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

# Prototype of the Blueprint New Skills Agenda Steel

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## Executive Summary

The recent Prototype Blueprint is outlining a first strategic approach to proactively adjust skills demanded by the steel industry. Based on the recent and future technological and economic developments so far, demand and supply of training measures are outlined, possible strands and structures are figured out to be tested and checked with the stakeholders in the foreseen implementation and test phase. 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 European Steel Technology and Skills Foresight Observatory (ESSA ETF) (demand side), and (b) a European Online Training Ecosystem (ESSA OTS) as well as Regional Skills and Training Ecosystems (ESSA RTS) planned for the rollout (supply side).

Within the first implementation phase the necessary parameters for a sustainable integration of existing European and national/regional structures will be elaborated, 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 additional offers will be checked, esp. train the trainer modules, and integrated further in the **steelHub** of the Online Training Eco-System (ESSA OTS). More pilot training modules and offers from the steel companies and training providers will be collected and integrated in the steelHub (Online Training Eco-system) in line with the ESSA approach. Steel industry relevant training measures of other (mainly Erasmus and Leonardo) projects will be checked for an integration in the Online and Regional Training Systems, e.g. for Greening Technical VET (GET VET) and Equality and Diversity Learning in the European Steel Industry (EDLESI) as well as train the trainer modules. On the job, onsite training in companies and VET schools are mainly part of the Regional Training Eco-Systems (ESSA RTS) to be established.

Beside the already running 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.

The European Steel Technology and Skills Foresight Observatory (ESSA ETF) will be implemented 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 Ecosystems. 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.

## Background

The main objective of the project is to develop and run a Blueprint for an ongoing, *steel industry driven* European Steel Skills Agenda (ESSA), which is a strategy for the continuing and short-termed implementation of new skills demands to improve sustainability and resilience of the Steel Industry. This will be piloted by the development of related scenarios, strategies, frameworks, training modules and tools, 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 to meet the future requirements of the industry. Therefore, this first Blueprint Prototype sets the ground for the European Steel Skills Agenda (ESSA) and Sector Alliance based on the results of the first two years of the project. As it is industry driven it is strongly based on the company related skills requirements (Work Package 3 - WP3) which derived from the technological and economic development and foresight (WP2) complemented by the anticipation of future requirements by the Vocational Education and Training (VET) Systems (of so far selected member states representing different VET systems) (WP4). The Blueprint is designed as a practical and user-friendly orientation and information framework delivering contributions and solutions **from the steel industry for the steel industry**, incorporating all the stakeholder groups of the project (companies, training providers, research institutions, and associations / social partners). All the activities so far and the Blueprint outlines have been also informed by the results of the Steel Sector Careers project (https://op.europa.eu/s/n6SH). The strong network of the steel sector also ensures to have a synergetic exchange with other sectors (e.g. the energy intensive SPIRE sectors via the SPIRE-SAIS project) in regard to successful up-skilling approaches. Nevertheless, this Prototype Blueprint is just outlining possible strands and structures based on the ESSA results and discussions evidence so far, to be tested and checked with the stakeholders in the next phase.

The Blueprint Prototype serves as a first input and groundwork for the implementation and transfer of the Blueprint and the policy recommendations and dissemination activities (WP6 and 7). Therefore, the next phase of the European Steel Skills Agenda and Alliance (ESSA) will be the pilot implementation and transfer of the Blueprint Prototype (incl. first concepts for rollout and tests in the companies and on the steel regions level) as well as related policy recommendations and cooperation activities (esp. cooperation with relevant other sectoral Blueprints). Assessment of the blueprint and implementation of the established European Steel Skills Alliance (ESSA) will be completed in WP6 and 7. This includes feedback and improvement by the steel associations and social partners, the Advisory and Policy Group (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). In an iterative and cyclical way, the test of the prototype will inform a second round and improvement of the technological foresight, company skills requirements and VET systems contributions (WP2, 3, 4) which will lead to an improved ground for the final version of the Blueprint (end of 2023).

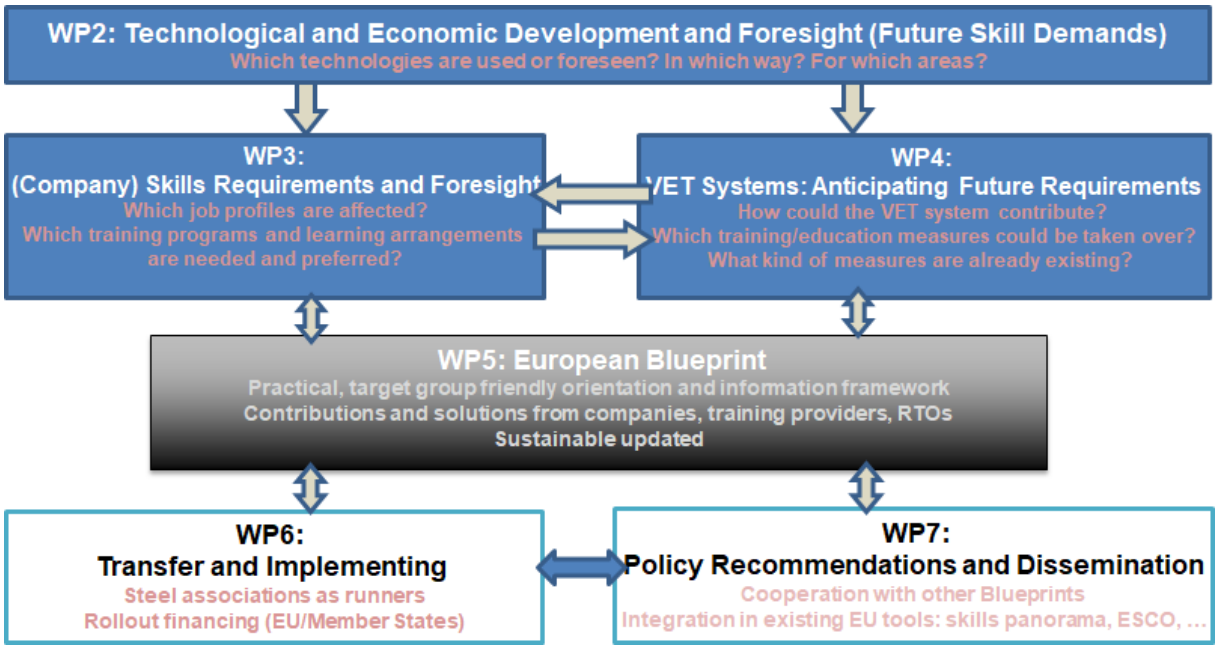



**Figure 1: Structure and work programme of ESSA**

The current prototype of the Blueprint is composed of:

- Strategies for the implementation of measures to meet defined skill needs, based on the sector skills framework and the improvement of sector occupations and job profiles
- Identification of relevant tools and upskilling schemes
- Development of training courses, tools and activities for integration within VET, company and association training programmes, including:
  - training courses for up- and reskilling existing profiles,
  - update of occupational profiles or parts of it
  - new leadership and work 4.0
  - train the trainer, improvements of training providers
  - new training methods and arrangements, considering new possibilities of digital learning and support and workers participation (e.g. workplace innovation, but also by using digital tools like tablets, smart phones, laptops, etc.)
- Development of a strategy to overcome central human resources challenges of the steel industry: 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 as well as strategies increasing the workforce mobility and diversity (e.g. increasing the attractiveness of the steel industry for women).
- Develop and implement success measures. Revisit and update lists of recommendations before roll-out.

The Prototype Blueprint will be further developed and piloted in WP6, mainly focusing on:

- strategies for the implementation of measures to meet defined skill needs,
- up-/reskilling schemes for existing and new occupational profiles and related VET curricula,
- further development of the prototypes of training tools and modules to adjust the immediate skills needs of the companies.

First the main approach of the Blueprint will show that ESSA develops a holistic and transformative orientation system with new alliances and changing social practices. Based on the work package structure of ESSA five topics and their interrelation will structure the Blueprint strategies, activities, measures, and tools:

1. Technological and Economic Demands and Skills Requirements
2. Skills Adjustment
3. Strategies / Measures
4. Alliances and Leadership
5. Rollout.

The Blueprint is devised as an online brochure/checklist (pdf) but also as an **interactive** online program with a user demand-oriented interface ensuring continuous updating. An abbreviated printed brochure is also in consideration to attract people (in conferences, meetings, and other events).

Central offers of the ESSA Blueprint so far are:

- European Steel Technology and Skills Foresight Observatory (ESSA ETF) ensuring a European wide coordination: e.g. of Steel Sector Campaigns (Image, Recruiting, Diversity, …), Awards, Test Fields, Pilot Projects
- Online and Regional Training Ecosystem Framework (ESSA OTS and RTS)

The Blueprint development and implementation will be done in five phases:

Phase 1 and 2 (2019): Requirements / Reflection (completed)
Phase 3 (2020): Prototype (completed)
Phase 4 (2021): Improvement / Implementation and Rollout Strategy
Phase 5 (2022): Optimisation/Finalisation
Phase 6 (from 2023): Sustainable Establishment and Rollout to Steel Regions (first rollout activities, tests already in 2022)

Key challenges of the Blueprint relate to the priorities of companies and the resources that will be allocated to skills development on top of other issues the industry is currently dealing with. Skills are important for the steel industry as these contribute to productivity and creating high-value products, yet the industry faces global issues and market issues that push back skills development and space for engagement with skills issues (such as overcapacities and global competitive distortion, COVID-19 crisis). Bringing together industry stakeholders is crucial to increase the efforts towards skills development. How the industry is supported to recover is also an important factor that will affect where skills stand in the priority list of the steel industry.

## Programmatic Orientation and Blueprint Outline

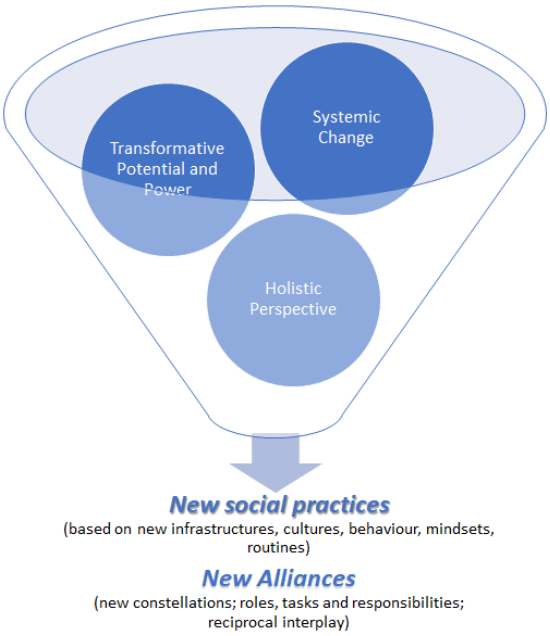



**Figure 2: ESSA approach – new social practices and alliances**

The development of the Blueprint is a bottom-up social innovation process, integrating all the relevant stakeholder groups (companies, training providers, research institutions, associations and social partners) right from the beginning. This includes also the integration of managers, workers and trainers from different departments, combining a company with the training providers perspective - on a European and a national and regional level. Taking up this holistic approach ESSA looked for the transformative potential and power of technological and social (people related) change in a systemic way → developing an accepted orientation framework for adjusting skills proactively leading to new social practices (for new infrastructures, working conditions, behaviour and mindsets) to improve existing routines. To move things forward in this directive new alliances with new constellations, roles, tasks and responsibilities in a reciprocal interplay have to be established.

The structure and work programme of ESSA (see Figure 1) is reflected in the general Blueprint outline:

1. Current and future technological and economic developments and related 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 (iterative, feedback-loop approach):
    - Foresight Observatory: coordination of the technological foresight and skills needs on regular monitoring tools (such as ESSA European Steel Technology and Skills Foresight Panel (ESSA ETF), Skills Assessment Checklist)
    - 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 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 good or best practice awards, online forum(s), 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 lifelong has to be established between companies/industry/social partners - VET systems - the individual worker.

4. To sustainably run the Blueprint new alliances and governance structures have to be integrated in existing sector structures, assigning leadership for the 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, ...) as far as is feasible and possible.

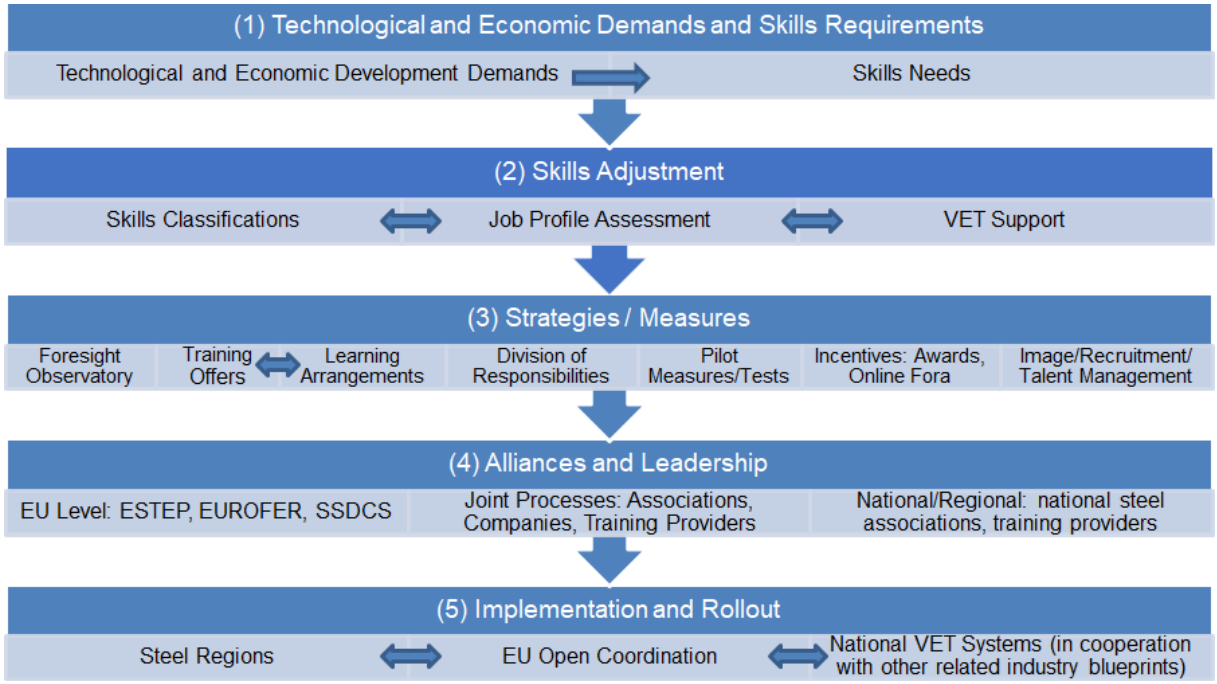



**Figure 3: General blueprint outline**

The holistic and industry driven approach of the Blueprint for a **Technology and Economy Driven Skills Adjustment** is shown in the following flow chart is listing the main topics from a skills perspective, which will be combined with related strategies, activities, and tools. A first cluster (demand) sets technology (and economy) as the genuine driver of new applications (implemented with specific company objectives) leading to organisation implications. The triangle of **technology - organisation - human** is the frame for defining the new skills needs. A second cluster is dedicated to supplying 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 (private) training offers and VET system support (via curricula of initial and continuous VET, aiming to identify gaps in the provision of certain skills categories). 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).

