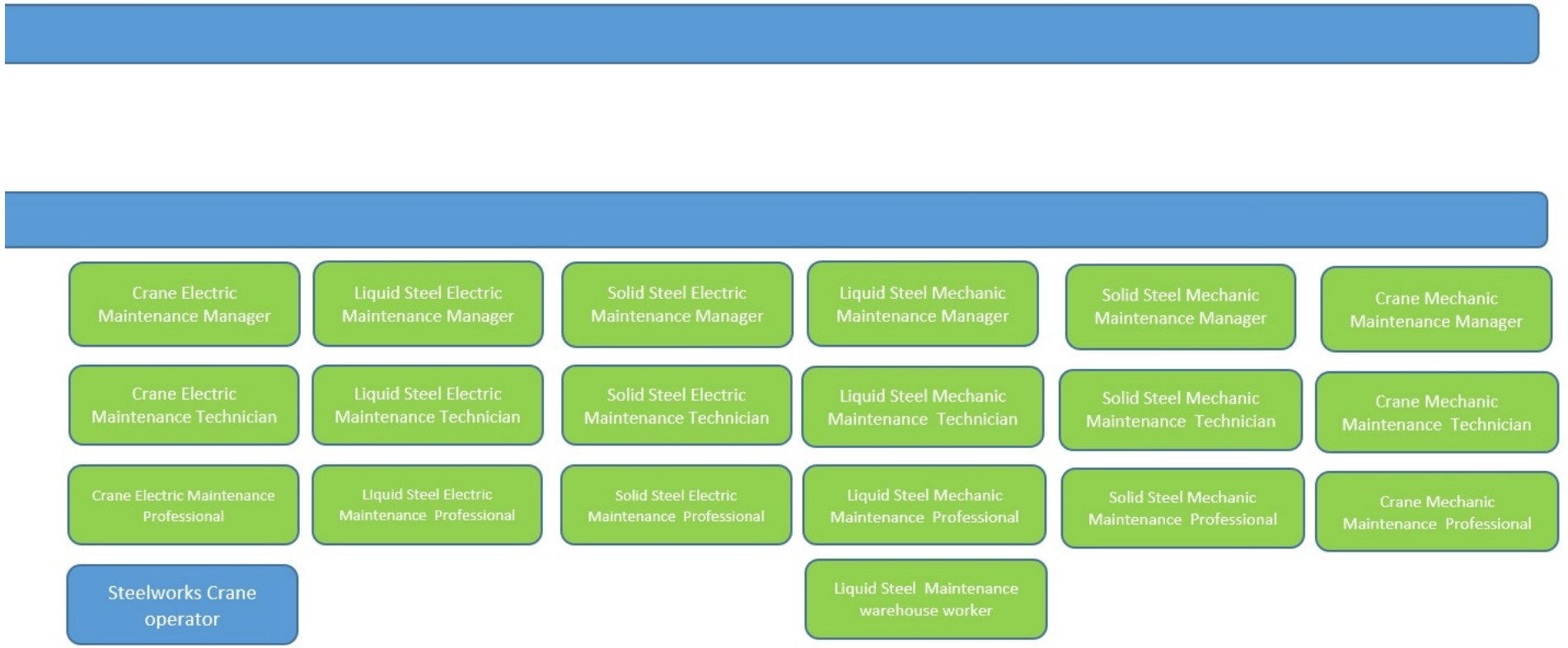

Level 1 Families
Raw Materials and Sinter
Level 2 European Steel profesional role profiles
Ore Yard Production Manager
Sinter Production Manager
Mechanic Maintenance Manager
Electric Maintenance Manager
Ore Yard Production Shift Manager
Sinter Production Shift Manager
Mechanic Maintenance Technician
Electric Maintenance Technician
Ore Yard Panel Control Supervisor
Sinter Supervisor
Mechanic Maintenance Professional
Electric Maintenance Professional
Ore Yard stacker and reclaimer operator and maintenance
Sinter Panel Control Operator
Operator and maintenance of other machines
Sinter Operator and Maintenance
Ore Yard Operator and maintenance

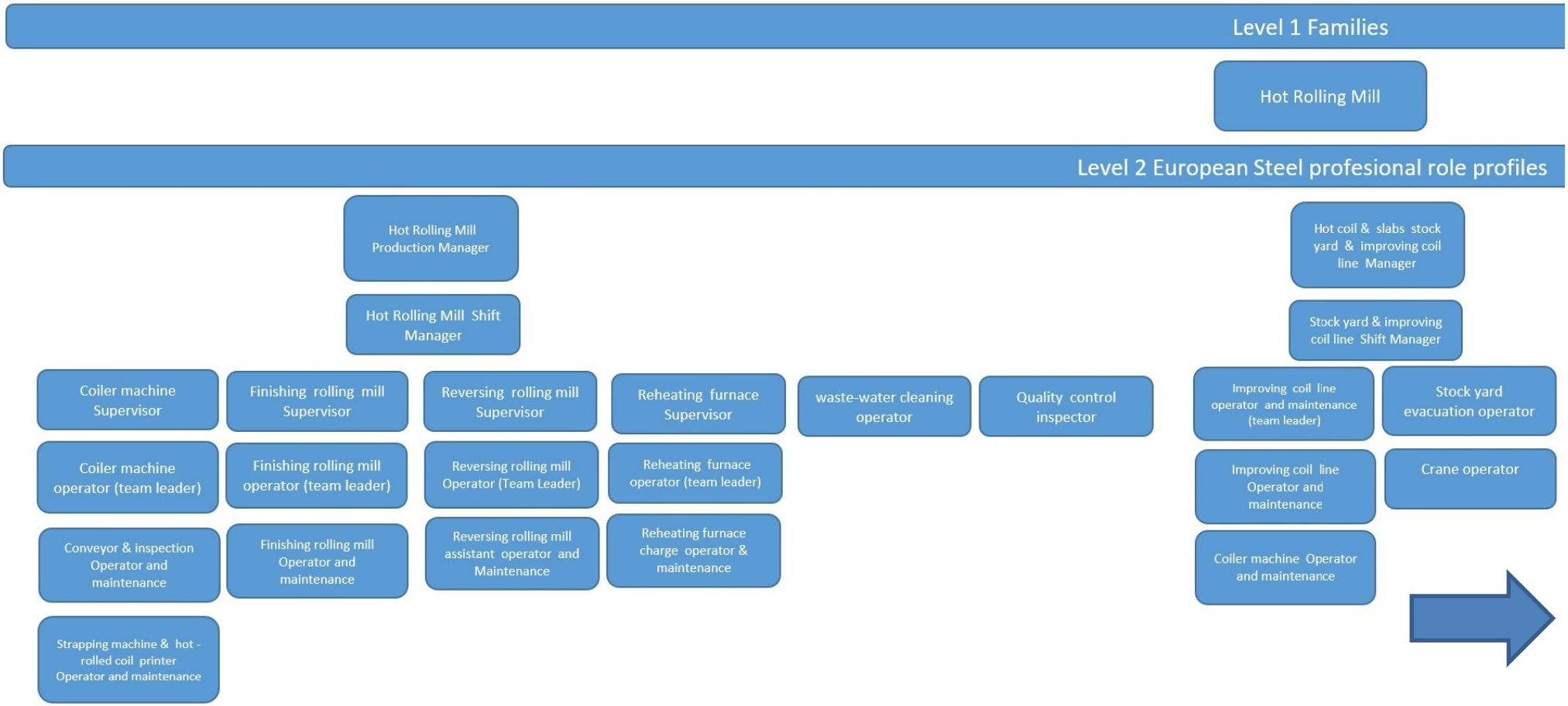

Level 1 Families
Blast Furnaces
Level 2 European Steel professional role profiles
Blast Furnaces Production Shift Manager
Blast Furnaces Process technician & mechanic autonomous maintenance
Blast Furnaces Process technician & electric autonomous maintenance
Blast Furnaces Process professional & mechanic autonomous maintenance
Blast Furnaces coordinator
Blast Furnaces Operator
Blast Furnaces Joint operator
Blast Furnaces Maintenance Operator
Blast Furnaces refractory lining coordinator
Blast Furnaces machinery foreman
loads and unloadsl operator
Blast Furnaces autonomous equipment
Iron Pig desulphurisation Supervisor
Iron Pig desulphurisation operator
hot-metal transfer car overturning operator
Iron Pig coordinator
refractory lining Supervisor
refractory lining foreman
mechanic maintenance technician
mechanic maintenance professional
Blast Furnaces technical support
electric maintenance technician
electric maintenance professional
Blast Furnaces technical support