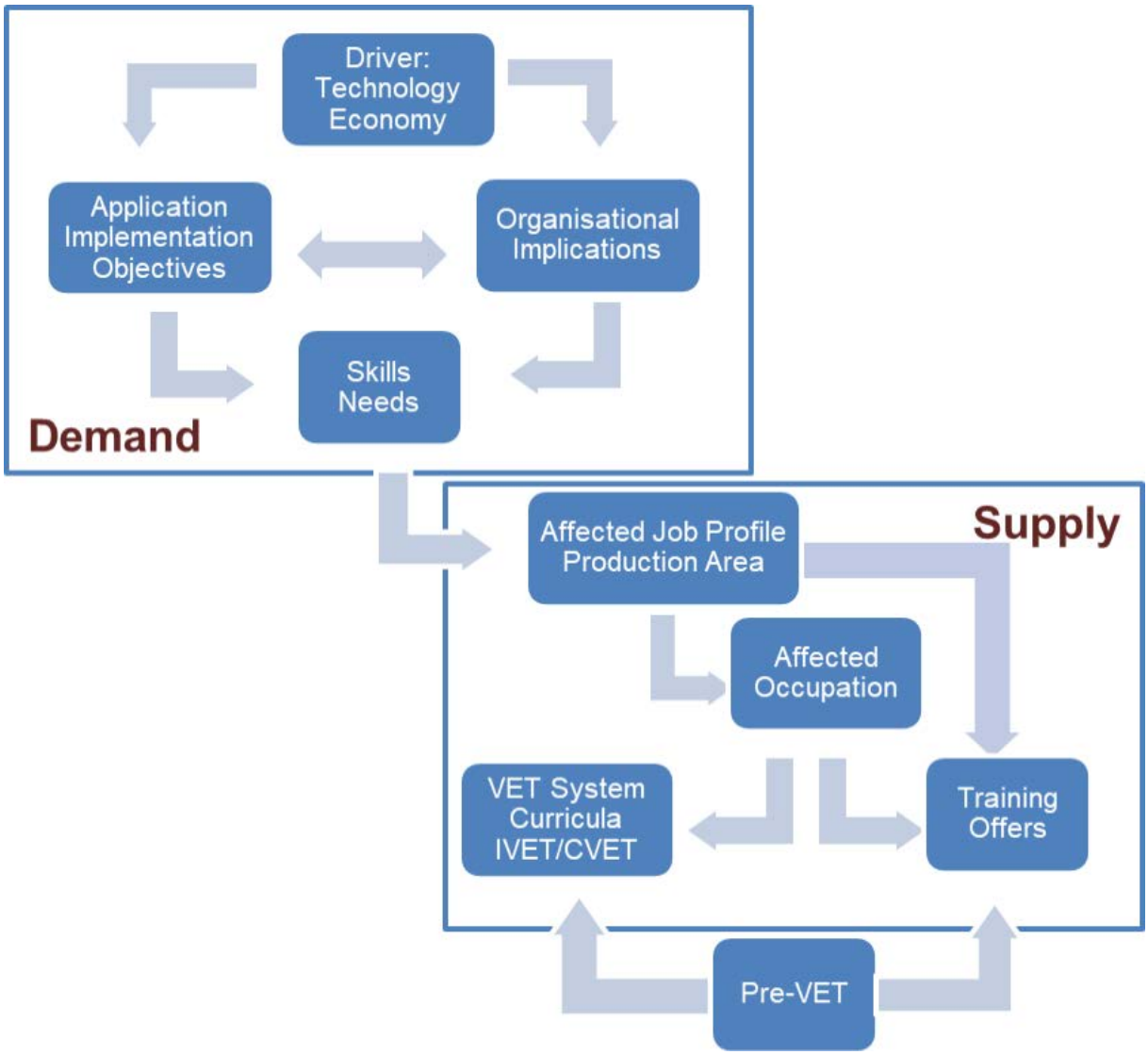



**Figure 4: Industry and technology driven skills adjustment**

However, beside the industry driven perspective ESSA also focuses on a worker-centric approach of technological development:

> *"Against the backdrop of the implementation of the broad range of Industry 4.0 technology the workers are confronted with changing roles and increased reliance on complex technologies. Upskilling of the workforce includes therefore also workers empowerment, challenging their traditional education life cycle of training, work and retirement. Technological development has to be complemented with the cognitive, experience and practical based skills of the workers, already in the technological innovation development phase - leading to more responsibility for and increased supervision of the production process, advanced "collaboration" between humans and robots."*
>
> *"Rather than asking the industry worker to adapt his or her skills to the needs of rapidly evolving technology, we want to use technology to adapt the production process to the needs of the worker, for example to guide and train him/her."*
>
> *(ECB paper Industry5.0, p.2)*

Additionally, the process of developing the ESSA Blueprint is organised as a social innovation process, integrating relevant and intrinsic motivated stakeholders of different areas and proveniences right from the beginning in the consortium (including associated partners, willing to participate on their own costs). Starting with the **challenge** of adjusting skills needs because of new technological and economic development, the **idea** of a sectoral Blueprint of the Erasmus+ program was taken up, leading to the **intervention** of setting up a first European Steel Skills Agenda and Alliance 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** are planned, ensuring upgrading of the interventions and implementation of the Blueprint.

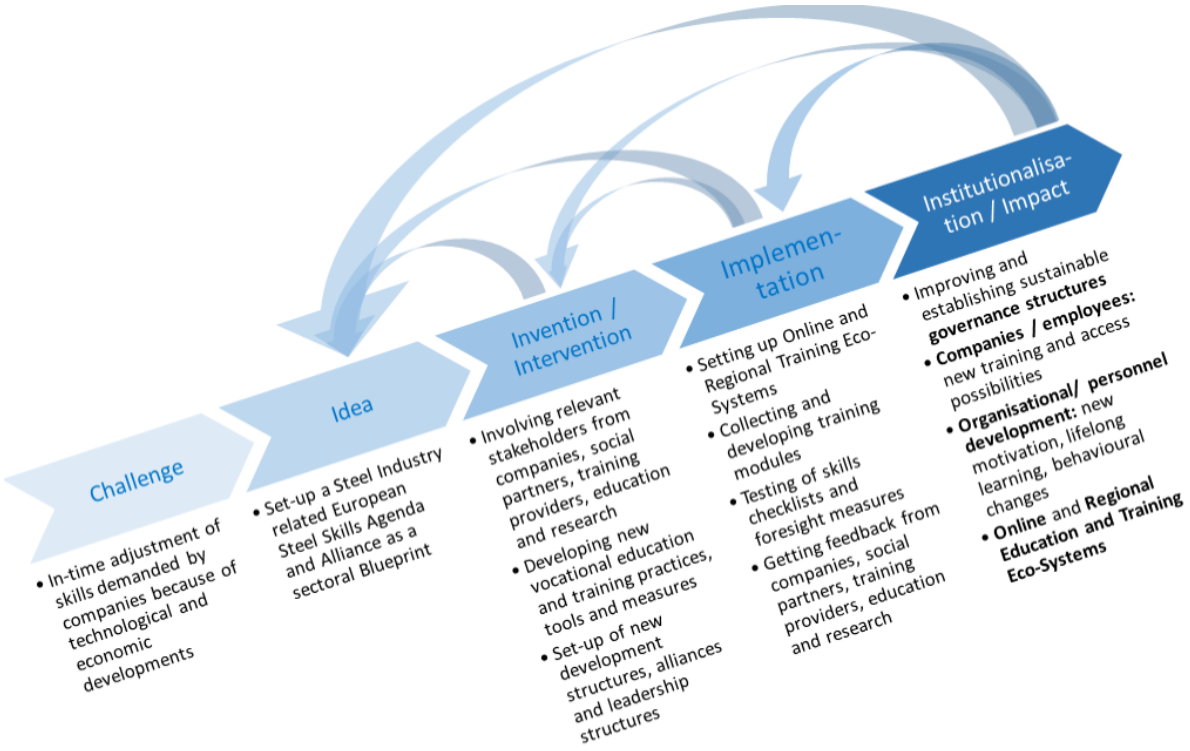



**Figure 5: Blueprint development as a social innovation process**

# 1 Technological and Economic Demands and Skills Requirements – The Demand Side

The starting point and background of the Blueprint are the technological and economic developments as far as they can be foreseen. In general, changes in the European Steel Industry are not only due to technical change but also due to pressure of globalisation and Non-EU Import of steel products because of global overcapacities (state subsidies distort the world steel market and the steel trade flows). To adjust the skills proactively the current and future implementation of new technologies have to be considered with respect to their implementation and related organisational changes. Defining the demand side an intensive desk research and analysis of European current innovation projects in the steel sector (e.g. RFCS, HORIZON2020) took place, reflecting the existing innovation streams within the steel sector including Best Available Technologies, technologies for low-carbon

steel and Additive Manufacturing, and complemented by a survey of steel companied. A wider backdrop was provided also by the aforementioned Steel Sector Careers Blueprint.

The determination of skills demands is based on this inspection of the technological and economic drivers, their application, implementation and objectives and their organisational implications. Here it has to be kept in mind, that companies are mainly following the production logic, and human resources and skills are often left behind (because they are often not appointed to production necessities). ESSA will have to make sure that both are combined: improved skills will improve production and products as well as competitiveness. Therefore, a systematic connection between intra-personal skills and the adjustment of production logic and chain has to be established.

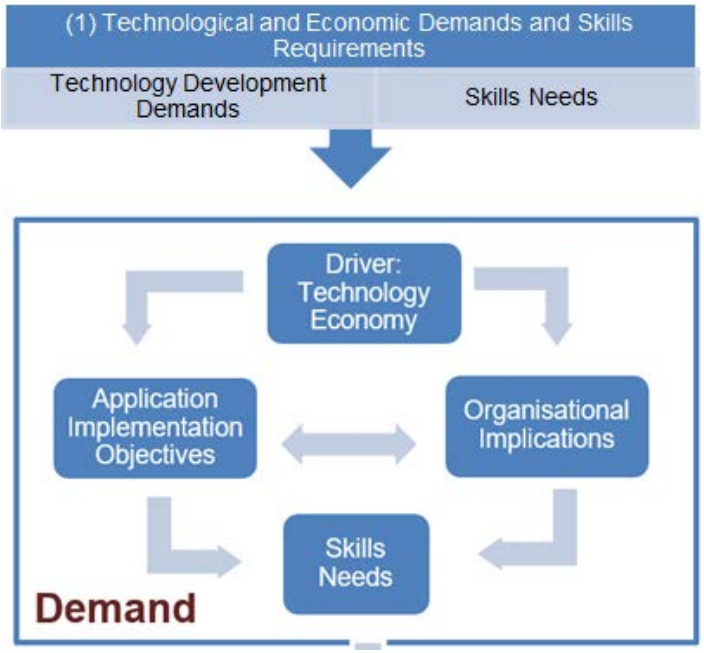



**Figure 6:**
**Technological demand and skills requirements**

Looking at the demand side of the technology and industry driven skills needs the drivers identified are covering a broad range of technologies, implementation areas, organisational implications, involving different production areas and products. As a result of the forecast analysis based on recent innovation projects most of recent Industry 4.0 technologies are in place, including Key Enabling Technologies (KETs) in the area of advanced manufacturing and processing: 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, Virtual/Augmented Reality and Predictive Maintenance.

| Technologies in place | Applications | Objectives |
|---|---|---|
| • New generation of sensors<br>• Big Data and Analytics<br>• Machine Learning<br>• Artificial Intelligence (AI)<br>• Internet-of-Things (IoT)<br>• Internet-of-Services<br>• Mechatronics and Advanced Robotics<br>• Cloud Computing<br>• Cybersecurity<br>• Additive Manufacturing<br>• Digital Twins<br>• Predictive Maintenance<br>• Virtual/Augmented Reality | • Online / Offline Assistance and Support Tools<br>• Additive Manufacturing (new alloys for powders and 3D printing)<br>• Robotic applications for the replacement of (manual/human) activities<br>• Supply chain management<br>• Virtual testing<br>• Inspection and defects detection system<br>• Tracing<br>• Product tracking<br>• Real-time production control and monitoring systems<br>• Process Simulation/Optimisation<br>• Knowledge Management tools | • Processes optimization from an economic perspective:<br>- Energy efficiency<br>- Efficiency of raw material consumption<br>- Lower Operating Expense (OPEX)<br>• Reduction of losses as well increase of product qualities and productivity<br>• Increase of health and safety in the workplace<br>• Valorization and enhancement of the Company knowledge |

**Table 1: Technologies, applications and objectives**

These desk research results were underlined by the survey answers (see figure 7): Planned investments cover a broad range of technologies (with Cyber Security, Data Analysis, and IoT technologies in front), affecting a broad range of company areas (with process chain control and data management on top), and with a lot of different benefits (such as cost reduction, improvement of quality and workplace safety, competitiveness and sustainability).

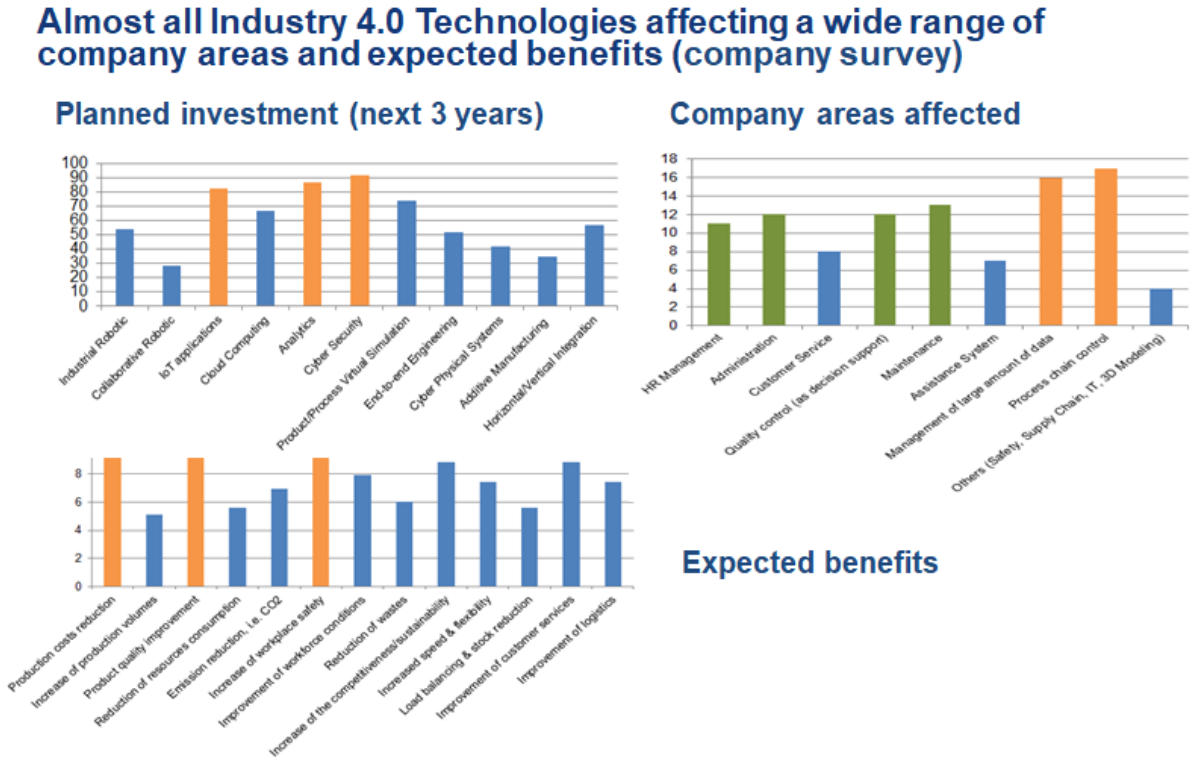



**Figure 7: Planned investment, affected company areas, and expected benefits (survey results 2019, percentage of participants)**

The ESTEP Focus Group Smart Factories combined 18 research, development, and innovation areas related to the steel industry to five technological clusters of which one especially is putting human empowerment and human-in-the-loop on top (see Figure 8). This more detailed list of current research activities from a smart steel factory perspective indicates the main application areas:

- Improvement of production processes
- Autonomous operations
- Improvement of green steel
- Augmented support of workers and management, including new skills acquisition and learning arrangements
- Expanding information and communication technologies

| | R&D&I Areas | Technological Clusters |
|---|---|---|
| 1 | New sensors, soft sensors and plug-in objects | Automation, Process Setup, Process Control & Supervision |
| 2 | Big Data & Analytics - Artificial Intelligence, Machine Learning, Deep Learning | |
| 3 | Modelling: First Order Modelling, Multi-scale & Multi-Physical Modelling, Data Driven Modelling | |
| 4 | Digital Twins, Virtual & Augmented Reality | |
| 5 | Remote Operations, Robots, Drones | Autonoumous Operations, Remotization |
| 6 | Cyber Physical Systems and Autonomous Systems | |
| 7 | Productivity, Efficiency, Interoperability, Scalability, Flexibility | Digital Technology for Sustainability |
| 8 | Asset Inventory & Monitoring, Predictive Maintenance & Asset Management | |
| 9 | Energy Management, Emission and Pollution Monitoring & Control, Circular Economy Platforms. | |
| 10 | Intelligent Logistics & Logistic Management | |
| 11 | Tracking & tracing of products and product Quality; Smart Product Inventory | |
| 12 | Integrated Manufacturing Chain & Supply Chain Optimization and Management | |
| 13 | Augmented Reality, Smart Pulpits, Wearable Systems, Business Intelligence | Empowering Humans, Human-in-the-Loop |
| 14 | Cognitive HMI; H2M; M2M techniques & technologies | |
| 15 | New Skills, AR & VR for Training, Continuous Learning, | |
| 16 | Super-Internet; IoT & IIoT; Smart Networks | Digital Technology for IT&OT Landscape |
| 17 | Flexible and Data-driven ICT Architectures, Cloud, Standardization | |
| 18 | Cybersecurity | |

**Figure 8: Technological clusters in the steel industry**

Against this backdrop, it becomes evident that the steel industry is on track and in line with the "**twin transformation: digital and green**" announced by the European Commission (e.g. within the the Clean Steel Partnership, in which a part of the budget is allocated to people and digitisation). In detail digital and green transition in the steel Industry comprises:

- Integration of all systems (sensors, automation, and IT systems) and productions units in different dimensions:
  - Vertical: systems across the classic automation levels from the sensor to the enterprise resources planning system
  - Horizontal: integration of systems along the entire production chain
  - Transversal: based on the decisions taken during the steel production chain, considering technological, economic and environmental aspects at the same time (automation and optimization technologies and their combination in an integrated way)
  - Life-cycle: integration along the entire lifecycle of a plant from basic engineering to decommissioning
- Digitalization trends: adaptive online control, t-p optimization, t-p synchronization of data, zero-defect manufacturing, traceability, intelligent and integrated manufacturing
- Knowledge Management (big data and human expertise) as key factor for new developments.