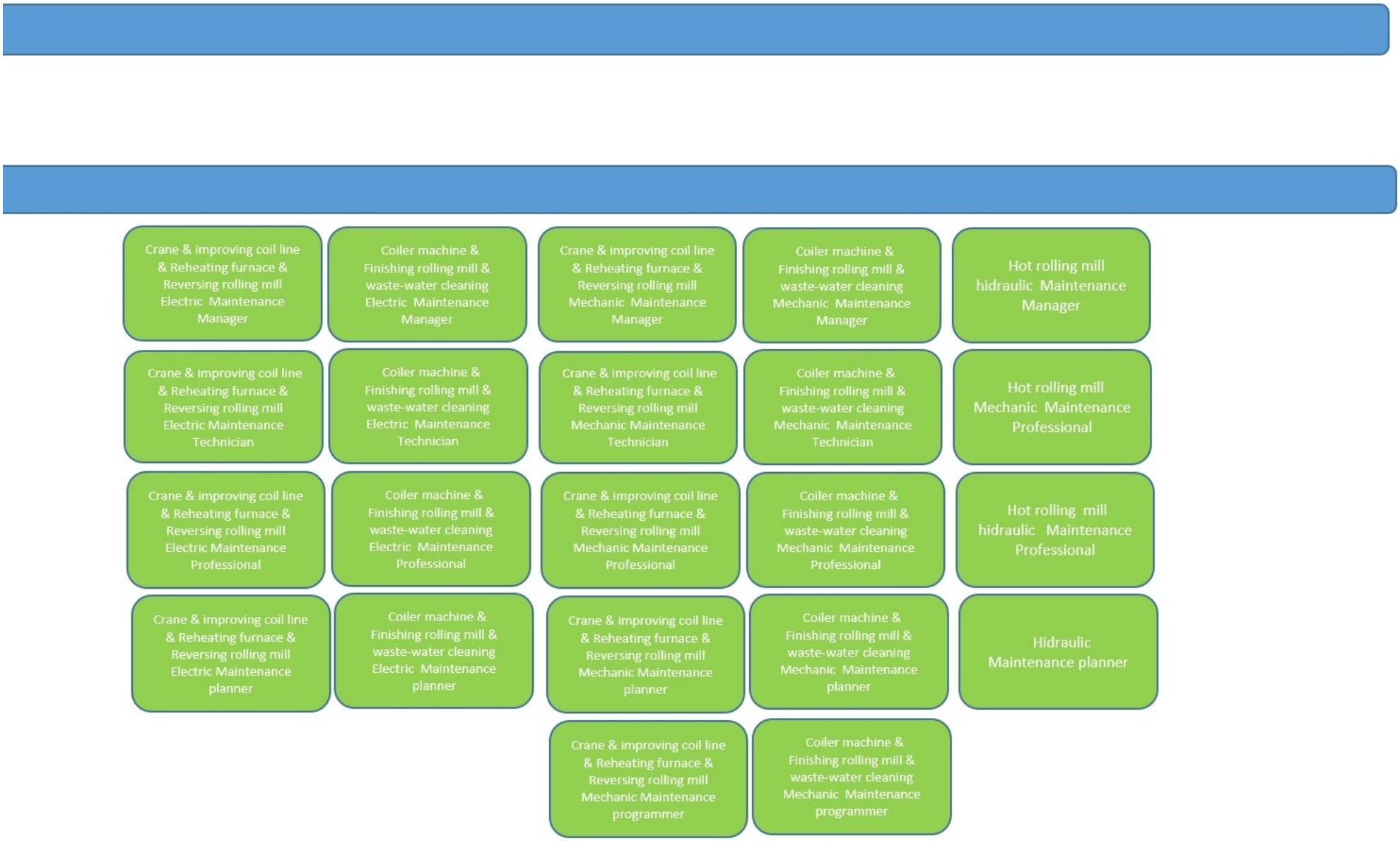

Level 1 Families
Coke Batteries
Level 2 European Steel professional role profiles
Heating Manager
Heating Technician
Heating/Process operator & maintenance
Planner
Coke Batteries Panel Control Supervisor
Heating Operator & Maintenance
Coke Batteries Production Manager
Coke Batteries Production Shift Manager
Coke-oven operation Supervisor
Coke Batteries Operator & Maintenance
Auxiliary process operator
Autonomous maintenance Technician WCM
Coke By- product operator & maintenance
Electromechanical Breakdown Maintenance Technician
Mechanic Breakdown Maintenance Professional
Electric Breakdown Maintenance Professional
Mechanic Maintenance Manager
Mechanic Maintenance Technician
Mechanic Maintenance Professional


Electric Maintenance Manager
Hidraulic Maintenance Technician
Mechanic Maintenance Planner
Mechanic Maintenance programmer
Electric Maintenance Technician
Electric Maintenance Planner
Electric Maintenance instrumentation & PLC expert
Mechanic Maintenance Professional
Electric Maintenance Professional

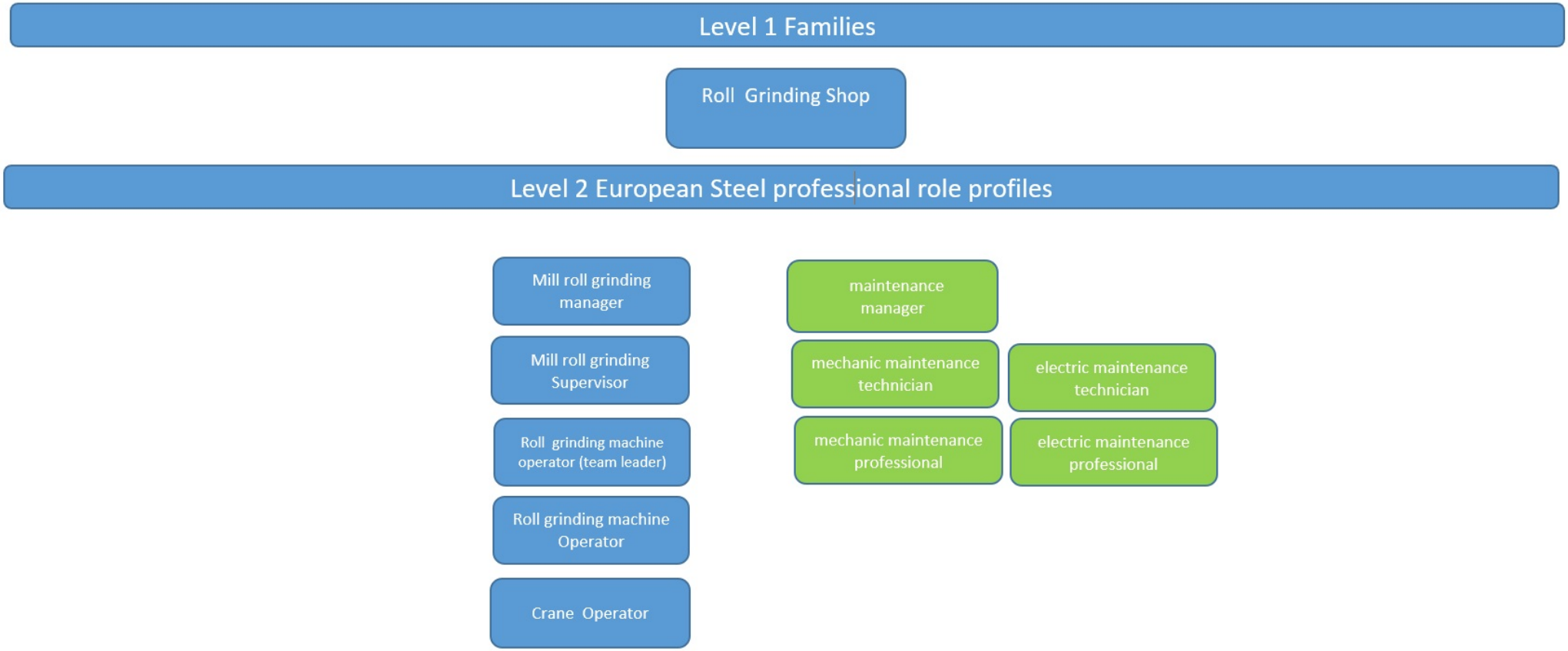

Level 1 Families
SteelWorks
Level 2 European Steel professional role profiles
Liquid Steel (Secondary Metallurgy & Ladle) Production Manager
Secondary Metallurgy Supervisor
Ladle & Refractory Supervisor
Secondary Metallurgy operator and maintenance
Ladle Preparation operator (team leader) and maintenance
Secondary Metallurgy Assistant Operator and maintenance
Ladle Preparation Operator and maintenance
Liquid Steel (Conversion) Production Manager
Liquid Steel Shift Manager
OG Supervisor
Blowing Supervisor
Blowing Operator (Team Leader)
Converter Operator and Maintenance
Transfer pig iron Operator
OG Operator
torpedo tipping Operator
Coordination Supervisor
Water plant Supervisor
Water panel control operator & maintenance
Solid Steel (continuous casting) Production Manager
Solid Steel (continuous casting) Shift Manager
Continuous casting Supervisor
Continuous casting operator (team leader)
Ironed Operator and maintenance
Oxycutting Operator and maintenance
Solid Steel (slab yard & forwarding) Production Manager
Solid Steel (slab yard & forwarding) Shift Manager
Slab Yard & forwarding Supervisor
Slab Yard operator (team leader) and maintenance
Slab Yard Operator and maintenance
Solid Steel Product Technician