Objectives and expected benefits are deriving from optimisation, automation, interconnection of production processes:

- Improvement of quality, flexibility and productivity through the optimization and interactions of the individual production units
- Adaptive online control, through-process optimization, through-process synchronization of data, zero-defect manufacturing, traceability, intelligent and integrated manufacturing
- Improved Knowledge (Data and Human expertise) Management
- Enhanced environmental process performance by combining digital and $CO_2$ mitigation technologies
- Increased health and safety

Main economic factors:

- Reduction of energy and raw material consumption, lower operational expenditure (OPEX), reduction of losses, increased product quality and productivity, improved flexibility and the reliability of processes, customer orientation (quality and specificity)
- New business models & organizational structure: stronger networking between business processes, creation of efficient interfaces, integrated data exchange and management

Nevertheless, the potential of the technological solutions (reflected in the analysed innovation *projects*) seems to a high degree unused and unfolded because of missing systematic digitalisation and investment strategies and priorities. Although there is a high innovation *research* engagement (reflected and evidenced by a huge number of projects related to Technology Readiness Levels TRL 6/7/8), there is still an **implementation lag** of existing technologies (TRL 9) because of high investments needed, high risks, and the recent economic situation (on the global market, the current corona pandemic). Investment perspectives are needed to develop an advanced digital and green steel industry to ensure the transition from pilot projects to implementation and institutionalisation. This is not only due to the European steel industry, as a paper on "Industry 5.0" states: "Despite claims of digital technology developing exponentially and becoming ever more disruptive in nature, the adoption of digitalisation in European industry seems to be of a more gradual nature. Although specific new technologies may allow for new, disruptive approaches, the large infrastructural investments required for some types of industry and the fragmentation into a multitude of small players (lacking digital skills or investment capacity) in other areas, result in the current uptake of digital technologies in European industry being linear rather than exponential, and gradual rather than disruptive." (DG Research & Innovation 2020, Concept Paper Industry 5.0, Draft p7)

However, whilst technological development and insertion is shown to be largely gradual and phased there remains a significant disjuncture between technological innovation and skills provision - in the perspective of the industry *VET systems lag behind technological innovation*. Within the context of ESSA new technology implementation is affecting the workers and the workplace in a more incremental way. Innovative applications in this way are mainly implemented for supporting workers and work with and for the given but optimised infrastructure.

| The practice perspective of a company<br>(workshop with representatives from different company areas and hierarchies): |
|---|
| Specialisation is growing, mass production is declining, data exchange is growing (of the up-stream and downstream production processes, new links between shifts, information from shift do shift, plant-wide process optimisation, error search and guided trouble shooting), quality control is increasing because of new technologies, every plant and company is working different, former orientation of maintenance is changing from current malfunctions to continuous data, knowledge and condition based lean and foresight maintenance<br><br>Leading to a growing importance of individual experiences and competences, interdisciplinary teams, broad range of qualifications, long company internal training and familiarisation periods (2-3 years) (for new positions and after VET / HE graduation)<br><br>Improving integration and use of new media (monitors, tablets, boards, smartphones, ...), new sensors and measurement technology in the production and maintenance processes for transparent and foresight-oriented knowledge, activities, and knowledge-based monitoring and decision making. |

**Table 2: Technological development (workshop results with company representatives)**

Against this background a first skills needs analysis leads to three main complementing strategies:

- Incremental up-skilling of existing job profiles with a main focus on transversal skills and up-skilling of the existing workforce
- Buy-in of digital competences from external experts, consultants outside the company that could not be imparted by upskilling of the existing workforce
- Recruiting and retaining talented people with digital skills.

Whilst specific, technical skills are still needed (Steel Sector Careers Project) and to be updated and upgraded, transversal or soft skills are more and more in focus because of the new digital applications. Transversal skills across different job profiles are important to enhance the workforce and companies' resilience against different types of turns by improving adaptability of workers and so potentially a better capacity to deal with organisational changes where and when needed.

Both types of skills could be related as company and/or steel sector specific as well as process industry overarching. Therefore, also transferable (mainly transversal or soft) skills from sector to sector or to different VET systems of the member states have to be considered to take advantage of possible synergies. The ongoing technological and organisational improvements desire continuous learning, more and more also in an interdisciplinary perspective (e.g. by adding green and digital applications to the steel production, integrating customer requirements).

Based on these results and assumptions the main challenges are the broad range of

- Relevant new technologies
- Concerned job profiles
- Affected production areas (including particularly maintenance).

The main challenge is how to serve the whole range of professions and how to select and prioritise affected job profiles. To close the digital skills gap esp. upskilling of low and middle skilled workers as well as recruiting and retaining talented people with digital skills (because of the still existing negative perception of the steel sector and its recent economic situation) (see Steel Sector Careers Project) are

key. The question of job losses through further automation and replacement of routines by new technologies seems recently not to be expected in a relevant way. This might be due to the already done atomisation of production years ago with a loss of about 40.000 jobs. As global restructuring is still also an issue for the EU industry seeking competitive advantages, besides competition on cost the focus is much more on quality nowadays. But, if Europe will continue to have a quality-oriented steel industry not only investment in research and innovation, new products and technology, and regulatory protections is required but also in skills. The trend to specialise creates at the same time a high need for outstanding communication skills. Only if a specialist is able to efficiently communicate with specialists of other domains, the complex challenges of today and tomorrow can be mastered in a competitive way.

Nevertheless, there are different scenarios hypotheses concerning jobs and skills: substitution, polarisation (more low and more high skilled workers with reduction of the middle level), and upskilling. Based on our current results ESSA is assuming a somewhat uniform and consistent penetration of the key Industry 4.0 technologies across the sector and that the Blueprint tools and strategies are outlined on the basis of this ideal-typical scenario (which may apply to some countries or companies, but not necessarily to others), showed by current evidence. However, in further observation and discussion ESSA will continuously check the still remaining potential for appearing totally new job profiles and negative implications and job losses.

**Skilling and Training in Times of Covid-19**

The Covid 19 crisis is a good example that digital skills are catalysed by economic and societal demands and necessities. As most of the steel companies reduced and stopped production during the pandemic crisis 2020, education of apprentices and training of the workforce could be a measure to use the time given. There are already digital training courses available for online courses on different topics (including digital skills), e.g. at the steel university[1], within the big companies, and national training providers. The crisis could be used to increase new learning arrangements (quantitatively and qualitatively). Training providers, companies, workers and apprentices have to improve their digital skills for both learning and the workplace.

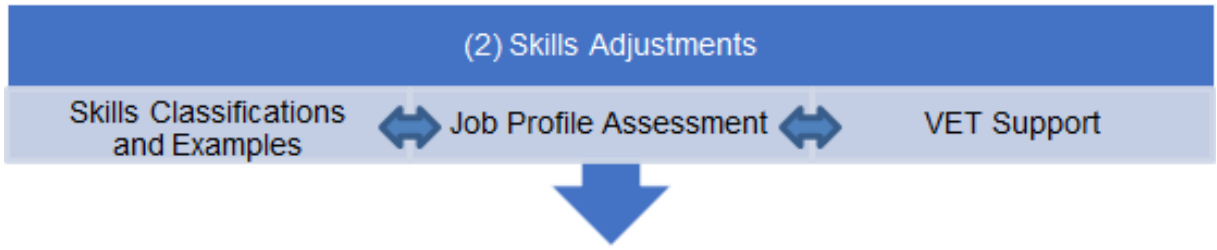
Some training providers have already learning labs (incl. relevant machines), used for online learning and training possibilities. Some companies offer education and learning remotely. For instance, 60 trainers of thyssenkrupp Steel Europe are teaching now 660 apprentices in their home offices, focusing on specific topics like health and safety, compliance, and maintenance.

This crisis is the right time to focus on the improvement of digital skills for learning and teaching as well as for re- and upskilling of the workers: this is the heart of ESSA.

# 2 Skills Adjustment Approaches

Based on the technological and economic implications a strategy for adjusting skills in a proactive way was piloted leading to a steel sector specific **skills classification** (grounded on existing classification schemes, such as the European Qualification Framework EQF, the ESCO Database, and the European e-Competence Framework) and an overarching **job profile assessment** (oriented at the functions within the production areas, including maintenance).

[1] https://www.worldsteel.org/more-items.html?tag=%2FLearning&page=1&origin=%2F




Based on the results in chapter (1) Industry 4.0 is expected to affect 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 occupational descriptions, roles and functions. Besides, there will be a moderate upskilling of a lot of existing job profiles and occupations (digitalisation of unchanged occupations).

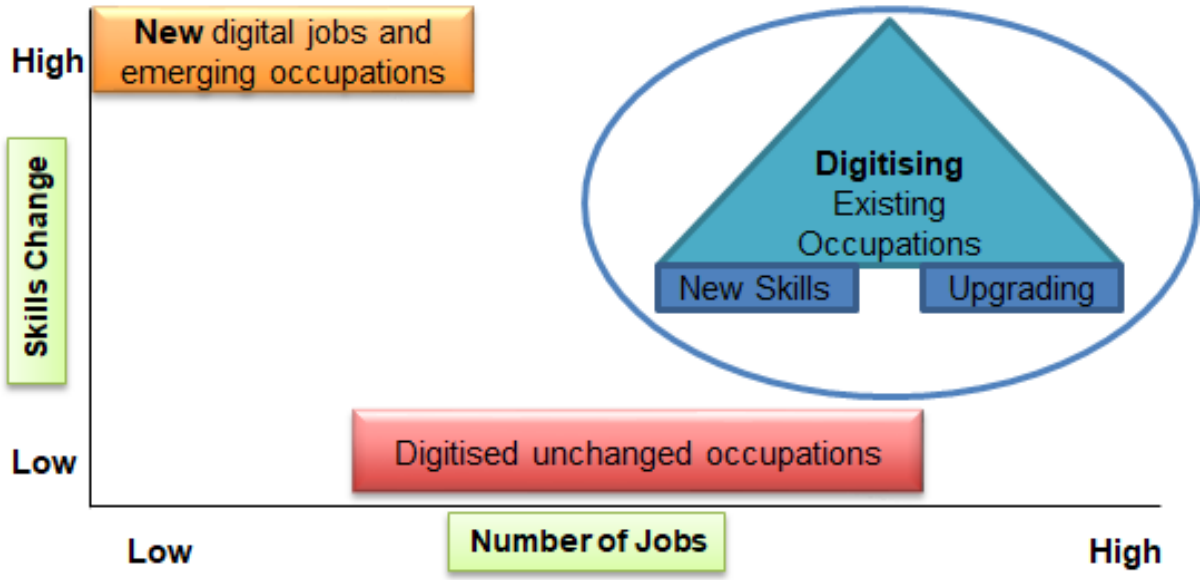



**Figure 9: Number and skills degree of affected jobs (based on Schmid, CEDEFOP, World Congress on TVET, 13-16 May 2012)**

Although ESSA is focusing on the *incremental* technological change in production (e.g. as it was done in the COCOP project) it is relevant to keep an eye also on still happening *disruptive* technological change (mainly based on automation and taking place in maintenance (see ROBOHARSH project Colla et al. 2017). It is important to differentiate between *incremental* (COCOP: adding a control system to existing production systems) and *disruptive* technological changes (ROBOHARSH: replacing manual work in a substantial way via robotic assistance with a new control and monitoring system). While in COCOP new skills are dedicated to gather additional information from a plant-wide perspective for the production process, in ROBOHARSH completely new digital skills are replacing manual dexterity. Both processes have different needs and ways to integrate operators and workplace experience as well as a different impact on skills and training. But again, the main company strategy nowadays is to buy-in digital know-how externally that cannot be trained to or covered by the existing workforce.

### *2.1 Sectoral upskilling schemes*

Before being able to identify successful **sectoral upskilling schemes** in the steel industry, there is the need to define the digital changes and the impact and requirements at the workplace and for the job profiles and roles, predominantly for its production and maintenance departments. As the ESSA analysis and the further results of workshops with steel companies showed, digital changes affect more or less and in different ways the complete steel making process, meeting on different groups of recipients with varying *access*, *abilities* and *willingness* to digitalization. Steel industry is on its way of transformation, but also (partly) trapped in old structures of education plans/content, training methods and imparting of knowledge. Innovative forms of learning concepts and skills development have more or less lighthouse character. Facing shorter cycles and more dynamics including a tremendous growth in media diversity make digital changes obvious: Opportunities for remote diagnosis rise (also meeting the employees will to work e.g. in a home office), machine learning could enable smarter production and maintenance processes, but still, skills are needed to cope with big data complexity in order to unfold the digital possibilities steel companies could profit from. This high-speed logic implies that the steel making infrastructure needs to address high speed training and qualification demands, since the whole steelmaking process is potentially affected by digital changes.

To meet production and maintenance needs, VET and company **training curricula in general should address complexity and the dynamics of change**, i.e. being open for modification in order to meet the ability and the willingness as well as motivation of employees to participate successfully in digital changes and its impact on-site production. For that reason, the sector has defined beneficial factors for successful steel specific education and training, such as target-group orientation, open minded attitude, user orientation, attractiveness of methods, try and error possibilities, cooperation orientation and on/near-the-job imparting of knowledge. Deriving from practical experience, hence industry driven, basic agreements on fundamental contents face consensus, but still, steel industry uses mostly traditional training methods, especially from a blue-collar worker perspective. Instead, project related training with precise scheduling could enhance the promotion (partly transformation) from operators (physical/ repetitive work) to supervisory or managerial level. Also, on-site training arrangements that meet the precise skill need of a special working situation should be more common, and focused on in the future (i.e. micro learning arrangements).

The steel sector is fully aware, that compliance restrictions prevent from intense intra-sectoral exchange since the rules of competition law are of utmost importance. But undoubtedly, training methods must meet the needs of companies and must be attractive and target group oriented for those who shall apply knowledge, no matter in what company of the steel sector they are working. Therefore, ESSA is promoting a **European joint alliance and strategy for upskilling** the workforce fundamentally and serving a platform for innovative learning arrangements and contents, accessible for the whole sector. Increasing the attractiveness of training and imparting of knowledge by innovative methods is one of the success factors of upskilling schemes, facilitates the adaption to shorter cycles mentioned above and adds value to the sector, e.g. by addressing problem-solving competencies of the workforce. The transformation from classical trainings to target group specific digital ways (e.g. by using Virtual Reality or simulators) and micro-learning modules promise to be success factors in upskilling schemes since they could be provided just in time when needed.