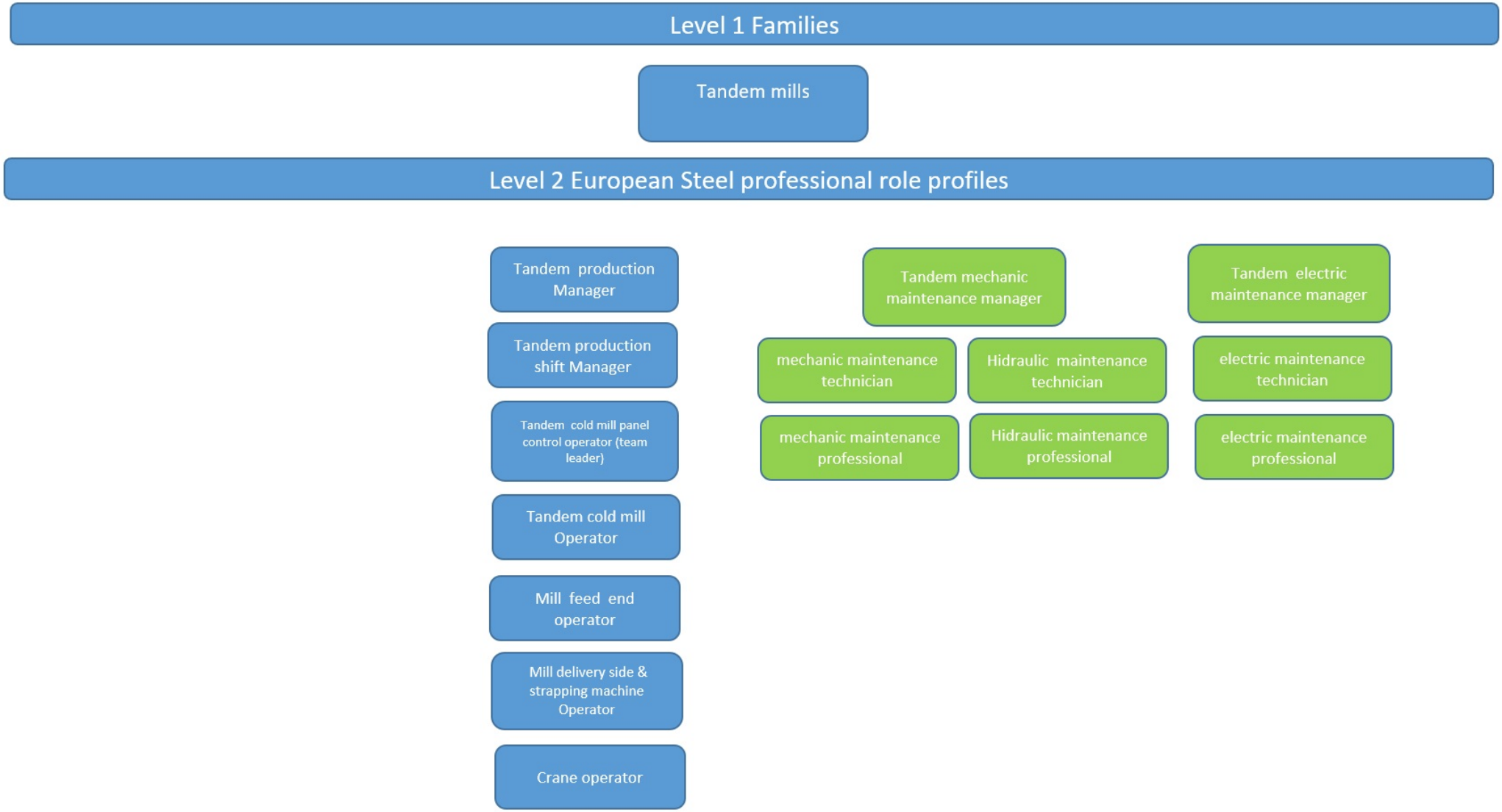

Crane Electric Maintenance Manager
Liquid Steel Electric Maintenance Manager
Solid Steel Electric Maintenance Manager
Liquid Steel Mechanic Maintenance Manager
Solid Steel Mechanic Maintenance Manager
Crane Mechanic Maintenance Manager
Crane Electric Maintenance Technician
Liquid Steel Electric Maintenance Technician
Solid Steel Electric Maintenance Technician
Liquid Steel Mechanic Maintenance Technician
Solid Steel Mechanic Maintenance Technician
Crane Mechanic Maintenance Technician
Crane Electric Maintenance Professional
Liquid Steel Electric Maintenance Professional
Solid Steel Electric Maintenance Professional
Liquid Steel Mechanic Maintenance Professional
Solid Steel Mechanic Maintenance Professional
Crane Mechanic Maintenance Professional
Steelworks Crane operator
Liquid Steel Maintenance warehouse worker

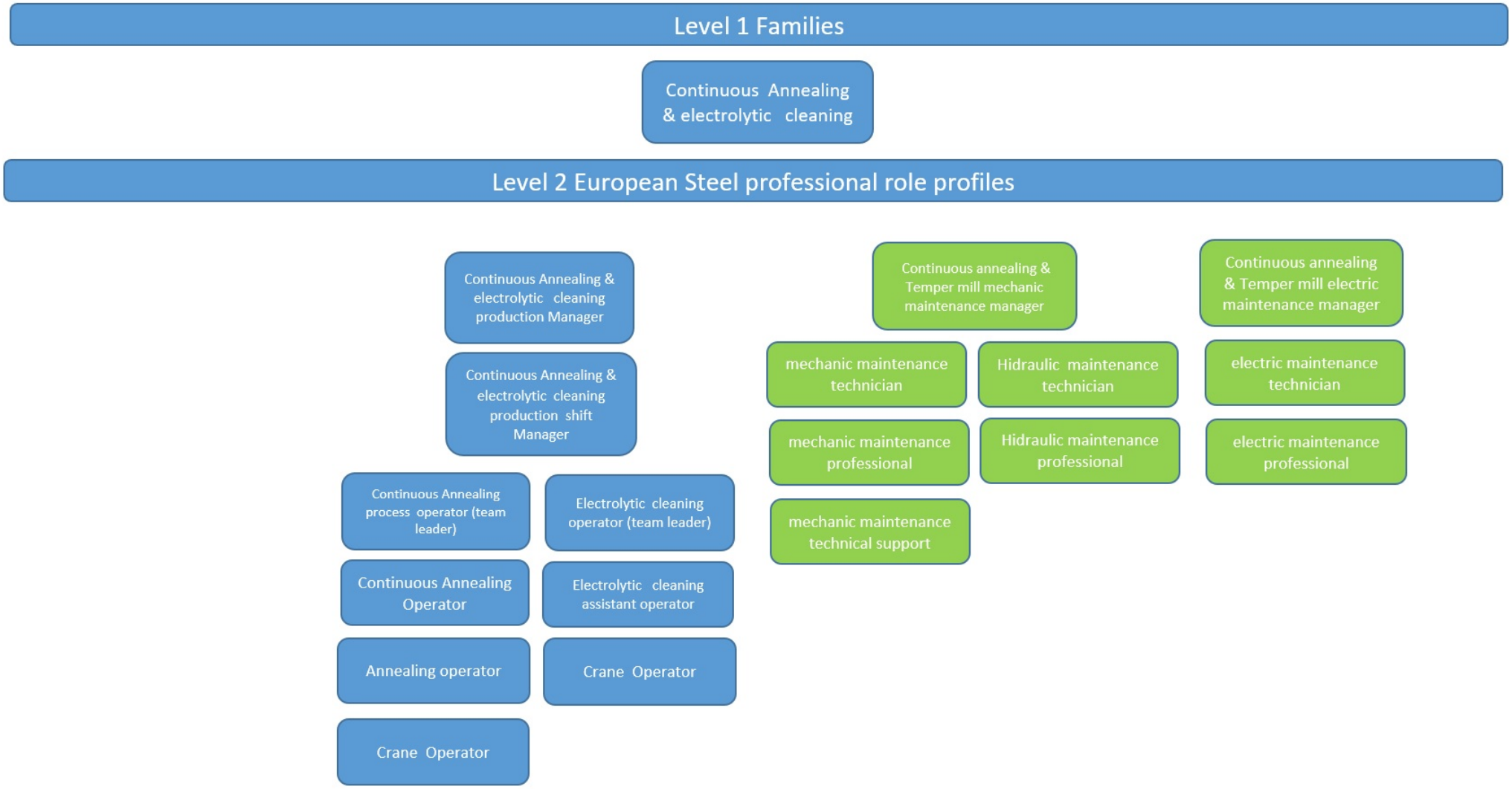

Level 1 Families
Hot Rolling Mill
Level 2 European Steel profesional role profiles
Hot Rolling Mill Production Manager
Hot Rolling Mill Shift Manager
Coiler machine Supervisor
Finishing rolling mill Supervisor
Reversing rolling mill Supervisor
Reheating furnace Supervisor
waste-water cleaning operator
Quality control inspector
Coiler machine operator (team leader)
Finishing rolling mill operator (team leader)
Reversing rolling mill Operator (Team Leader)
Reheating furnace operator (team leader)
Conveyor & inspection Operator and maintenance
Finishing rolling mill Operator and maintenance
Reversing rolling mill assistant operator and Maintenance
Reheating furnace charge operator & maintenance
Strapping machine & hot - rolled coil printer Operator and maintenance
Hot coil & slabs stock yard & improving coil line Manager
Stock yard & improving coil line Shift Manager
Improving coil line operator and maintenance (team leader)
Stock yard evacuation operator
Improving coil line Operator and maintenance
Crane operator
Coiler machine Operator and maintenance


Crane & improving coil line & Reheating furnace & Reversing rolling mill Electric Maintenance Manager
Coiler machine & Finishing rolling mill & waste-water cleaning Electric Maintenance Manager
Crane & improving coil line & Reheating furnace & Reversing rolling mill Mechanic Maintenance Manager
Coiler machine & Finishing rolling mill & waste-water cleaning Mechanic Maintenance Manager
Hot rolling mill hidraulic Maintenance Manager
Crane & improving coil line & Reheating furnace & Reversing rolling mill Electric Maintenance Technician
Coiler machine & Finishing rolling mill & waste-water cleaning Electric Maintenance Technician
Crane & improving coil line & Reheating furnace & Reversing rolling mill Mechanic Maintenance Technician
Coiler machine & Finishing rolling mill & waste-water cleaning Mechanic Maintenance Technician
Hot rolling mill Mechanic Maintenance Professional
Crane & improving coil line & Reheating furnace & Reversing rolling mill Electric Maintenance Professional
Coiler machine & Finishing rolling mill & waste-water cleaning Electric Maintenance Professional
Crane & improving coil line & Reheating furnace & Reversing rolling mill Mechanic Maintenance Professional
Coiler machine & Finishing rolling mill & waste-water cleaning Mechanic Maintenance Professional
Hot rolling mill hidraulic Maintenance Professional
Crane & improving coil line & Reheating furnace & Reversing rolling mill Electric Maintenance planner
Coiler machine & Finishing rolling mill & waste-water cleaning Electric Maintenance planner
Crane & improving coil line & Reheating furnace & Reversing rolling mill Mechanic Maintenance planner
Coiler machine & Finishing rolling mill & waste-water cleaning Mechanic Maintenance planner
Hidraulic Maintenance planner
Crane & improving coil line & Reheating furnace & Reversing rolling mill Mechanic Maintenance programmer
Coiler machine & Finishing rolling mill & waste-water cleaning Mechanic Maintenance programmer