Education and training programs are suitable for the steel sector in at least two ways:

1. They should meet the shop floor needs and they should comply with (changing) formal job profiles. A promising approach for production/maintenance is to provide (vocational) training modules with micro learning on-site, informal learning and traditional training but also remotely, in order to meet the mobility needs of today´s workforce. This way of imparting knowledge by different media or tools is key to increase attractiveness of trainings and also allows their "on-site" applicability in many areas. This game changing way of upskilling has implications for the leadership culture: Since employees not necessarily have to be on-site to do their jobs, remote leadership will gain in importance and trust will replace attendance-culture. Furthermore, todays leaders have to stay up to date regarding their own IT skills.
2. Concerning formal job profiles, parts of the vocational or commercial training curricula should be if possible modularized, short education and training units (as part of Initial and Continuous VET). The formal requirements and somehow "statics" of traditional occupations in the steel industry are not able to withstand the dynamics mentioned above. Apprentices have to catch up with the speed of development, therefore, overall competences become more and more important. Thus, the question must be raised, if it is still appropriate to let young people aged 16 decide upon their definite occupation without having the possibility of (digital) specialization when running through the curricula. This question will become more and more relevant since automation and digitalization skills will be more and more demanded by the industry to cope with technological development. Basically, all occupational profiles will have to transform: more IT, more process-competence, more problem-solving and social competencies while meeting personal demands of the steel workforce 4.0 at the same time.

Having described digital changes, preconditions for successful sectoral upskilling schemes and the necessity of their suitability, it is important to circumscribe the idea of the future development of education and training programs. The workforce will work independently in complex topics with digital media, being individually responsible regarding its own training when closing knowledge gaps. There is no doubt, that guidance is needed to foster the idea of self-responsibility. Leaders need to differentiate between employees´ "pull factors" (such as training schemes for personal career progression) and "push factors" (fundamental training to be successful in the current position). But in times of ongoing digitalization, which can potentially lead to rationalization, it becomes more and more key to learn "on your own". This employee self-responsibility can only work in cooperation with focused and empathically leadership guidance. Executives must operate as mentors and motivators. They need to address employees´ confidence, since it is not an easy step to admit a lack of skills. Thus, if the future development of training shall be successful, it must be accompanied by an open feedback culture between employee and superior. Precondition for a successful development from the executives´ perspective is to prove their confidence in their employees. Leadership is not an easy task which needs time to put cultural change, hence conditions for self-learning, into operation. Leaders have to be "role models" when identifying new ways of learning in order not to be driven by development but to drive change and to demand new ways of training and education. It will become more crucial to demand performance in the future. Therefore, skill gaps must be closed fast by flexible programs.

This is underlined by required managerial and leadership competencies and qualities stressed by the talent survey results of ESTEP (Echterhoff/Schröder 2015, p. 28ff.): "The ability to motivate employees was seen as the most important behavioural competence. Top ranking behaviour included also

willingness to share success, openness to change and new information, and ability to make well-informed, effective and timely decisions. Also treating others with courtesy, sensitivity, and respect was seen as an important leadership behaviour." Therefore, an appropriate working environment is needed to unfold these issues.

Management needs to anticipate further developments of skills. Therefore, it must be aware of its proactive role when addressing skill needs. Due to further rationalization, complexity and transformation, the *leadership span* will extend. Executives must promptly identify significant future changes and control the demand for training of their workforce in time. To facilitate the imminent developments leaders must take responsibility for coaching and provide orientation. The understanding of the whole steel making process is important. The development of skills depends on various factors that have to be considered. As ecological changes and challenges might set path for further technological breakthroughs, human factors in total must not be neglected, such as skills.

Furthermore, a tightening of the labour market with regard to skills supply to the industry (quantity and quality) threatens to impede the pace of sector development. It is important that employers develop strategies to recruit and retain the best talent and build connections with education and training institutions e.g. VET schools, universities, as well as policy makers and other related stakeholders. For the industry to address its needs, it must remain politically relevant. Efforts in this direction require the building and maintaining of stakeholder relationships, and establishing firm patterns of collaboration and engagement at all levels. See the section below on Regional Training Ecosystems.

In this context, management has to define, which occupational profiles will survive and to take up a position, if modular training units (short and timely) are the future means of choice. Such modular (online) training has to consider the role of people in learning contexts like the shop floor (reality versus expectations) and be aware of what limits exist in a continuous process like steelmaking. Here, administrative support must act beneficial to foster digital education efforts; this can be done if e.g. people with a higher level of education and teaching/training qualification are temporarily deployed as trainers or coaches to close the knowledge gaps where they occur.

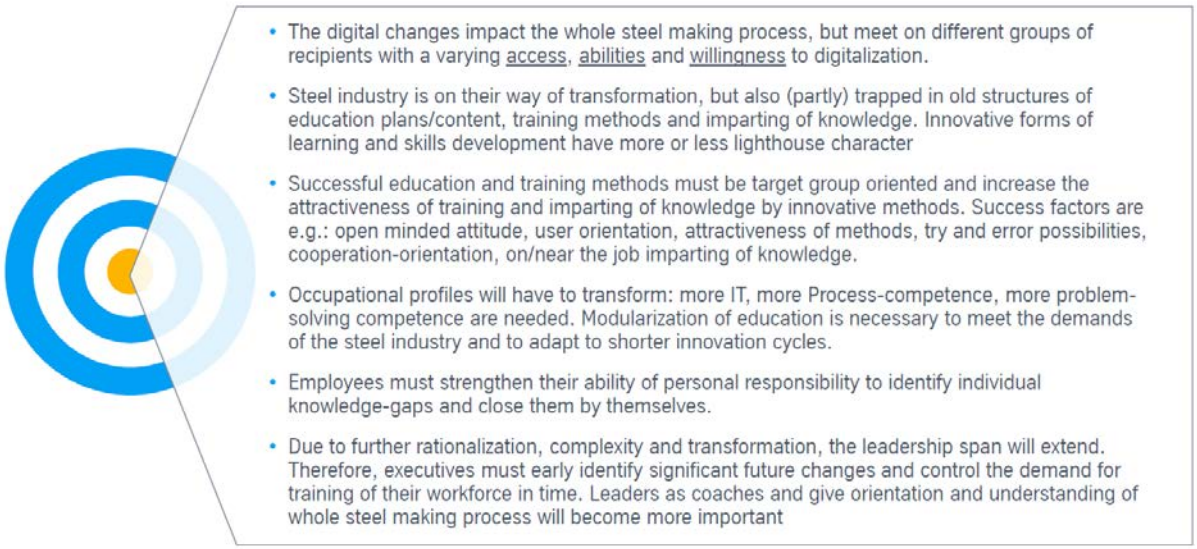



**Figure 10: Upskilling schemes for the steel industry**

### *2.2 Skills Classification*

Due to the broad range of the affected production areas, a repository and overview of all the professional role profiles were created. Then, the profiles were grouped in so-called **family trees** for all the production and maintenance functions in steel companies. The "Family tree" approach was used as a valid view to facilitate navigation and demonstrate relationships between job profiles. Ending up in 26 different family trees (or production areas) (level 1, see Figure 11) covering all in all more than 200 job profiles (level 2, example Melting Shop in Figure 12) demonstrate the high complexity structured from two different production processes ("Blast Furnace" and "Electric Arc Furnace"), different products and applications. The final version of this family tree aimed to be used as reference for the whole steel sector beyond the focus of skills adjustments (see complete list in the annex).

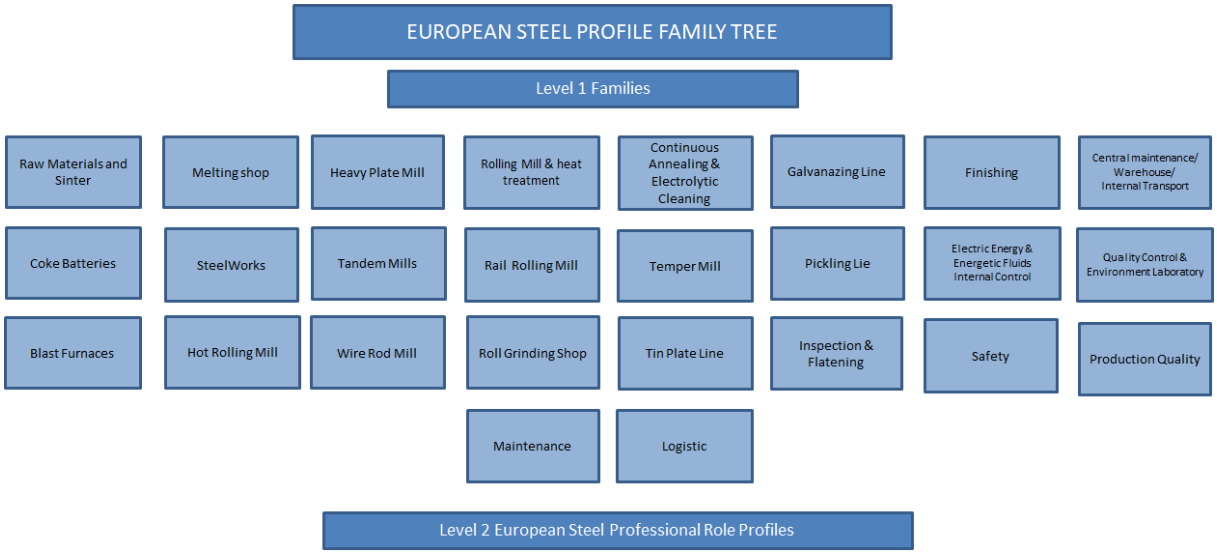



**Figure 11: European steel sector professional role profiles: 26 families at the top of the European steel sector profile family tree (level 1)**

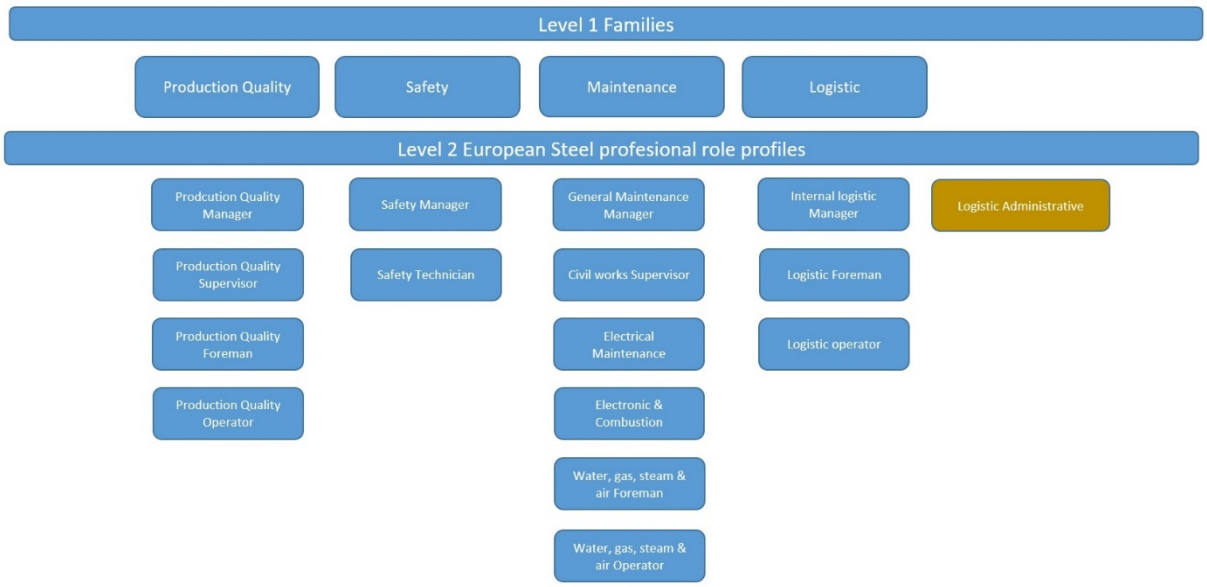



**Figure 12: Job profiles (level 2) example melting shop family**
**(blue: production, orange: administration)**

This job function and profile classification shows a huge range of different job titles across the Steel Sector professions and they are created for a variety of purposes including attracting new recruits and providing recognition for organisation loyalty through the promotion and construction of enhanced job titles. 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. 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 ISCO major 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.

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 as a first online training program based on ESSA results, see chapter (3)) 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.

The potential equivalence between ESCO and the profile titles in the Steel Sector enable us to take the ESCO description of occupations as the basis for a full description of the **Steel Sector Professional Role Profiles** and the steel job profile skills assessments. The European Steel Professional Role Profiles and the related steel job profile skills assessments were constructed consistently to provide a common template, since a *standard template* makes it easier for end-users to compare different profiles and present a fast start for developing new profiles or contributing to designing new job descriptions. The template was evolved towards the industrial needs incorporating sections for job description, mission, tasks etc, (from ESCO) and creating new sections for new skills categories, equivalent steel job profiles and skills levels.

Although, the family tree approach is highly useful from a sectorial-organizational point of view, it is unnecessarily complicated for VET framework providers to generate training programs. In order to reduce complexity and achieve an effective match of occupations and skills profiles, ESSA needs to generate a common ground combining the Steel Industry and VET (system) perspective. The European Steel Sector Professional Role Profiles and Job Profile Skills Assessments may also be used to implement an effective competence assessment process. Defining and implementing an internal competence assessment process enables verification of an organisation's existing roles and aids identification of competence gaps. The result of the assessment can be used to improve accuracy of different processes:

- In training, the competence gap analysis can be used to design accurate training paths that can, for example, develop the proficiency levels required to meet organisation requirements.
- In the development of an organization the result of the assessment can be used to guide the design of the organization itself, allocating resources optimally and identifying the competence shortcomings to inform the recruitment process.
- In career development, recruitment and talent management, the outcome of individual assessments can be used to identify optimal career development paths of the Steel Sector professional, benefiting the employee and the organisation.

To make an assessment process accurate and effective a **skills checklist** was developed focusing on the specific job profiles and their related skills. This checklist is following the T-shape approach combining specific specialised skills with transversal skills (see Figure 13). This approach was taken because beneath essential and optional production related technical skills new technologies of Industry 4.0 ask especially for an improvement of digital, green, social, personal and methodological skills (Skills4Industry Report 2019)[2] These skills might be generic steel specific or transferable skills also relevant for other (industry sectors).

[2] https://skills4industry.eu/sites/default/files/2019-11/EA0119570ENN%20Skills%20for%20Smart%20Industrial%20Specialisation%20and%20Digital%20Transformation%20-%20Final%20Report.pdf).

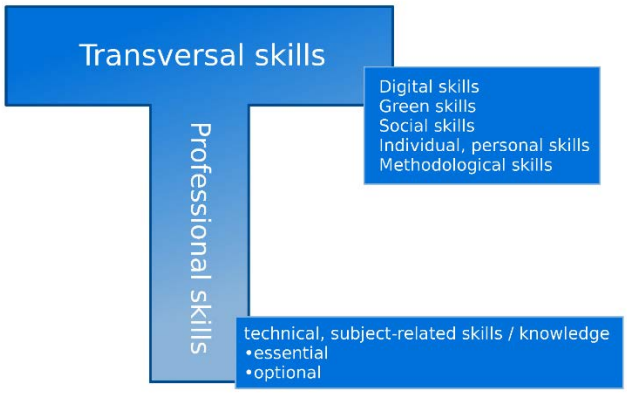



**Figure 13: T-shaped Skills Approach.**

Against this backdrop a **Job Profile Skills Assessment Template** was elaborated compromising a description of the profile, integrating the main tasks description from the ESCO database (if possible) and assessing the different skills categories by the current and future proficiency levels[3].

[3] 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 Labour 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.

| Level 1 | Technical skills | Transversal skills | | | | |
|---|---|---|---|---|---|---|
| Level 2 | Physical & Manual | Digital | Green | Social | Individual / personal | Methodological |
| Level 3 | General equipment operation<br>General equipment repair and mechanical skills<br>Craft and technician skills<br>Gross motor skills and strength<br>Inspecting and monitoring skills | Basic digital skills<br>Advanced data analysis and mathematical skills<br>Cybersecurity<br>Use of complex digital communication tools<br>Advanced IT skills & Programming | Environmental awareness<br>Energy efficiency<br>Water reduction<br>Waste reduction and management<br>Resource reuse/ recycling | Advanced communication and negotiation skills<br>Interpersonal skills and empathy<br>Leadership and managing others<br>Entrepreneurship and initiative taking<br>Adaptability and continuous learning<br>Teaching and training others | Critical thinking & decision making<br>Personal experience<br>Adapt to change<br>Work autonomously<br>Active listening | Basic numeracy and communication<br>Basic data input and processing<br>Advanced literacy<br>Quantitative and statistical skills<br>Complex information processing and interpretation<br>Process analysis<br>Creativity<br>Complex problem solving |

**Table 3: ESSA skills classification and definitions (overview)**

Five skill proficiency levels are defined in order to evaluate current and future skills from an industrial perspective:

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. 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, mentor, advise 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

Based on these skills categories, levels and definitions a **job profile skills assessment template /professional role profile (description) template** was developed to define job profiles, evaluate their current and future skills levels and identify their skills demands. This template will be tested for the nine job profiles described above within a survey (translated in different languages and explaining all the categories in a short definition). After the test survey the template will be improved and new job profiles added.

| PROFILE TITLE | PROFILE NAME | | | | |
|---|---|---|---|---|---|
| Summary Statement | | | | | |
| 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 mechanical 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 mathematical skills | | | | |
| | Cybersecurity | | | | |
| | Use of complex digital communication tools | | | | |
| | Advanced IT skills & Programming | | | | |
| Green skills | Environmental awareness | | | | |
| | Energy efficiency | | | | |
| | Water conversation | | | | |
| | Waste reduction and waste management | | | | |
| | Resource reuse/recycling | | | | |
| 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 | | | | |
| Individual, personal 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 interpretation | | | | |
| | Process analysis | | | | |
| | Creativity | | | | |
| | Complex problem solving | | | | |

**Table 4: Job profile skills assessment template**

The aforementioned equivalence between ESCO occupations and steel sector job profiles also opened the door to the automatization of the **European Steel Sector Professional Role Profiles** and **Job Profile Skills Assessments** through using ESCO database. Therefore, within ESSA an excel-based software was developed that will allow partly automating the description of the different steel-related job profiles. Our future plan is to be able to introduce the current/future skills and the current/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 also be checked if it could feed the ESCO database, enriching it with new occupations and descriptions (steel sector related and beyond).