Level 1 Families
Pickling line
Level 2 European Steel professional role profiles
Pickling production Manager
Pickling production shift Manager
Edge trimmer operator (team leader)
Pickling process Operator
Pickling operator
Uncolier Operator
Crane Operator
HCL plant & accesory equipment Manager
HCL plant & water treating plant Supervisor
HCL & accesory equipment operator
HCL & accesory equipment assistant Operator
Pickling line & HCL plant & accesory equipment mechanic maintenance manager
mechanic maintenance technician
mechanic maintenance professional
Pickling line & HCL plant & accesory equipment electric maintenance manager
electric maintenance technician
electric maintenance professional

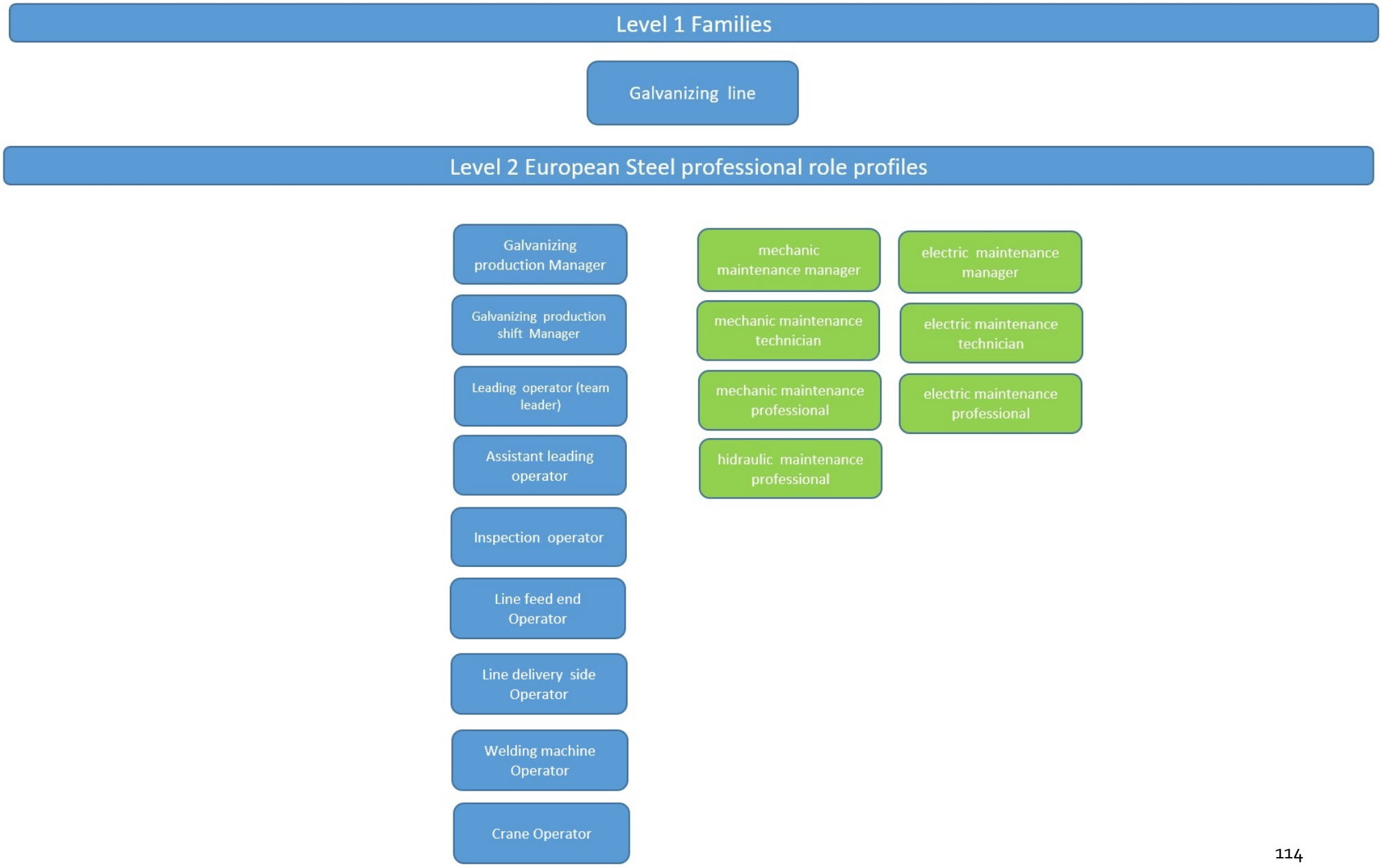

Level 1 Families
Roll Grinding Shop
Level 2 European Steel professional role profiles
Mill roll grinding manager
Mill roll grinding Supervisor
Roll grinding machine operator (team leader)
Roll grinding machine Operator
Crane Operator
maintenance manager
mechanic maintenance technician
electric maintenance technician
mechanic maintenance professional
electric maintenance professional

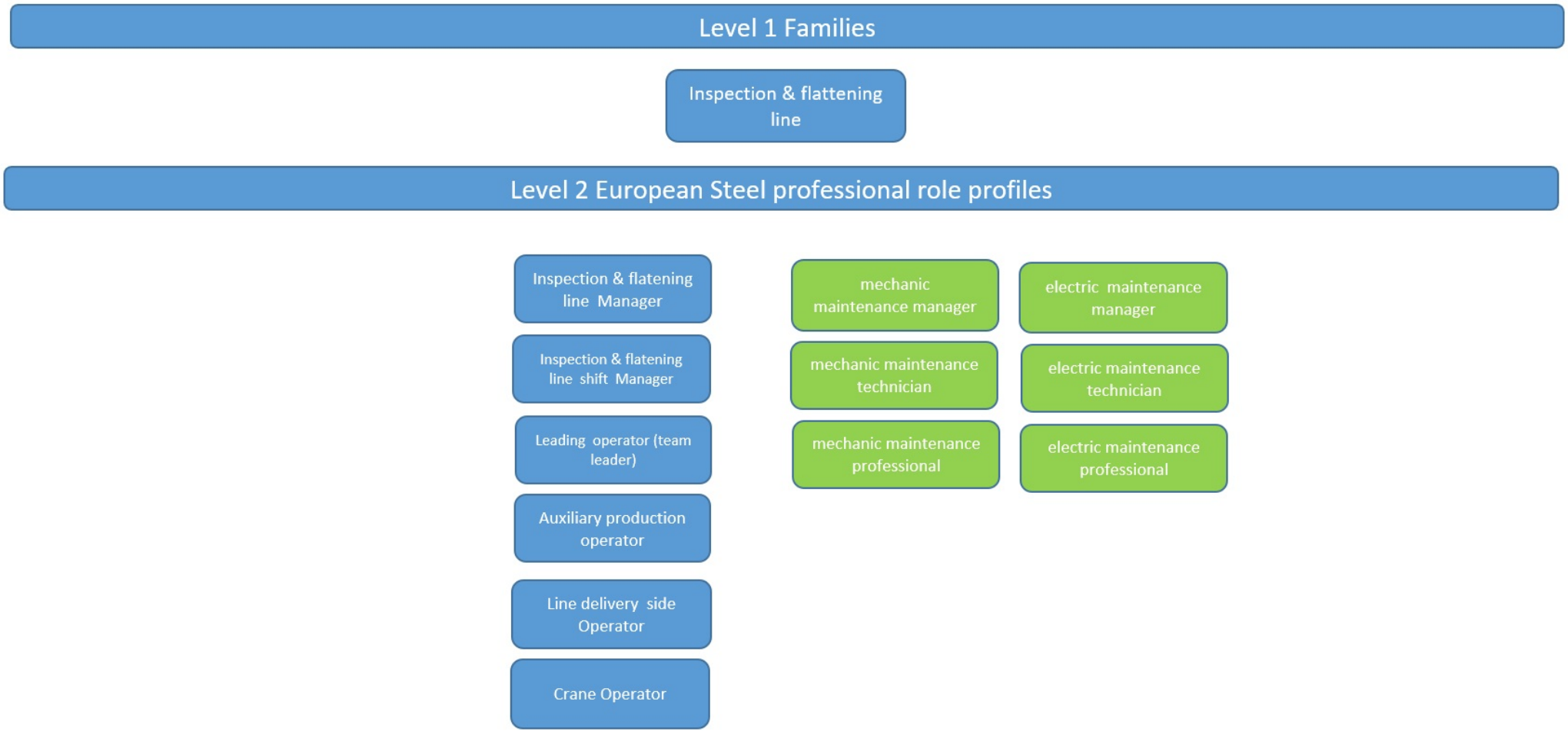

Level 1 Families
Tandem mills
Level 2 European Steel professional role profiles
Tandem production Manager
Tandem production shift Manager
Tandem cold mill panel control operator (team leader)
Tandem cold mill Operator
Mill feed end operator
Mill delivery side & strapping machine Operator
Crane operator
Tandem mechanic maintenance manager
mechanic maintenance technician
Hidraulic maintenance technician
mechanic maintenance professional
Hidraulic maintenance professional
Tandem electric maintenance manager
electric maintenance technician
electric maintenance professional