However, ESSA will have a look for specific steel industry related new job profiles in the future as well. Especially if there is the need of a new occupation delivered by the VET systems such as the *process technologist in the metal industry* (developed by the BIBB https://www.bibb.de/en/pressemitteilung_82105.php).

### *2.3 VET System Framework and Provision*

As already mentioned the main challenge of ESSA is to combine the industry driven classification of job profiles with the existing VET provision for occupations. As ESSA is industry driven, the steel company and sector requirements are prior to the VET systems perspective and function. ESSA will try to align industry skills requirements and adjustment measures as much as possible with the European and national VET system frameworks, tools and support mechanisms:

- On the European level with the ESCO database, EQF, Europass, ECVET, ECQA, and EQAVET creating a comprehensive recognition umbrella
- On the national level by exploring the link and support of different VET systems (central, regional, dual, industry related) to the skills demands of the Steel Industry.

On the **European level** the ESSA skills classification is integrating the steel sector relevant ESCO occupations concerning the description of tasks and specific skills (e.g. for the pilot job profiles listed above, except the Factory Hands). This is foreseen in an automatic integration of the ESCO database descriptions in the ESSA skills classification system. Starting with the specific skills (which are not only steel but more process industry related) an integration of transversal skills will be proved during the course of the project. Up to now these skills are not bundled in the way of the ESSA classification but more or less widespread in the ESCO database. In the table below the listed ISCO/ESCO occupation examples are interpreted and related to the Electric Arc Furnace and Blast Furnace Job Profiles in the steel industry.

| ISCO Group | ESCO Occupation | Electric Arc Furnace | Blast Furnace |
|---|---|---|---|
| 1219 | Department Manager | Melting Shop Manager | Blast Furnace Manager |
| 2141 | Process Engineer | Melting Shop Process Manager | Blast Furnaces Process Technician |
| 3119 | Process Engineering Supervisor | Melting Shop Process Supervisor | Blast Furnaces Process Professional |
| 1321 | Industrial Production Manager | EAF production Manager | Blast Furnaces Production Manager |
| 3122 | Machine Operator Supervisor | EAF Foreman | Blast Furnaces Foreman |
| 3135 | Blast Furnace Operator | EAF Operator | Blast Furnaces Operator |
| | Machine Operator | | Blast Furnaces Joint Operator |
| 8343 | Production Plant crane Operator | EAF crane Operator | Loads and Unloads Operator |
| | Refractories Coordinator | | Blast Furnaces Refractory Lining Coordinator |
| | Refractories Supervisor | Refractories Supervisor | Blast Furnaces Refractory Lining Supervisor |
| | Refractories Operator | | Blast Furnaces Refractory Lining Foreman |

**Table 5: ISCO and ESCO related steel job profiles for Electric Arc and Blast Furnace steel making (examples)**

The **national VET system analysis** of five different VET systems (Germany, Italy, Poland, Spain, and UK) shows that they are also active in reforming formal occupations, curricula, and measures due to the digitalisation of industry 4.0. These reforms are very much in line with the ESSA approach. Integration of national VET system players is foreseen mainly during the rollout of in ESSA to the member states, focusing on the steel regions where most of the European steel companies are placed. The support of national VET institutions is integrated as well but focussing on the skills demands of the companies and the steel region. Although we know, that potential impact on national/regional VET systems by ESSA is limited we will align our efforts with other sectoral industry blueprints by addressing common recommendations and trying to engage with key players. It is not intended to change VET systems in general but to enrich public vocational education and training curricula and teaching where possible by concrete Blueprint measures and tools for the steel industry (esp. integrating the regions in the ESSA Online Training Ecosystem and by setting up regions specific Regional Training Ecosystems). This will help to serve different centralised and decentralised VET systems, combining national and local needs, overcoming fragmented system and policy structures. It will be done by a steel related modular approach (maybe also relevant for process industry in general), supporting dual VET by collaboration of schools and companies, integrating possibilities of recognition of informal and non-formal learning via the VET system, and supported by social partnership. This might also lead to a re-balancing VET offers by extending it to the post-secondary and tertiary level, including better connecting VET with higher education. All in all, leading to new mechanisms to incorporate informal

and non-formal learning in the VET system (recognition and validation of prior learning) and to improve the permeability of VET systems.

The European proactive mechanisms of skills forecast and systematic reviews of qualifications will be transferred to the regional level, combining practical on-the-job training with wider theoretical knowledge and an enhancement of transversal skills (T-shape approach):

- Enhancing vertical and horizontal mobility within the steel industry as well as between different process industries
- Enhancing workers' and companies' resilience in rapidly changing (technological and economic) environments
- Improving connection and transition between VET and Higher Education.

In the context of qualification development and VET system curricula design, the European Steel Sector Professional Job Profiles can be used as

- A communication tool between employers and educators which improves consultation process and outcomes
- A starting point for more detailed job profiles and curricula design in specialised fields (e.g. CyberSecurity, Data and Big Data)
- Reference profiles within VET system curricula.

One of the key challenges of effective curricula design is managing how different stakeholders communicate and cooperate to design curricula that meet both educational and employer objectives. The skills assessment of the job profiles can provide a useful shared language and starting point so that discussions between these stakeholders are quickly focused on useful content rather than constantly re-explaining the foundations of the debate. Different stakeholders have different perspectives, terminologies and ways of thinking about steel sector related knowledge, skills and competence. However, it is important to take these different points of views, necessities, way of thinking and priorities of the stakeholders into account to understand also the need of reforms and changes in the steel sector and VET systems. Bridging the gap between company and VET system perspective is the declared objective of ESSA. The European Steel Sector Professional Job Profiles in line as much as possible with the ESCO terminology and description can be used to provide such a bridge or communication tool to facilitate this process. Professional Role Profiles add a crucial step by providing informative examples of which skills are needed for which tasks. This means that the employer can easily start with the tasks that need to be done and work back to what skills can be included in the curricula by educators. This will significantly speed up the agreement on curricula design between employers and educators. In terms of updating curricula for new or changed activities in the workplace a structure is in place to inform that debate. For example, when analysing the educational needs of a specific job, aligned European Professional Job Profile of the steel sector may be adopted to form a common vision of the role and its associated educational requirements. The competences within a profile provide guidance on skills and knowledge items that can be developed to inform VET system curricula design and desired learning outcomes.

Comparatively assessing the functioning of the VET systems of five European countries in relation to the industry requirements arising from intense digitalisation and technological transformation two levels have to be considered:

- macro-level which concerns the overall functioning of the national VET systems, and
- programmes level, which focuses on the main vocational and technical programmes running in the countries that provide skilled workers to the industry (connected with the identification and assessment of job profiles).

All the five case study countries have recently undergone (or are currently undergoing) **VET reforms** that were devised by the responsible authorities to cope with the current industrial and labour market challenges (in the direction of the ESSA objective of an industry driven adjustment). 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:
    - allowing 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
- 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.

Table 6 below offers an overview of the five case study countries in a multi-level analytical perspective. On a macro-level, the economic model of a country influences the type of skills that are more likely to be delivered within a system. Coordinated Market Economies, such as Germany, for instance, are usually associated with a more technically skilled workforce, while Liberal Market Economies tend to show higher preferences towards general education. The type of skills formation system operating in a country highlights the respective involvement of states and companies in the organisation of skills provision. The level of standardisation refers to the meso-level of analysis and points at the degree to which VET meets the same standards nationwide. The final level of analysis (micro) offers some relevant information on the mostly adopted type of learning arrangements and some essential characteristics of the different systems. Overall, the table shows that national VET systems are undergoing similar patterns (see below), although national differences still remain relevant. As companies are embedded in local contexts, new training arrangements and upskilling/reskilling proposals should consider the still present national differences in VET systems in order to complement them in the most appropriate way.

| Country | Economic model | Skills formation system | Standardisation Level | Learning arrangements | Essential characteristics |
|---|---|---|---|---|---|
| **Germany** | Coordinated Market Economy | Collective | High | Mainly apprenticeship-based | Solid dual system<br>Consensus based regulation<br>Incremental adaptation<br>Occupation-based system<br>Holistic approach to occupational competencies<br>Technology neutral provision<br>Referenced to EQF |
| **Italy** | Mediterranean Capitalism | Statist → (Collective) | High | Mainly school-based | National and Regional VET provision<br>Recently introduced dual VET arrangements<br>Post-secondary level more connected with companies<br>Integrated route from secondary to tertiary VET<br>Based on learning outcomes<br>Qualification-based system<br>Referenced to EQF |
| **Poland** | Dependent Market Economy | Statist → (Collective) | High | Mainly school-based | System undergoing deep reforms (technical & vocational schools/dual model) until 2022<br>Distinction between programme and qualification<br>Recently introduced dual VET arrangements<br>Mechanisms in place for the recognition of prior learning<br>Based on learning outcomes<br>Qualification-based system<br>Referenced to EQF |
| **Spain** | Mediterranean Capitalism | Statist → (Collective) | High | Mainly school-based | Double VET route (in education or employment)<br>Recently introduced dual VET arrangements<br>Mechanisms in place for the recognition of prior learning<br>Modularity<br>Based on learning outcomes<br>Qualification-based system<br>No EQF referencing |
| **United Kingdom** | Liberal Market Economy | Liberal | Low | Mixed | Complex governance<br>Plurality of providers<br>VET taken mostly at secondary level<br>Raising demand in apprenticeships<br>Becoming more employer-led<br>Distinguishing role of awarding bodies<br>Modularity<br>Referenced to EQF |

**Table 6: VET systems main characteristics in the five case study countries.**

In line with the ESSA approach all the countries, except for Germany in which this was already established, aimed for better integration of employers in the qualification design process and the training provision. Cooperation between industry and academia is key in the creation of dual education programmes: one of the most effective methods to provide the future workforce with the needed competencies and know-how, while at the same time making them familiar with the industry. Dual education is not well established in all Member States, and should be promoted because combining VET with company performance and skills was stressed by companies and stakeholders during the course of the project more and more (also recommended by the Steel Sector Careers Blueprint). This might be also a way to a more *collective and industry driven type* of skills formation within the VET systems. Additionally, overcoming frequent VET funding cuts through companies' engagement (especially relevant for hi-tech occupations) has to be put on the agenda.

The German case shows a less degree of change, compared to the other countries: initiatives have been undertaken to face the problem of skills mismatches through "occupations screenings" with the aim to understand the impact of technological innovation on some industrial key sectors, including metalworking. This resulted in the introduction of **additional learning modules** on digitalization and 4.0 enabling technologies (e.g. the module "Digitalisation of work, data protection and information security" [*Digitalisierung der Arbeit, Datenschutz und Informationssicherheit*]).

Poland, instead, is undergoing the deepest structural changes. A series of reforms have been initiated in 2016 and are changing the landscape of general and vocational programmes, the outcomes of which will become visible in the coming years. As regards the United Kingdom, the extent of VET reforms depends on the different countries and devolved administrations. While England seem to tend more towards structural reforms such as the replacement of former apprenticeship frameworks with new employer-led standards and the introduction of new technical programmes (e.g. T Levels), other countries such as Wales are adopting a more cautious approach aimed at reviewing the current offer against the needs of employers and learners. In Italy and Spain recent reforms have mostly aimed at introducing dual arrangements (although this option is not much adopted yet), reviewing the national standards for the occupational profiles and strengthening the links between secondary and post-secondary VET.

A preliminary screening of the programmes indicates that IVET qualifications designers in the different countries are paying - in line with the ESSA approach - more attention to soft and digital skills and to combine cross-sectoral and occupation-specific skills to meet both the needs of employers and learners (see table below). This includes the establishment and better combination of VET regulation and qualification at technology and work organisation level. The table below show the various programmes in the five different VET systems that offer qualifications relevant to the industry. While this table is just an overview of the main programmes, it should help us to identify amongst these the programmes and qualifications that link with the nine selected job profiles (described further up).

| | Germany | Italy | Poland | Spain | United Kingdom |
|---|---|---|---|---|---|
| **Secondary level (EQF2-4)** | Vocational schools (*Berufsfachschule*)<br>Apprenticeship (*Ausbildungsberufe*) | Technical schools<br>Vocational schools<br>Strictly VET programme (*Istruzione e Formazione Professionale - IeFP*)<br>Apprenticeship | Sectoral programmes (*Szkoły branżowe I stopni*)<br>Technical programmes (*Technika*) | Basic VET (*Formacion Profesional basica*)<br>Intermediate VET (*Formacion Profesional de grado medio*)<br>Apprenticeship | College-based VET (e.g. National Vocational Qualifications - NVQ; Business and Technology Education Council - BTEC etc.)<br>Technical programmes (T Levels)<br>Apprenticeship |
| **Post-secondary level (EQF4-6)** | Technical schools (*Fachschule*)<br>Advanced vocational training (*Meister*)<br>Apprenticeship (*Fortbildungsberufe*) | Higher Technical Education and Training (*Istruzione e Formazione Tecnica Superiore - IFTS*)<br>Higher Technical Institutes (*Istituti Tecnici Superiori - ITS*)<br>Apprenticeship | Vocational schools (*Szkoły policealne*) | Higher VET (*Formacion Profesional de grado superior*)<br>Apprenticeship | College-based higher VET (BTEC, NVQ etc.)<br>Higher apprenticeship |

**Table 7: VET programmes in the five case study countries delivering qualifications relevant to the industry**

**Challenges/Criticalities:** Rapidly changing industrial landscapes and labour markets require not just timely but coherent responses. Our comparative analysis of VET systems shows a latent tension between fast responses and mid- to long-term incremental adaptation. This is 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 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 might undermine the capacity of the system to deliver what ESCO defines as skills with a higher degree of *reusability*, so limiting workers as well as businesses' resilience. The German concept of "vocational action competence" (*Handlungskompetenz*), instead, seem to point towards a more holistic vision of the occupation and its associated competencies.

From this point of view, a crucial challenge for future VET would be *defining the optimal balance between soft, digital, cross-sectoral and occupation-specific skills*.

Another criticality concerns the degree of *fragmentation* of a VET system. Where governance is complex, the consistency of the whole system and its capacity to align with a national strategy might be undermined. A complex regulatory framework might also discourage the engagement of both social partners and learners. A challenge for all European countries would be to guarantee high-quality and internationally-transparent VET qualifications, at the same time rationalising the overall system functioning.

The ESSA Blueprint could help to release the tension between different approaches (short-termism flexibility vs. long-term planning; fragmentation vs. centralisation) providing an overview of the shortcomings and gaps in VET provision in different systems and delivering a set of VET-related recommendations with the aim to support a long-term sectoral skills development strategy that also considers the need for more flexible approaches. At the same time, through the online training ecosystem (see next chapter), ESSA could complement national systems with additional guidance for learners, micro-credentials and tailored training, in so enriching and adding more flexible provision.

However, the ESSA given overview of the skills adjustment approaches and frameworks show a broad range of topics to be considered. This is underlined and broadened by the relevant areas for VET done by Andrew McCoshan (Centres of Vocational Excellence CoVE)[4]. Teaching and learning have to change but also governance, funding and leadership embedded in new cooperation and partnerships. Looking at this overview ESSA is on the right track by setting up training and skills ecosystems via the Foresight Observatory and Regional and Online Training Eco-systems (see next chapter).