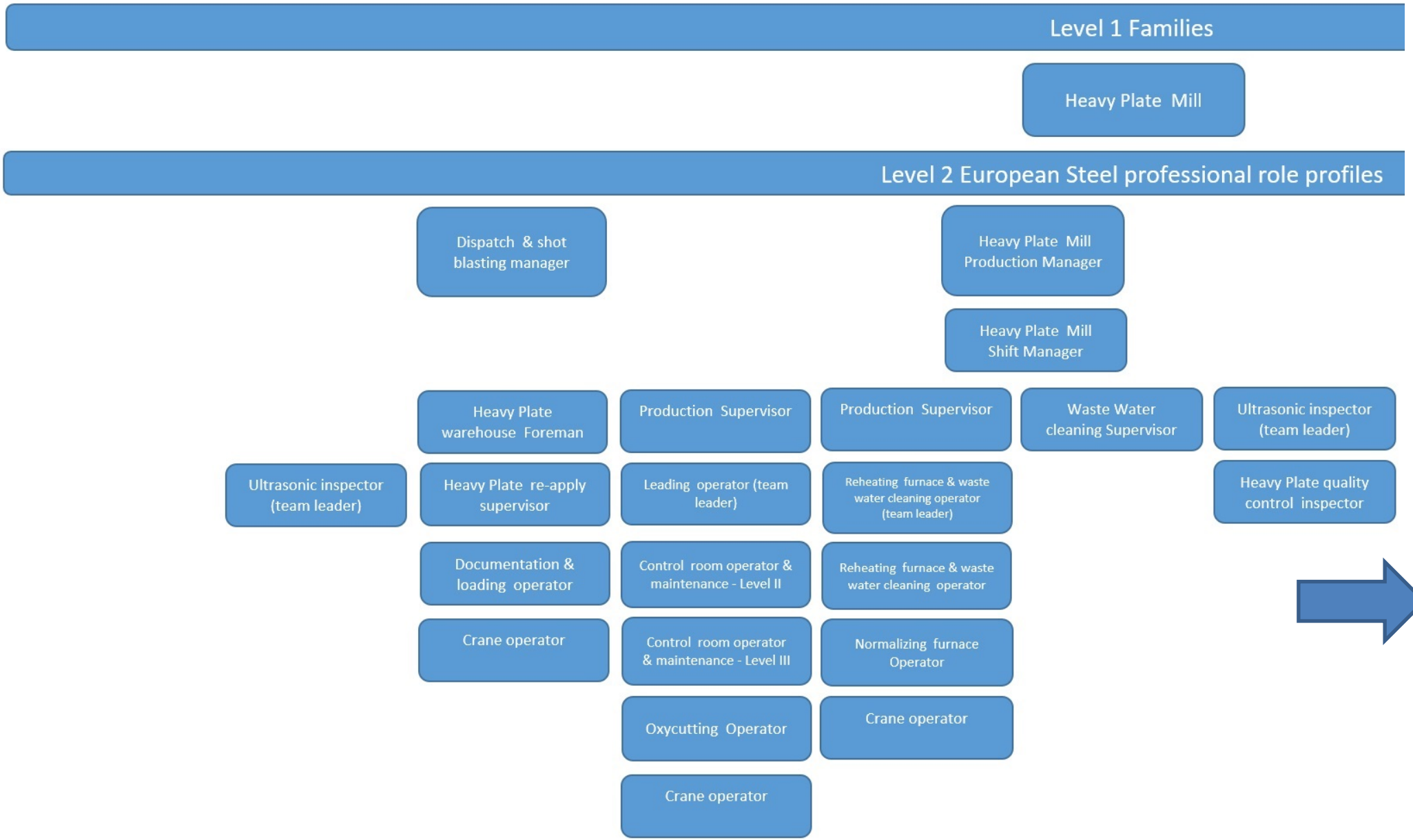

Level 1 Families
Continuous Annealing & electrolytic cleaning
Level 2 European Steel professional role profiles
Continuous Annealing & electrolytic cleaning production Manager
Continuous Annealing & electrolytic cleaning production shift Manager
Continuous Annealing process operator (team leader)
Electrolytic cleaning operator (team leader)
Continuous Annealing Operator
Electrolytic cleaning assistant operator
Annealing operator
Crane Operator
Crane Operator
Continuous annealing & Temper mill mechanic maintenance manager
Continuous annealing & Temper mill electric maintenance manager
mechanic maintenance technician
Hidraulic maintenance technician
electric maintenance technician
mechanic maintenance professional
Hidraulic maintenance professional
electric maintenance professional
mechanic maintenance technical support

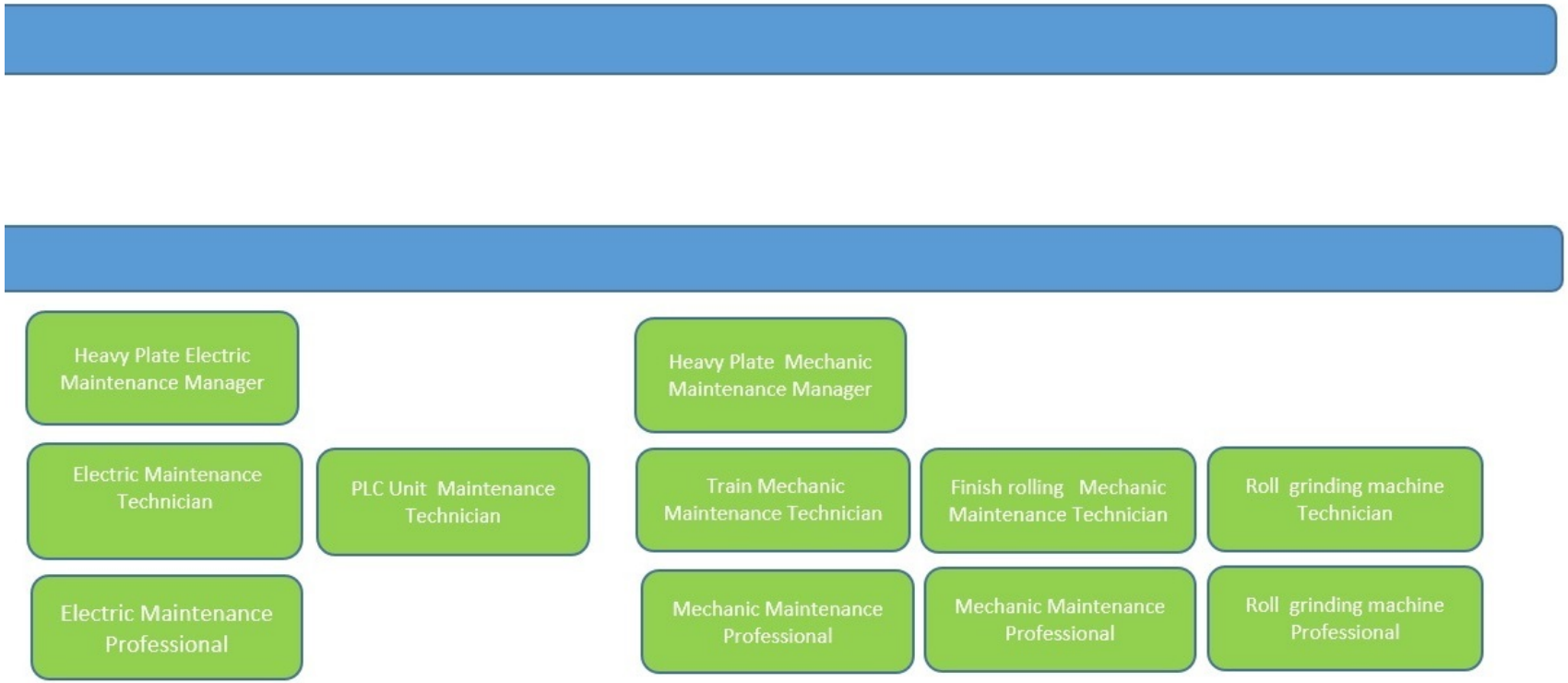

Level 1 Families
Temper mill
Level 2 European Steel professional role profiles
Temper mill production Manager
Temper mill production shift Manager
Tempering operator (team leader)
Tempering Operator
Crane operator