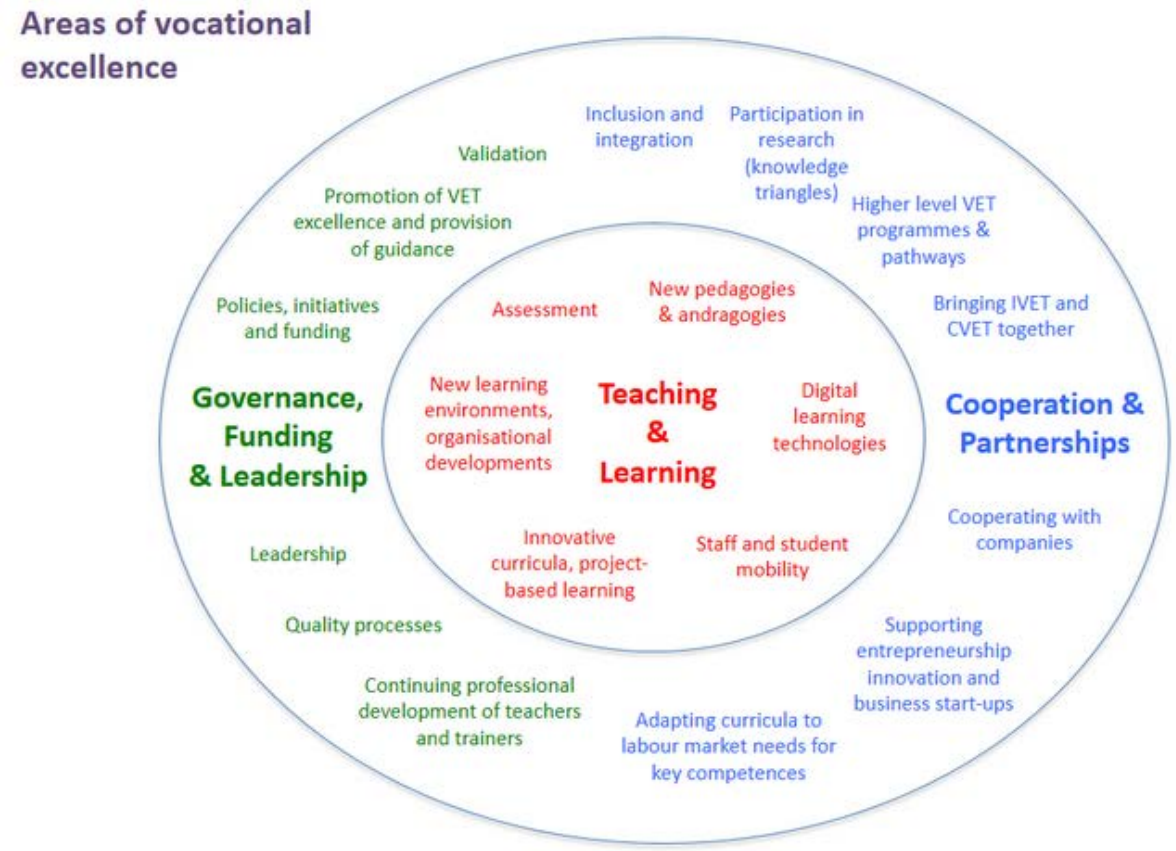
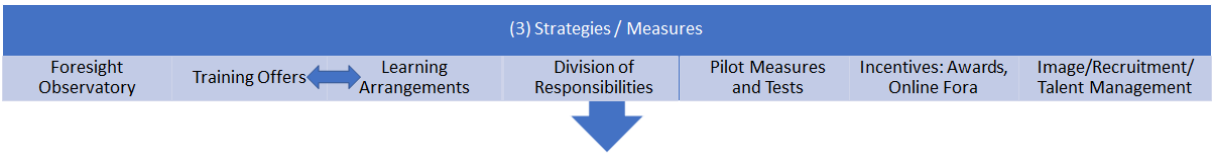



**Figure 14: Areas of excellence in VET**

(taken from https://epale.ec.europa.eu/en/blog/centres-vocational-excellence-what-do-they-mean-teachers-and-trainers).

[4] https://epale.ec.europa.eu/en/blog/centres-vocational-excellence-what-do-they-mean-teachers-and-trainers

# 3 Strategies / Measures – The Supply Side




Strategies and measures 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 ESSA **R**egional **T**raining Eco**s**ystems (ESSA RTS) (supply side).

## *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 Anticipation and Support of 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**). The survey will consist of a standard question set to monitor the recent demands repeated more or less in every issue and added by an important issue of the year. The panel survey will combine and elaborate the already developed tools (WP2 survey, WP3 job profile template, WP4 VET institution interviews, WP5/6 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 yearly 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.

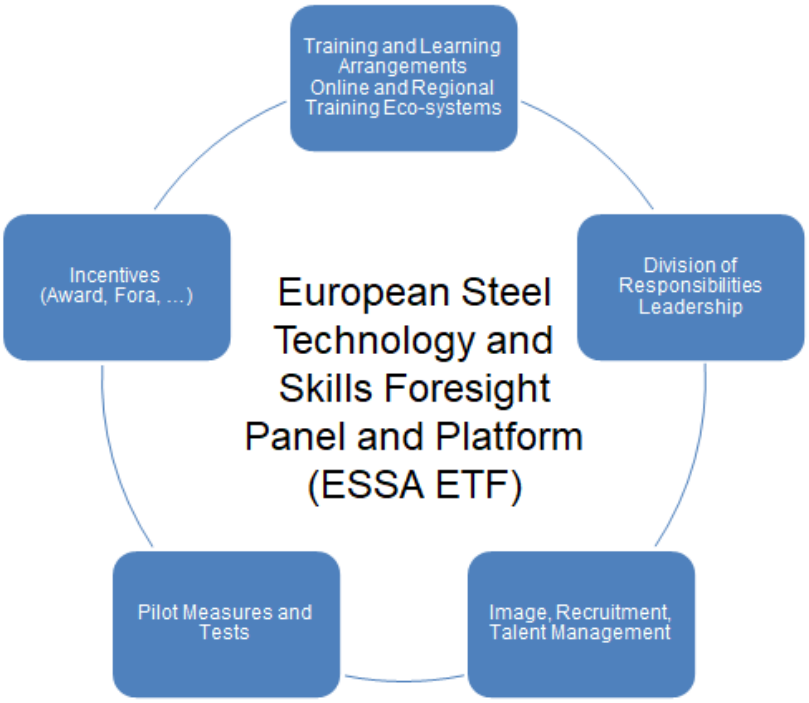



**Figure 15: European Steel Technology and Skills Foresight Observatory (ESSA ETF)**

The Observatory will be based on **collaboration** of (steel and VET) **stakeholders** at the EU level (ESTEP, EUROFER, industriALL, SSDCS, RFCS, SPIRE, Cedefop, ESCO and others). "Skills Leaders" are foreseen as communication and coordination nodes between the European, national, and regional level (see chapter 4 Alliances and Leadership). The ETF should also be related and interconnected to existing (or forthcoming) European **platforms** (see table below).

| Platform | URL | Relevance |
|---|---|---|
| Skills Panorama | https://skillspanorama.cedefop.europa.eu/en | integrates in one single portal data and information on skills needs and mismatches |
| European Platform for Digital Skills and Jobs | https://ec.europa.eu/inea/en/connecting-europe-facility/cef-telecom/apply-funding/2019-digital-skills-jobs | boosting digital skills in Europe, offer information, resources, overview of training and funding opportunities and a community space for networking and collaboration both on European and national level |
| Pact for Skills | https://ec.europa.eu/social/main.jsp?catId=1517&langId=en | overarching initiative within the new New Skills Agenda,<br>shared engagement model for skills development in Europe companies, workers, national, regional and local authorities, social partners, cross-industry and sectoral organisations, education and training providers, chambers of commerce and employment services all have a key role to play |
| Smart Specialisation Platform | https://s3platform.jrc.ec.europa.eu | options to identify those regions and regional clusters that are focussing on the same sectors as ESSA<br>useful for the plan for regional roll-out of project results. |
| European Cluster Collaboration Platform | www.clustercollaboration.eu | options to identify those regions and regional clusters that are focussing on the same sectors as ESSA<br>useful for the plan for regional roll-out of project results. |
| European Network for the Transfer and Exploitation of EU Project Results | www.enter-network.eu | Amplify dissemination work<br>The European Network for the Transfer and Exploitation of EU Project Results Since 2005, E.N.T.E.R. has brought together organisations from across Europe in successful EU project work. Join our network by registering your organisation and your projects. |
| European Apprentices Network | https://apprenticesnetwork.eu/ | Recruitment of talents and young people |
| eTwinning | https://www.etwinning.net/en/pub/index.htm | community for schools in Europe and offering a platform for staff (teachers, head teachers, librarians, etc.), working in a school to communicate, collaborate, develop projects, share and being part of a learning community in Europe |
| Centres of Vocational Excellence | https://eacea.ec.europa.eu/erasmus-plus/actions/centres-of-vocational-excellence_en | bringing together a wide range of local partners, to develop "skills ecosystems" that contribute to regional, economic and social development, innovation, and smart specialisation strategies |
| Others | | to be completed |

**Table 8: Interconnected platforms to the ESSA Observatory**

### *3.2 ESSA Observatory Roadmap*

Following the suggestion of the **Steel Sector Careers** Blueprint the ESSA ETF Observatory will set up a roadmap, to ensure monitoring and adjustment of skills (demand side) and to organise education and training for them (supply side).

1. **Monitor and anticipate** new skills demands of the EU steel industry via the observatory (ESSA ETF)
2. Provide and promote training in **T-shaped skills** of the main job profiles concerned
3. Set-up and support the **Online and Regional Training Eco-Systems** (see chapter training offers and learning arrangements)
    - Promote new learning arrangements
    - Expand and promote relevant **digital** and **on-the-job training**
    - Communicate on the importance of lifelong learning
    - Promote **(reverse) mentorship** as a way of knowledge transfer
4. Improve the **image** of the sector and careers within it (see chapter Image - Recruitment - Talent Management (3))
    - Conduct EU-wide communication campaigns
    - Advertise and promote job opportunities in the sector to candidates of varied disciplines (incl. a new diversity by women, migrants, etc.)
    - Advertise good working conditions in the sector
    - Promote the steel sector in primary and secondary schools (pre-VET)
    - Conduct awareness-raising campaigns
    - Include underrepresented groups, such as women and migrants
    - Document and award best practices (of skills adjustments)

### *3.3 Training Offers and Learning Arrangements*

The Foresight Observatory as a continuous monitoring and workout platform for the skills demands side Training Eco-systems will form the supply side as information and exchange platforms for training development and offers by designing (updated or new) training courses and learning arrangements. Within the supply side skills demands have to be aligned to affected job profiles of different production areas of the steel companies. The impact or improvement of related formal occupations of the VET systems have to be identified and checked according to potential and necessary changes in the curricula and training offers for these occupations. Underscoring the formal patterns of change within VET systems, it is necessary to find ways to incorporate new skill demands related to job profiles within company training provision in more immediate ways to meet pressing needs. However, the change of the VET systems to support industry needs in a short-term effective way remains significant, esp. when it comes to higher basic skills of the new generations (including pre-VET education) and increasing the attraction for process industries like steel.

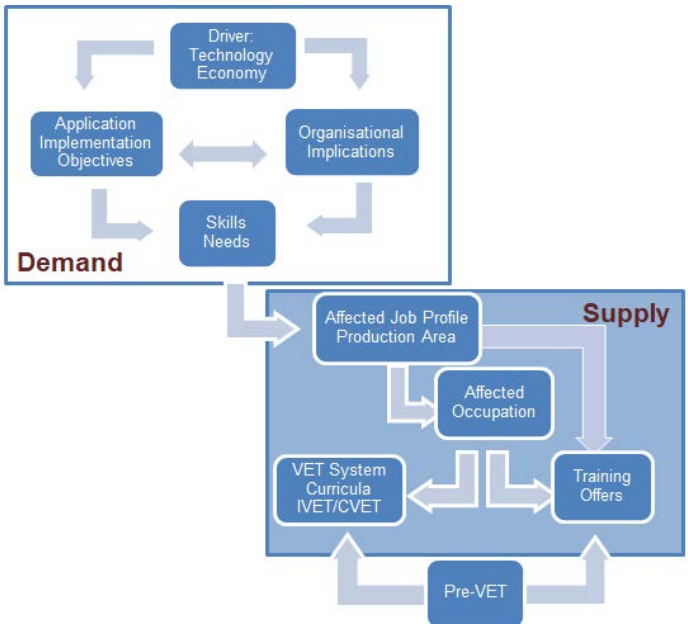



**Figure 16: Vocational Education and Training as an answer to skill needs - the supply side**

(New) training offers should reflect **(new) learning arrangements**. Digital transformation is not only focusing on re- and upskilling of the workers but also relevant for new learning and teaching arrangement. Digitalisation will also improve and increase new learning possibilities and arrangements (quantitatively and qualitatively): Training providers, companies, workers and apprentices have to improve their digital skills for both **learning and operating** at the workplace. Not only the Corona pandemic but also the speed of (technological and continuous) changes show the importance of more and new (digital) online learning and training possibilities. Digitalisation of learning modules, improved digital skills, flexible and agile trainers and learners are relevant elements of new digital learning strategies and alliances. New formats are needed articulating new developments in time comprising different possibilities such:

- Online training and simulation
- On the job training
- Integration of general or specific modules in company training schemes
- Reverse mentorship as a two-way process between older and younger employees (as suggested by the Steel Sector Careers Blueprint SSC)
- Webinars
- Individual and specific groups training paths (in-company, across companies, individuals, …)
- Self-learning modules and models (with real time feedback for iterative corrections)
- Vocational guidance and counselling
- Experiential learning (e.g. production process assessment concerning energy efficiency)
- Blended learning, combining classroom and workplace, linking VET schools and workplace, improved coordination of knowledge acquisition and practical learning)
- Project-based, challenge-based and integrative learning, game-based learning
- Social and collaborative learning
- New forms of assessment and validation: ePortfolios, learning challenges, feedback to learners, new links between assessors and learners
- Virtual Reality
- and others.

To illustrate the new learning possibilities a few new formats are listed. A big part is to know, what the needed skills will be without having the technology yet and to set up some **play and test fields**, using new digital possibilities:

- labs where people can be trained at new digital solutions (see training laboratories below)
- simulations (digital twins), helpful for emergency practice - people can really train all the different accidents, which can happen, which could not be done at the normal installation.
- virtual reality / augmented reality (often used in labs)
- digital assistance which can support the workers in his activities but also to improve his knowledge concerning the work (digital knowledge management), trouble-shooting at the job-place

Other formats are focusing on **exchange of digital knowledge** in a kind of reverse mentoring illustrate such new formats a few examples will be described.

**steelTalks** (Steel University) (https://steeluniversity.org/learn/steeltalks/) is a short webinar focusing on current hot topics of the steel industry

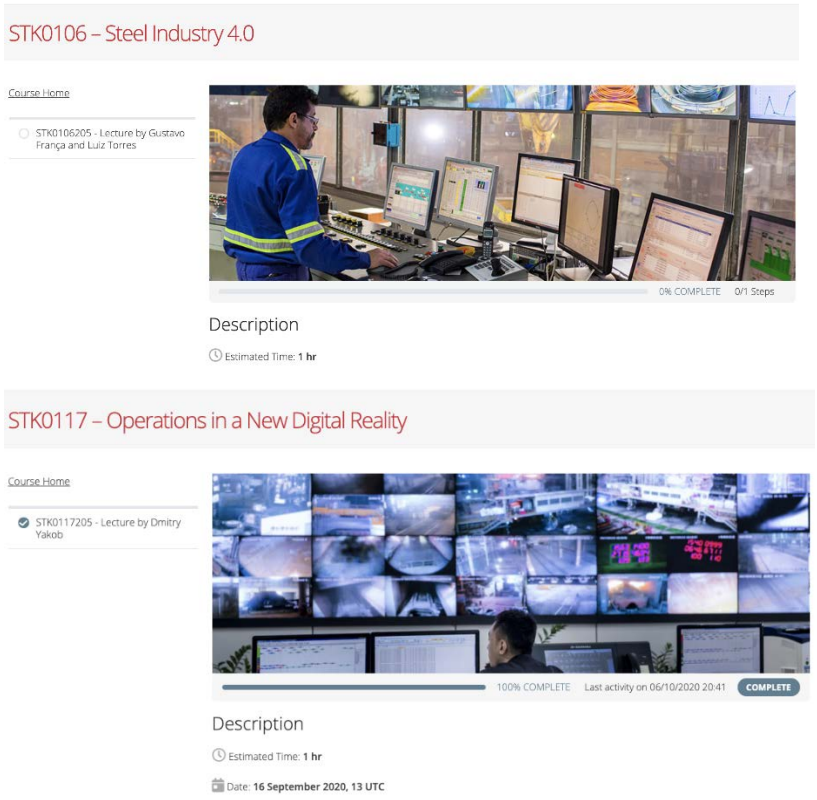



**Figure 17: steelTalks of the Steel University**

**Digiscouts®** (apprentices, SMEs) **(**https://www.digiscouts.de/) is a program to utilise the interest of apprentices and to attract the dual VET young trainees are looking for unfolded potential of digitalisation in the companies by using a discovering tool and a digital exchange platform, accompanied by a coach of the company.

**(Reverse) Mentoring**: Promote (reverse) mentorship as a way of knowledge transfer between older and younger workers – Large amounts of workers being on the brink of retirement is one of the urgent challenges the steel industry is facing (e.g. with the pro Zukunft (Future) program from thyssenkrupp).

Mentorship appears to be a particularly viable method of ensuring that valuable knowledge is not lost in the process and is appropriately transferred to younger generations of workers. On the other hand, young people bring in valuable skills in their own right that they can share with their more senior colleagues, particularly in terms of digital skills. Solidifying and further expanding mentorship programmes, whenever possible in the form of reverse mentoring, therefore must be a crucial part of any forward-looking education and training strategy." (Steel Sector Careers Blueprint, Final Report 2019, p. 10)

**Training Laboratories:** Training is specific developed laboratories (field labs, living labs), learning how to use new technologies, with the lab tests skill gaps are appearing, anticipating and getting ready, before new technologies will enter the company.

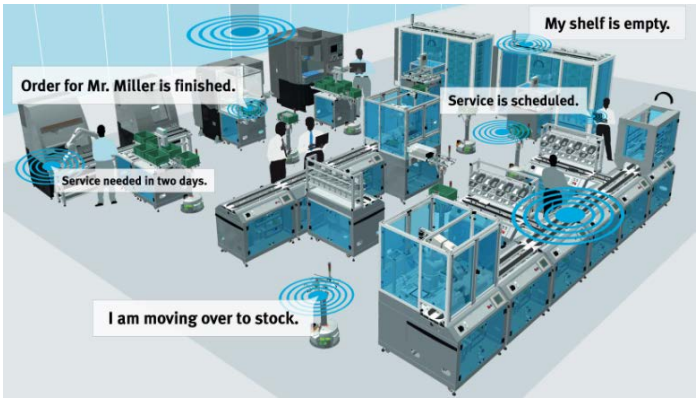



**Figure 18: Learning Labs (Danieli Automation SpA, DIGI&MET) / Festo Lernfabrik 4.0**
(https://www.festo-didactic.com/ov3/media/customers/1100/dsi_lernfabrik_4_0.pdf)

### *3.4 Training Eco Systems*

The results of ESSA 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 by an **Online Training Eco-system** (digital platform) and on the level of steel regions by national/regional specific **Regional 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 analogue training modules that could be integrated in a broader training program of the companies and VET providers):

- virtual / online: independence of time and space, integration of relevant modules in company and individual learning paths, … (see success factors of bitkom Position Paper June 2020 below)
- on-site / workplace related: real working experience, interactive learning, …

Concerning VET system integration complementarity could be seen as follows:

1. Regional/national ecosystem could address recommendation to the states where gaps emerge and provide relevant and up-to-date information on sectoral trends and skills gaps on the basis of which the key actors can act to change the system from within (e.g. improve curricula, take into account different learning arrangements); also, providing policy-makers with abstract models and examples of effective regional VET-business configurations (e.g. see the one described below for Tata Steel).
2. Online ecosystem could provide guidance on how to better navigate and make use of national VET (especially CVET and recognition of non-formal and informal learning procedures) and EU frameworks; also, the online ecosystem can build micro-credentials on top of VET systems to fill gaps and complement them with more customised training (e.g. the continuous casting simulation described below).

| Success Factors for Digital Learning (bitkom Position Paper, 02 June 2020) |
|---|
| 1. New work and new learning will grow together in an interrelated way: flexible self-regulated learning independent of space and time, coached and monitored by new leadership, digital learning responsible needed to check relevant offers |
| 2. Cultural change and new leadership: decentralisation of decisions and work, participation of workers, monitoring and coaching instead of controlling, … |
| 3. New individual and pragmatic solutions, focusing on internal solutions |
| 4. Strategic learning concept is relevant (contents, methodological-didactical approach, learning strategy, …) |
| 5. Stakeholder integration (IT, management, unions, …) |
| 6. Diverse digital learning arrangements to be used: webinars, web-based trainings, videos and podcasts, mobile and social learning |
| 7. Internal and external solutions could be combined |
| 8. Digital learning as investment in the future, improving recruiting and retaining of workers |
| 9. Qualification for digital learning as success factor |

**Table 9: Success factors for digital learning (bitkom position paper, 02 June 2020)**

### 3.4.1 Online Training Eco-System (ESSA OTS)

Based on the ESSA approach and partnership (integrating stakeholders from companies, associations and social partners, training providers, research and development organisations) the Online Training Eco-System conceptualised as a "**steelHub**" is implementing and transfer human resources and training relevant contents and issues from and to all the relevant stakeholders:

- Associations
- Industry
- Other Blueprints
- VET Systems
- Individuals
- EU Tools

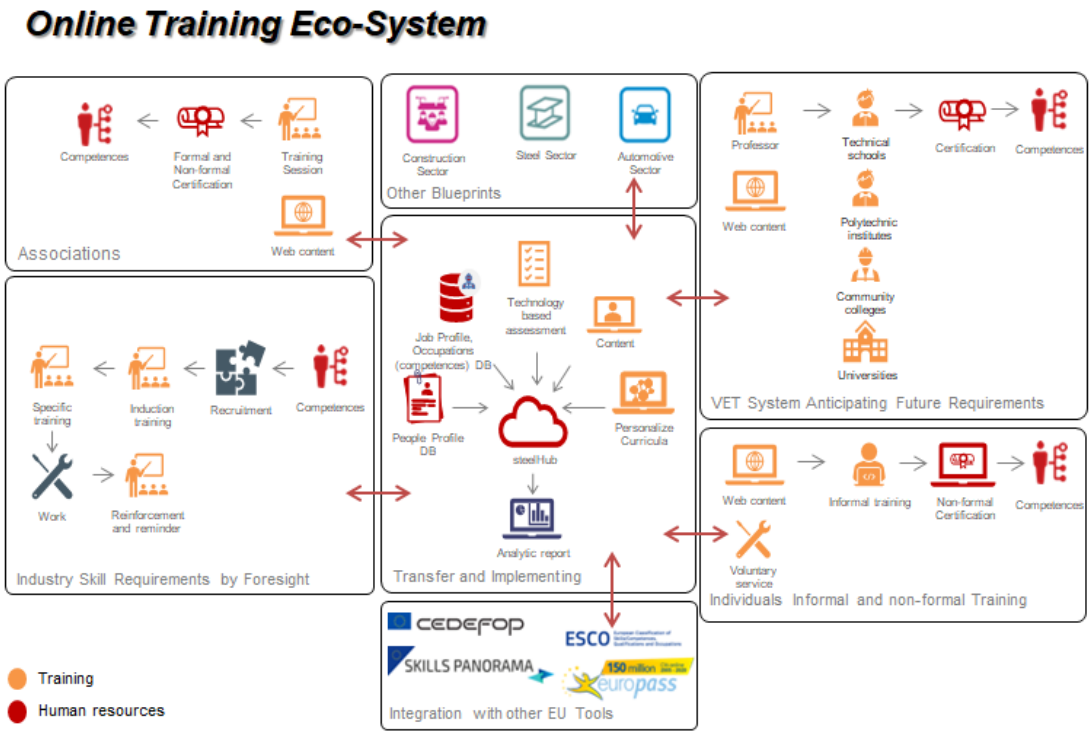



**Figure 19: Online Training Eco-System (ESSA OTS)**

The steelHub as centre of the online eco-system is engaging all the relevant and willing stakeholders and will continuously integrate and update job profiles and competences as well as a people 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 esp. relevant for lower skills levels). Courses have to be described in a comparable way and customer-oriented. General training courses but also modules for specific technology demands are developed.

ESSA is not starting at scratch. The already in place training program of worldsteel will integrate and develop the web-based steelHub. It is a database and analytics system hosted in the cloud which can generate files to be shared with companies and education providers. The system is built in a flexible way to allow organisations that do not have an own learning management system to still use it. Through the system and based on a standard database of competencies, one can gain a rapid overview of the strengths and weakness at the individual level, but also compare where a company stands among other companies and how people's competences are distributed within a company. Furthermore, individual learners can see which skills are needed for a specific position and see how their own level compares to the job requirements and to the industry standards. Based on this gap analysis, they can choose individually and company tailored specific training to build the needed competences due to the contents and evaluations are curated by means of the standard database of competences. Besides, the creation of an automatic and customize training path (personalize curricula) to close the gap for each individual is also possible.

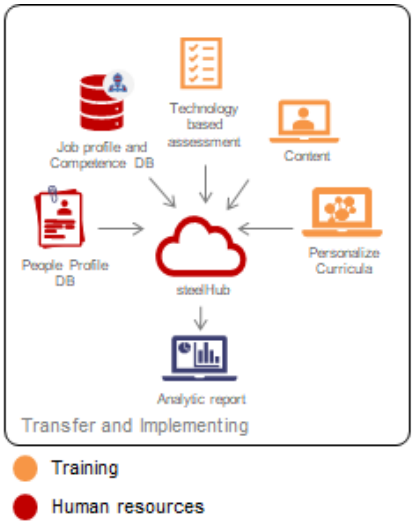



**Figure 20: steelHub as centre of ESSA OTS**

The **steelHub** will be an exchange platform for training offers (input and output). It will be a continuously updated inventory of training offers and modules curated with standard competences data base. The development of training activities and modules, **including training the trainers**, will be done by the different companies and training providers, coordinated by worldsteel as a platform coordinator. As an open platform, the steelHub training offers could be used by individuals, companies, VET providers (including VET institutions like vocational schools). Training could be integrated into VET provisions at company, national and sector level (incl. interrelation to existing EU tools like EQF, ECVET, ESCO, etc.). This central Blueprint platform will include the development of (a) training courses for up- and reskilling existing profiles, (b) new occupational profiles or parts of it, (c) new leadership and work 4.0, (d) train the trainer, (e) improvement of measures and offers of training providers by ESSA results, (f) new training methods and arrangements. As an online platform ESSA OTS is considering new possibilities of digital learning and support (social media, moodle, virtual labs, online learning, ...) and workers participation and empowerment (e.g. workplace innovation, but also by using digital tools like tablets, smart phones, laptops, etc.). The further development and running of the steelHub will be coordinated by worldsteel, done collaborative with divided responsibilities due to the expertise and preferences of the involved companies and training providers.

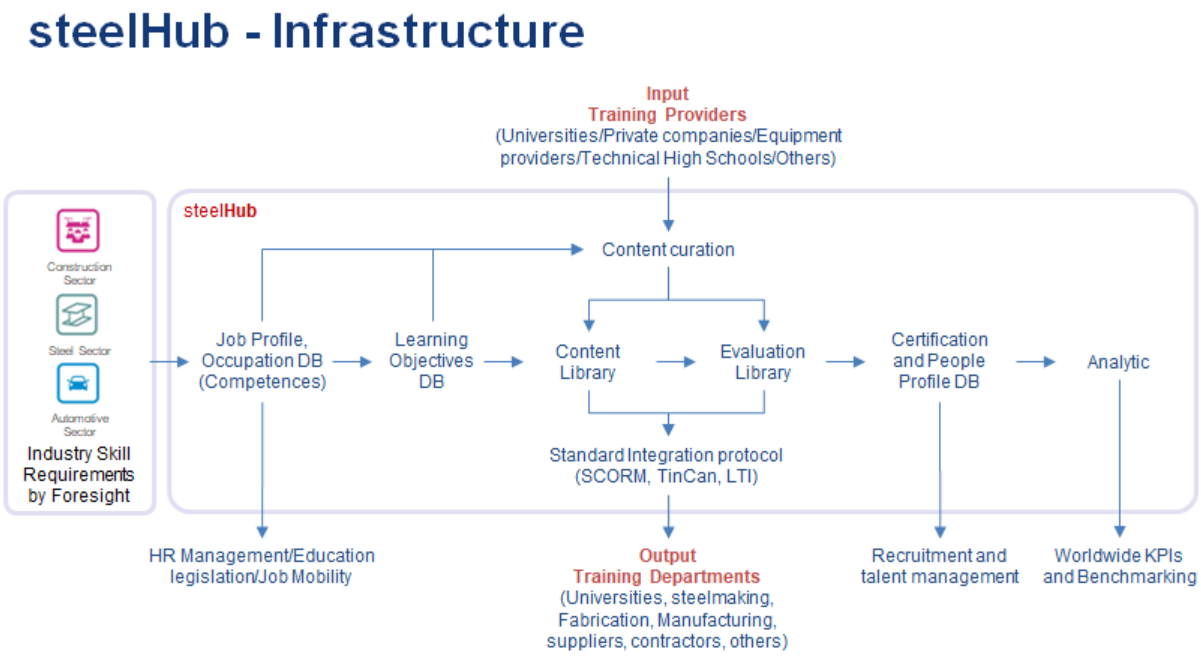


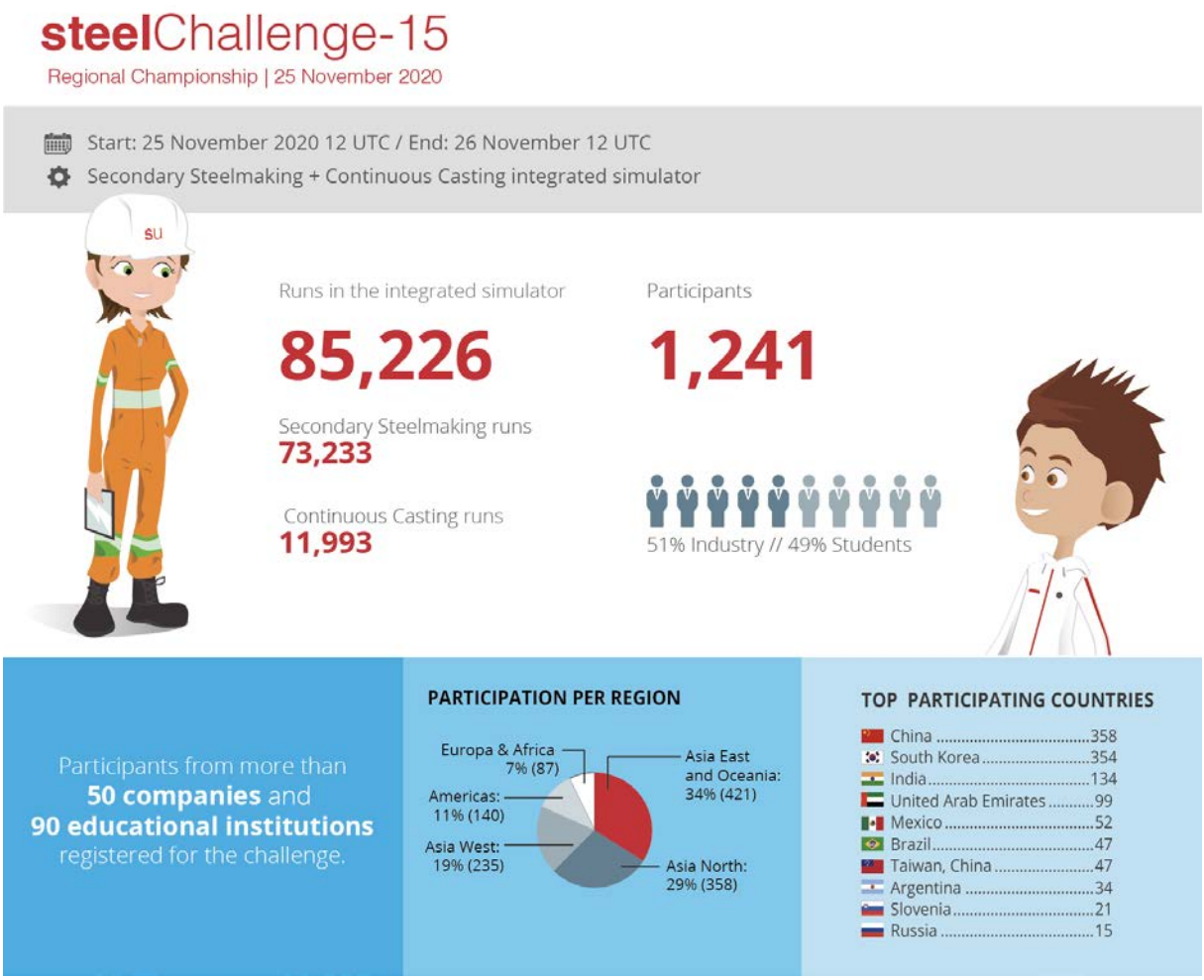

**Figure 21: steelHub infrastructure**

The **delivery method and protocols** of the training platform have been tested in a full scale over five multinational industries, where steeluniversity works us a "training provider" delivering more than 90 courses in 3 different languages into the Learning Management System (LMS) of the companies compatible with SCORM2004. The LMS included in this pilot test were Success Factor and SumTotal,

which are the main system in the steel industry. Courses include different assets, like videos, simulations and 3D model; which prove the flexibility of the system. It is necessary to expand the communication protocols to TinCan and LTI in order to cover all the possible options. VET system players have access thru steeluniversity.org composing a training group for each company, association or VET institution.