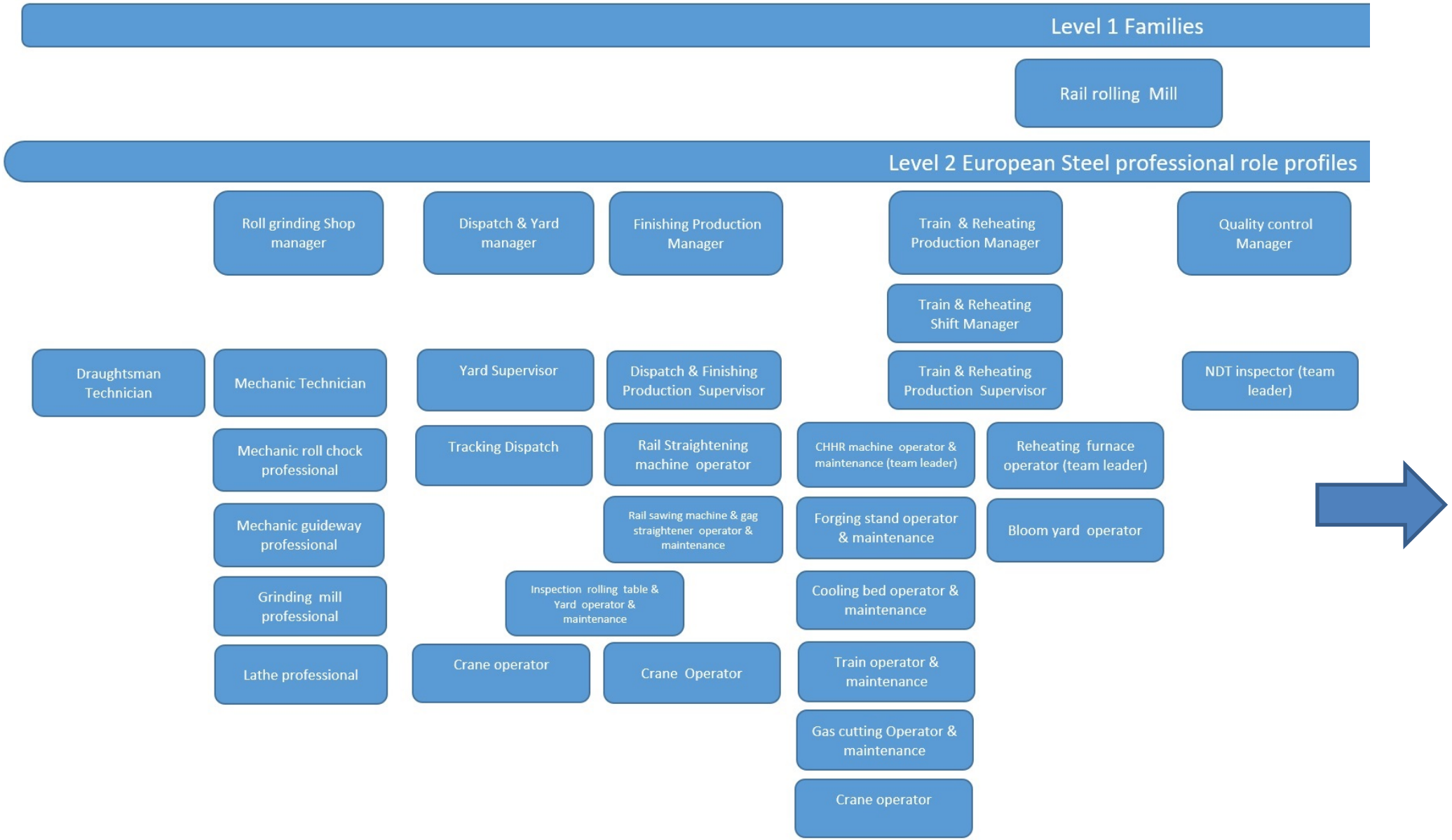

Level 1 Families
Tin Plate Line
Level 2 European Steel professional role profiles
Tin Plate production Manager
Tin Plate production shift Manager
Tin Plate process operator (team leader)
Tin plate process Operator
Tin Plate operator
Inspection line Operator
Crane Operator
Tin Plate mechanic maintenance manager
mechanic maintenance technician
mechanic maintenance professional
Tin Plate electric maintenance manager
electric maintenance technician
electric maintenance professional

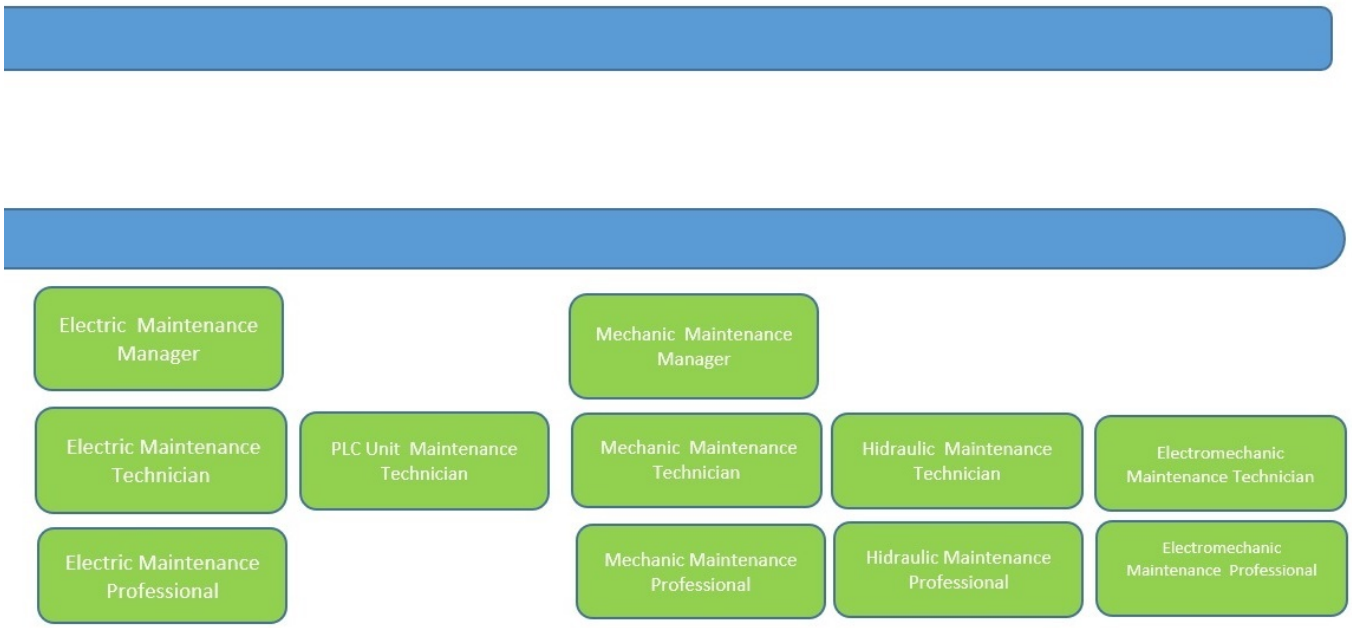

Level 1 Families
Galvanizing line
Level 2 European Steel professional role profiles
Galvanizing production Manager
Galvanizing production shift Manager
Leading operator (team leader)
Assistant leading operator
Inspection operator
Line feed end Operator
Line delivery side Operator
Welding machine Operator
Crane Operator
mechanic maintenance manager
mechanic maintenance technician
mechanic maintenance professional
hidraulic maintenance professional
electric maintenance manager
electric maintenance technician
electric maintenance professional

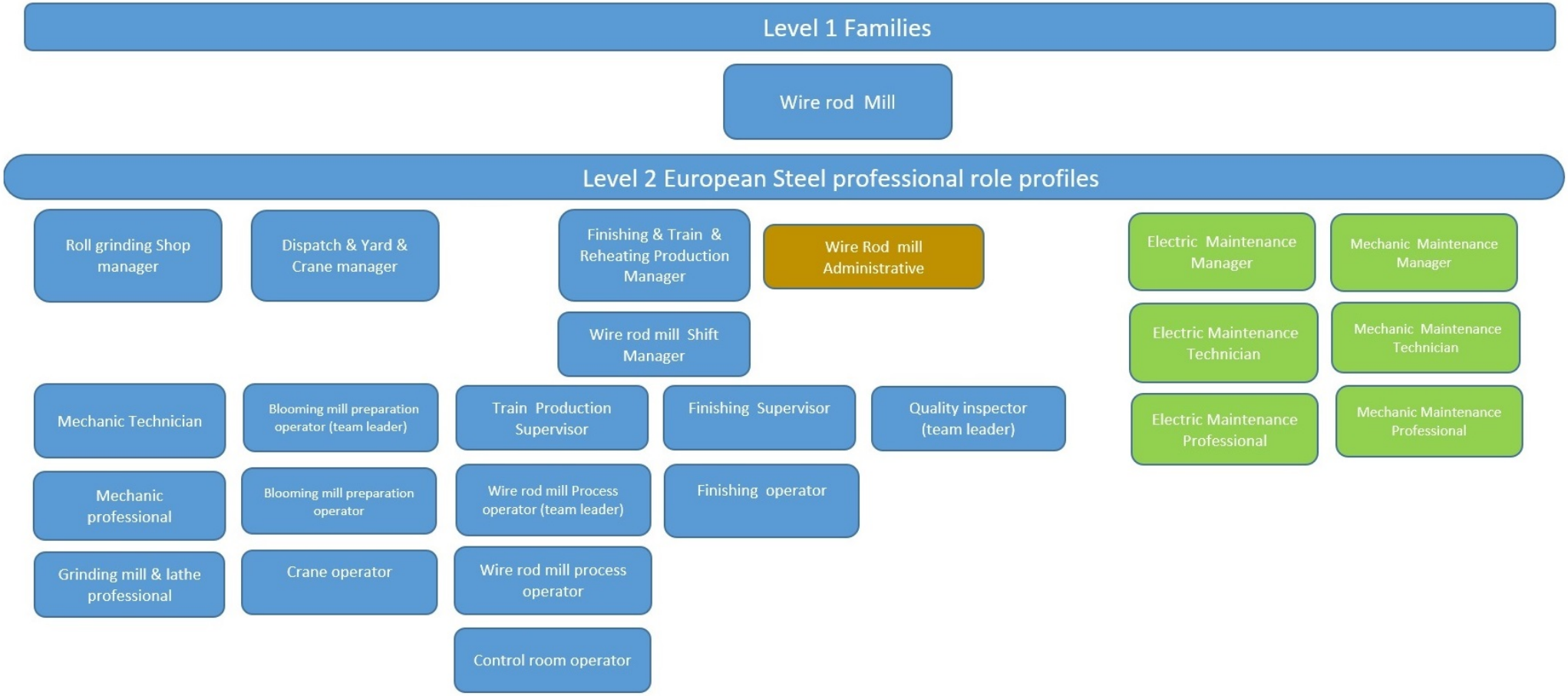

Level 1 Families
Inspection & flattening line
Level 2 European Steel professional role profiles
Inspection & flatening line Manager
Inspection & flatening line shift Manager
Leading operator (team leader)
Auxiliary production operator
Line delivery side Operator
Crane Operator
mechanic maintenance manager
mechanic maintenance technician
mechanic maintenance professional
electric maintenance manager
electric maintenance technician
electric maintenance professional

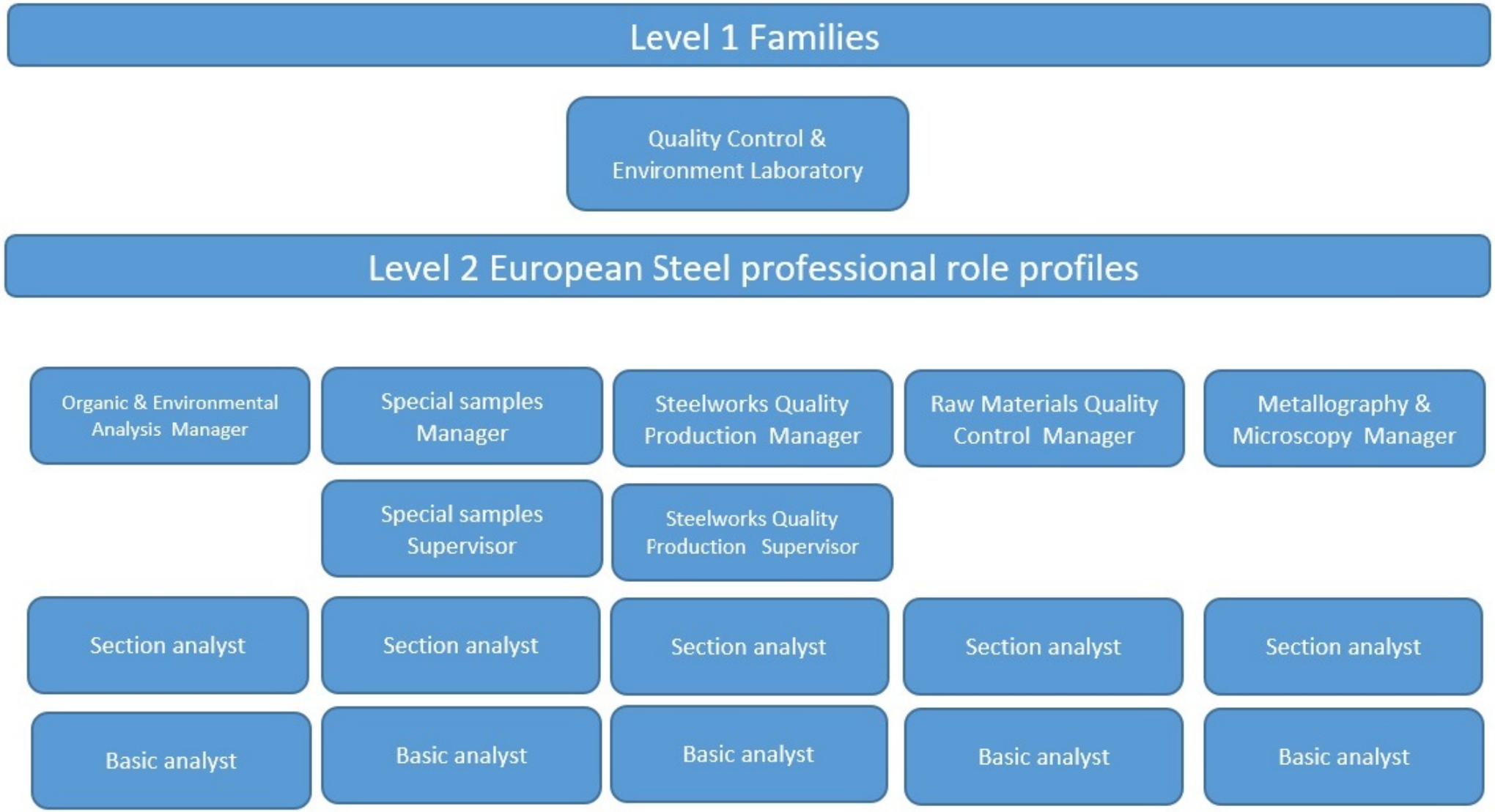

Level 1 Families
Heavy Plate Mill
Level 2 European Steel professional role profiles
Dispatch & shot blasting manager
Heavy Plate Mill Production Manager
Heavy Plate Mill Shift Manager
Heavy Plate warehouse Foreman
Production Supervisor
Production Supervisor
Waste Water cleaning Supervisor
Ultrasonic inspector (team leader)
Ultrasonic inspector (team leader)
Heavy Plate re-apply supervisor
Leading operator (team leader)
Reheating furnace & waste water cleaning operator (team leader)
Heavy Plate quality control inspector
Documentation & loading operator
Control room operator & maintenance - Level II
Reheating furnace & waste water cleaning operator
Crane operator
Control room operator & maintenance - Level III
Normalizing furnace Operator
Oxycutting Operator
Crane operator
Crane operator

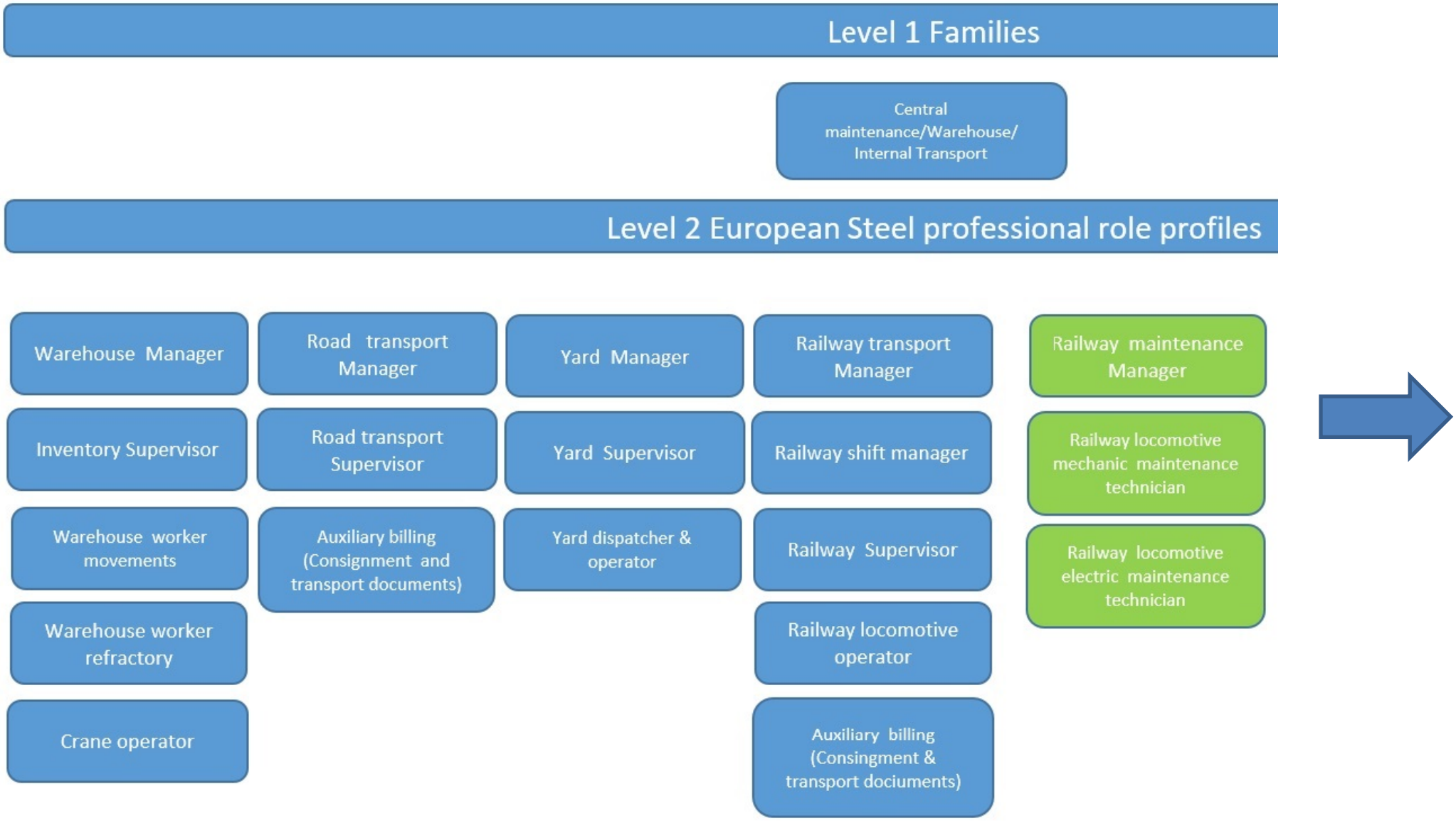

Heavy Plate Electric Maintenance Manager
Electric Maintenance Technician
PLC Unit Maintenance Technician
Electric Maintenance Professional
Heavy Plate Mechanic Maintenance Manager
Train Mechanic Maintenance Technician
Finish rolling Mechanic Maintenance Technician
Roll grinding machine Technician
Mechanic Maintenance Professional
Mechanic Maintenance Professional
Roll grinding machine Professional

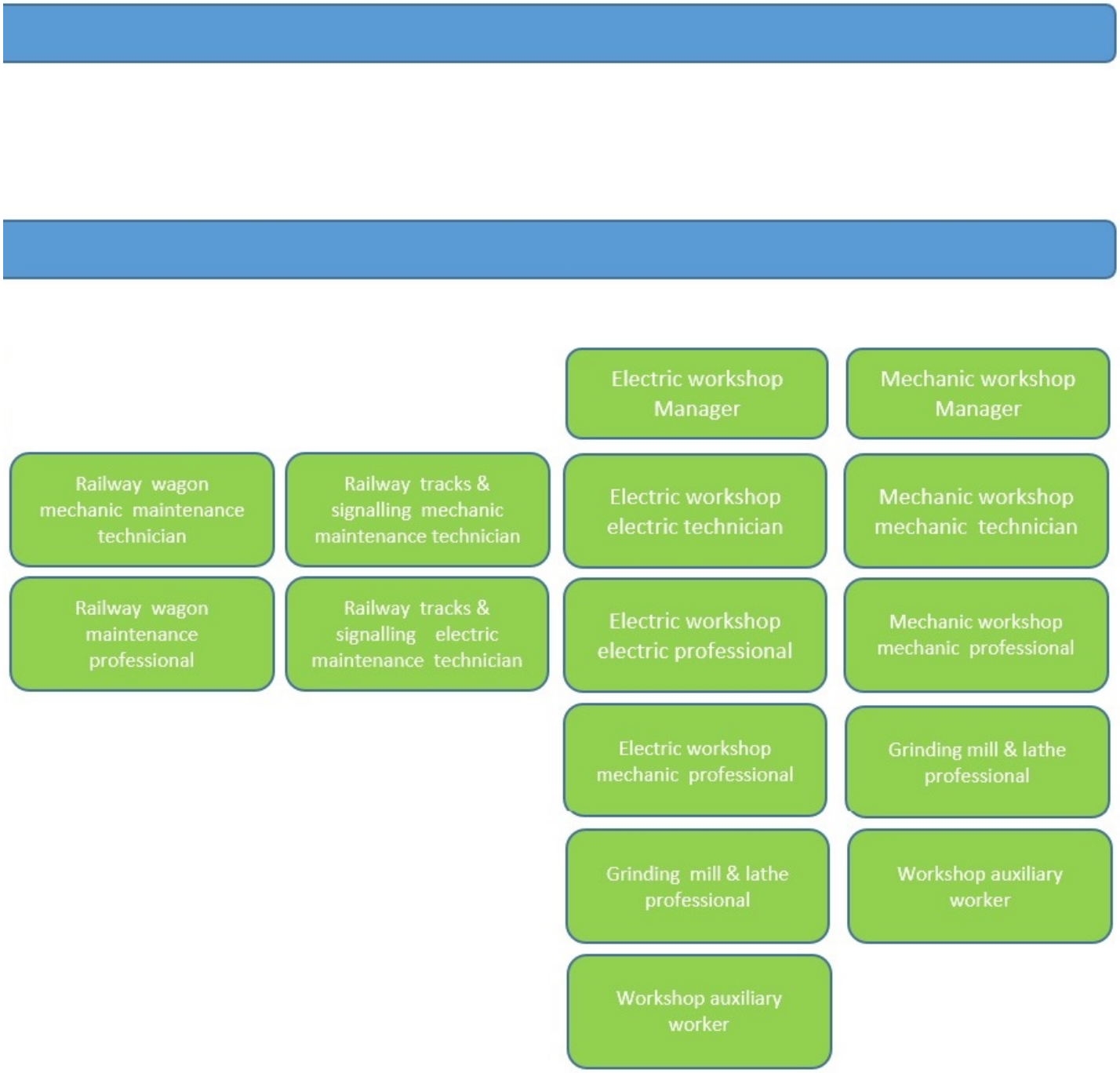

Level 1 Families
Rail rolling Mill
Level 2 European Steel professional role profiles
Roll grinding Shop manager
Dispatch & Yard manager
Finishing Production Manager
Train & Reheating Production Manager
Quality control Manager
Train & Reheating Shift Manager
Draughtsman Technician
Mechanic Technician
Yard Supervisor
Dispatch & Finishing Production Supervisor
Train & Reheating Production Supervisor
NDT inspector (team leader)
Mechanic roll chock professional
Tracking Dispatch
Rail Straightening machine operator
CHHR machine operator & maintenance (team leader)
Reheating furnace operator (team leader)
Mechanic guideway professional
Rail sawing machine & gag straightener operator & maintenance
Forging stand operator & maintenance
Bloom yard operator
Grinding mill professional
Inspection rolling table & Yard operator & maintenance
Cooling bed operator & maintenance
Lathe professional
Crane operator
Crane Operator
Train operator & maintenance
Gas cutting Operator & maintenance
Crane operator

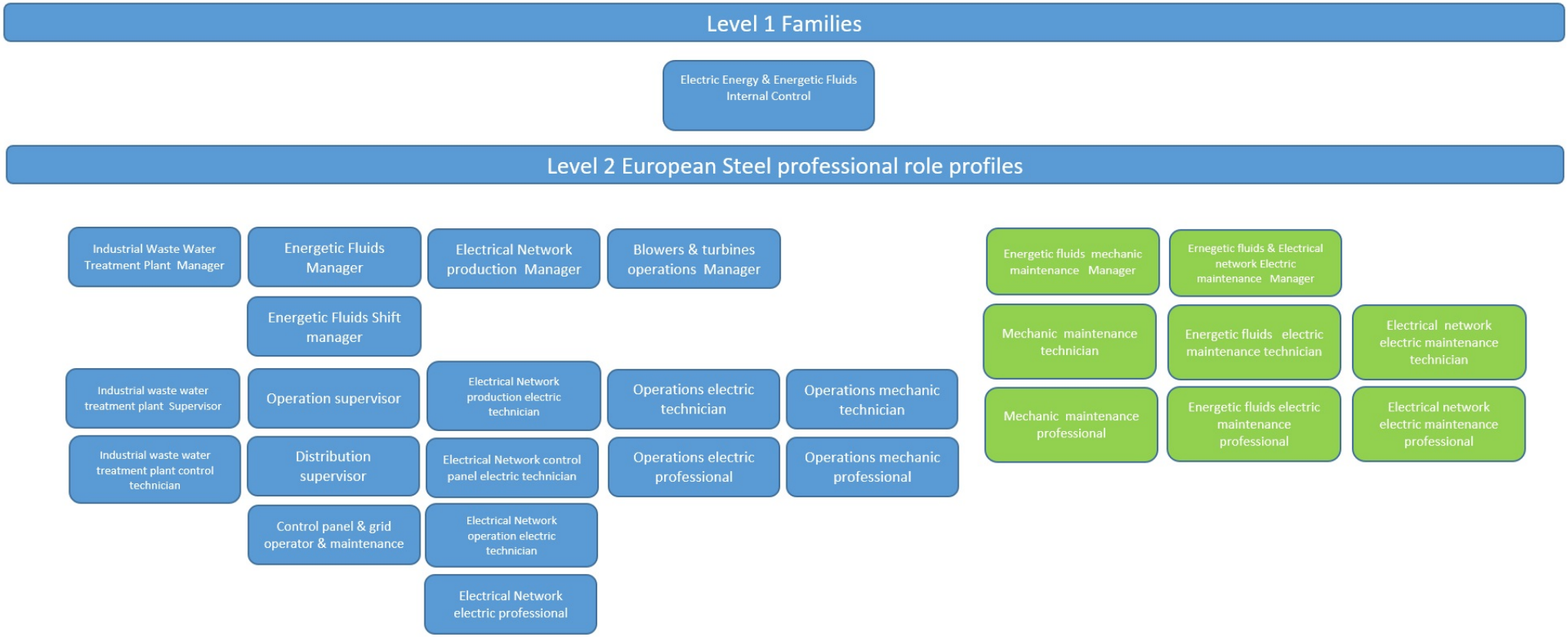

Electric Maintenance Manager
Mechanic Maintenance Manager
Electric Maintenance Technician
PLC Unit Maintenance Technician
Mechanic Maintenance Technician
Hidraulic Maintenance Technician
Electromechanic Maintenance Technician
Electric Maintenance Professional
Mechanic Maintenance Professional
Hidraulic Maintenance Professional
Electromechanic Maintenance Professional


Level 1 Families
Wire rod Mill
Level 2 European Steel professional role profiles
Roll grinding Shop manager
Dispatch & Yard & Crane manager
Finishing & Train & Reheating Production Manager
Wire Rod mill Administrative
Wire rod mill Shift Manager
Electric Maintenance Manager
Mechanic Maintenance Manager
Electric Maintenance Technician
Mechanic Maintenance Technician
Electric Maintenance Professional
Mechanic Maintenance Professional
Mechanic Technician
Blooming mill preparation operator (team leader)
Train Production Supervisor
Finishing Supervisor
Quality inspector (team leader)
Mechanic professional
Blooming mill preparation operator
Wire rod mill Process operator (team leader)
Finishing operator
Grinding mill & lathe professional
Crane operator
Wire rod mill process operator
Control room operator


Level 1 Families
Quality Control & Environment Laboratory
Level 2 European Steel professional role profiles
Organic & Environmental Analysis Manager
Special samples Manager
Steelworks Quality Production Manager
Raw Materials Quality Control Manager
Metallography & Microscopy Manager
Special samples Supervisor
Steelworks Quality Production Supervisor
Section analyst
Section analyst
Section analyst
Section analyst
Section analyst
Basic analyst
Basic analyst
Basic analyst
Basic analyst
Basic analyst


Level 1 Families
Central maintenance/Warehouse/ Internal Transport
Level 2 European Steel professional role profiles
Warehouse Manager
Inventory Supervisor
Warehouse worker movements
Warehouse worker refractory
Crane operator
Road transport Manager
Road transport Supervisor
Auxiliary billing (Consignment and transport documents)
Yard Manager
Yard Supervisor
Yard dispatcher & operator
Railway transport Manager
Railway shift manager
Railway Supervisor
Railway locomotive operator
Auxiliary billing (Consingment & transport dociuments)
Railway maintenance Manager
Railway locomotive mechanic maintenance technician
Railway locomotive electric maintenance technician


Electric workshop Manager
Mechanic workshop Manager
Railway wagon mechanic maintenance technician
Railway tracks & signalling mechanic maintenance technician
Electric workshop electric technician
Mechanic workshop mechanic technician
Railway wagon maintenance professional
Railway tracks & signalling electric maintenance technician
Electric workshop electric professional
Mechanic workshop mechanic professional
Electric workshop mechanic professional
Grinding mill & lathe professional
Grinding mill & lathe professional
Workshop auxiliary worker
Workshop auxiliary worker


Level 1 Families
Electric Energy & Energetic Fluids Internal Control
Level 2 European Steel professional role profiles
Industrial Waste Water Treatment Plant Manager
Energetic Fluids Manager
Electrical Network production Manager
Blowers & turbines operations Manager
Energetic Fluids Shift manager
Industrial waste water treatment plant Supervisor
Operation supervisor
Electrical Network production electric technician
Operations electric technician
Operations mechanic technician
Industrial waste water treatment plant control technician
Distribution supervisor
Electrical Network control panel electric technician
Operations electric professional
Operations mechanic professional
Control panel & grid operator & maintenance
Electrical Network operation electric technician
Electrical Network electric professional
Energetic fluids mechanic maintenance Manager
Ernegetic fluids & Electrical network Electric maintenance Manager
Mechanic maintenance technician
Energetic fluids electric maintenance technician
Electrical network electric maintenance technician
Mechanic maintenance professional
Energetic fluids electric maintenance professional
Electrical network electric maintenance professional