In order to test the **integration of the competences database and evaluation into the platform,** a first pilot technology-based assessment module was developed being in its test phase. As part of the nine test job profiles (see chapter (2)) the Continuous Casting Operation training module was developed based on the ESSA findings so far, including a simulation of the continuous casting steel production process with all relevant parameters and activities to be done by the operator / trainee.

During the test with some partners of ESSA it became obvious that the English version had to be translated into the languages of the operators using the tool. The translation has been done in English, Spanish, Russian and Germany and integrated into the LMS without problem. The simulation has been embedded into an online competition (steelChallenge-15) using a standard methodology "Evidence Centred Design Framework" to connect competencies, learning objectives and evaluation. **633** participants of the industry and **608** students registered for the competition and practiced during September, October and November to compete on November 25th 2020. The following infographic summary the results and participation.



The following video shows a complete run of the simulation for your quick review.

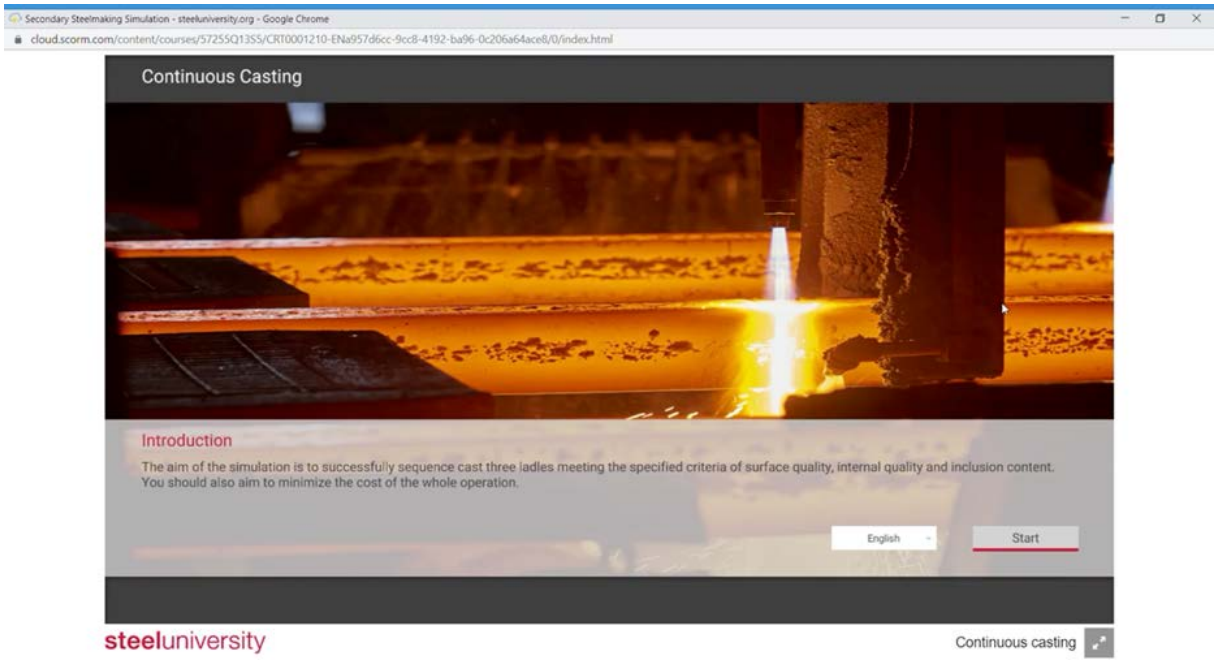



**Figure 22: Continuous Casting Operation (pilot module, see: https://vimeo.com/404972052, password: steel123)**

The Job Profile of the **Metal Processing Plant Operators** (focusing on Continuous Casting) was further operationalised by learning outcomes (see figure below) for knowledge and skills assessments of the Continuous Casting Operator training:

- Multiple choice exam to validate **knowledge** about Continuous Casting Simulation (**CRT0001205**). The Learning Outcomes to evaluate are the following:
    - Comprehend the fundamentals of continuous casting. (KWN0101)
    - Be familiar with modelling techniques related to heat transfer and solidification. (KWN0103)
    - Understand how the process water system works and identify its components (KWN0601).
    - Recognize system anomalies. (KWN0603).
    - Knows production process (KWN0901)
    - Controlled process characteristics and respective requirements (KWN0903)
- Process simulation of Continuous Casting (**CRT0001210**) to validate **skills**. The Learning Outcomes to evaluate are the following:
    - Prepare equipment for process operation (SKL0201)
    - Start and stop the equipment, including an emergency. (SKL0301)
    - Control the equipment operation based on instrumentation readings. (SKL0302)
    - Adjust the operating conditions of the equipment (SKL0303)
    - Monitor the health and operability of equipment during the casting process (SKL0304)

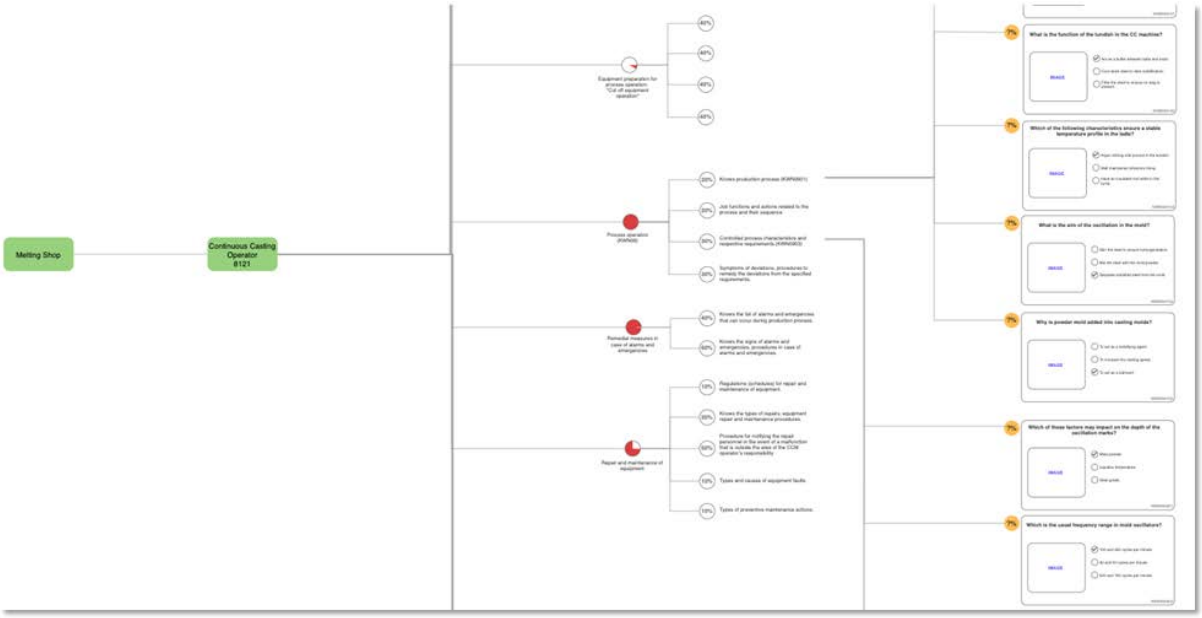



**Figure 23: Learning outcome based competence map**

Challenges for the practical implementation of the steelHub so far are:

- The more visible integration of transversal skills (this will be elaborated further and supported by the results from the skills survey of the nine pilot profiles),
- Compliance of the infrastructure with GDPR regulation.
- Agreement to use aggregated data generated by users for data analytic processing.
- Business model (including fees for usage of training modules and of the worldsteel infrastructure)
- Formal agreement and Copyright protection between administrative entity of the steelHub and content providers.
- Formal agreement and Copyright protection between administrative entity of the steelHub and Users.

### 3.4.2 Regional Training Eco-System (ESSA RTS)

The **Online** Training Eco-System (ESSA OTS) will be complemented by a **Regional** 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 (see chapter (5)) 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. In the following we illustrate an industry driven Regional Training Ecosystem (region Ijmuiden with TATA Steel).

The local context for companies will also be informed by type of production and meeting the skill needs of EAF and BOF are different (meaning different skill needs), and the plants will be at different stages of technological development and require different training provision, and VET provision has a local dimension also depending on the existing cooperation and infrastructures.

However, the regional training system approach has be further elaborated in the course of the project, in line with the to be developed rollout strategy (chapter (5)). Within these rollout activities it is 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.

**Industry Driven Regional Training Ecosystem (Example TATA Steel Ijmuiden)**

Most of the big steel companies do have strong relationships with the regions they are placed in. Corporate Social Responsibility activities (a) show the responsible corporate conduct towards environment, employees and other stakeholders going beyond legal requirements; (b) lead to new business strategies, cross-sector cooperation, stakeholder integration and interaction; and (c) are the starting point for new problem solutions and approaches - within the company and in the local, regional environment. Against this backdrop the regional cooperation within a Regional Training Eco-System all the willing stakeholders from different sectors (industry, policy, education and research, and civil society) will network together in a win-win-situation improving regional development. To illustrate how this networking could look like from the industry perspective, the Tata Steel eco-system experience is described in the following.

However, ESSA will have a closer look at other regional approaches (such as Smart Specialisation, Cluster Platforms, Centres of VET Excellence and others) during the next phase of the project.

**Tata Steel Academy**

Tata Steel has a long-standing tradition of educating employees within the company (about 80 years). The example of Tata Steel in the region of Ijmuiden is referring to the TATA Steel Academy. All activities are centralized in the Tata Steel Academy, comprising an own company school, a training centre, a material handling centre and an Advanced Analytics Academy. At Ijmuiden, the company school was founded in 1939. Every year around 170 apprentices enrol in a vocational training programme leading to a formal certificate (EQF level 3 or 4) recognized by the Dutch government. Furthermore, also employees enrol – while already working for the company – in vocational programmes at EQF level 4 and 6 (and in the near future also 5). The vocational programmes are offered in a close partnership with a VET provider (Nova College) and several universities of applied science in the region. Training is now provided in cooperation with a VET provider in the region, Nova College. This is in line with the overall model in The Netherlands, which foresees a close collaboration between VET providers and businesses. At Tata Steel, students spend 80% of their time in the company and one day a week learning at Nova College and obtain a certificate which is recognised by the government. In the training centre and at the material handling centre, 6,000-7,000 training courses (e.g. safety training, technical training, operational excellence, material handling) are provided every year to Tata Steel's employees, but also to businesses from the region. Additionally, Tata Steel focuses on enhancing interest in technical disciplines, especially for girls and young women. For instance, this is done during the Girls' Days, on which girls get to discover careers in technical industries and meet role models that prove they can have interesting careers in these industries.


Additionally, Tata Steel Academy partakes in Techport, a regional public-private partnership, the goal of which is to achieve future international competitiveness of the regional manufacturing and maintenance industry, well-trained technical staff and a culture of open innovation. The partnership focuses on four action lines, namely: technology promotion (especially among young people), attractive technology education, attractive jobs in technology (that is, how to recruit and retain new talents) and innovation. Examples of actions undertaken by Tata Steel Academy as part of the partnership are usage of 3D printers, advanced analytics, virtual reality, classes in science and technology for pupils from primary schools. Two projects that deserve particular attention are the Fieldlab Smart Maintenance and the Hyperloop. The former was started together with various partners from the industry, but also education providers (both VET providers and universities) to enhance the curriculum in Smart Maintenance offered by Tata Steel Academy and to train employees from all companies through a test setup of a water pump installation. Tests are based on real-life situations fed back by steel plants. The Hyperloop is a project meant to create a clean alternative for short haul flights, in which smart autonomous vehicles move through a network of safe tubes made out of steel. Tata Steel Academy uses this project to combine R&D with education. Students from the Academy and from universities and researchers work together to design, produce and test prototypes of the tubes.

**Field Lab Smart Maintenance**

Field Lab Smart Maintenance is an example of a project with different partners: *Tata Steel, ROC Nova College, Vrije Universiteit Amsterdam, Amsterdam Center of Data Analytics, SKF, Bosma & Bronkhorst, Semiotic Labs, IJssel Technologie, SKF Group, Inertia, Facta.* The Field lab comprising a part of the curriculum for the VET school, short workshops/trainings for employees from all the partners, and it is part of the development for an Associate Degree (level 5 EQF) Smart Maintenance. The Field Lab is a test setup of a waterpump installation, where students and employees can test and practice how to innovate our maintenance strategies by using sensors and algorithms. Tata Steel factories deliver the input for real situation cases and issues to be tested and experienced in this fieldlab.

**National policy supporting the development of strong regional ecosystems**

In the past decade Dutch national, regional and local policies have been stimulating the enhancement of strong regional ecosystems. Two important developments should be mentioned in relation to this.

First of all, around 2008 national educational policies took a new path in stimulating VET providers and universities of applied science to focus more on their economic region and create a more regional focused based curriculum with strong partnerships with regional companies and more emphasis on innovation. As most countries, the Netherlands has specific regional economic strengths; for instance, the Chemical industry in the south "Chemelot area" or the High Tech industry in the Brainport area.

As it was believed that educational providers played an essential role in the region for these sectors to prosper and grow, educational providers were stimulated to focus much more on these specific industries in their region, and adapt and modernize their curriculums around these areas, to attract more new students, to play a role in upskilling of the human capital in the region and to have a role in the innovative strength of the region.

To stimulate this, national policies subsidized the creation of regional public private partnership in Centres of Expertise (with Universities of applied science) and Centres of Innovative Craftsmanship (with VET providers) to create together with companies and knowledge institutes strong centres of education and innovation around a certain sector in the region. Conditions were that – as it was a public private partnership - also companies had to contribute significantly to the centres (in kind or cash). Furthermore, also regional and local governments needed to invest. (See more https://wea-rekatapult.eu/). Since this development several national stimuli have been created to enhance regional public private partnership to strengthen the regional ecosystems.

The other development started around the same period. The Dutch national government developed more "focused based" economic policy. Besides a broad generic economic policy, there also became a more in-depth focus and stimulus for specific sectors. These sectors were selected based on most innovative for the country but also most competitive on the world market. Nine "Topsectors" were defined; sectors that the Netherlands is specifically innovative in and one of the world leaders and/or of significant importance to the Dutch economy. Some examples are: High Tech Systems & Materials (HTSM), Agriculture & Food, Logistics, Chemicals etc.

Around these sectors, mostly regionally based, national policy focused on the enhancement of stronger R&D and innovation. Furthermore, there was also special emphasis on the role of the regional ecosystem in this: well-educated human capital, more innovation and collaboration *between* companies and knowledge institutes and a healthy labour market. Every Topsector created a human capital agenda focusing on more partnerships between education, businesses, knowledge institutions and local and regional governments.

**Regional private public partnership: Techport**

Also, in the region of Tata Steel IJmuiden, the past years an increased focus has been on making the regional ecosystem stronger. Tata Steel Academy partakes in Techport, a regional public-private partnership, a regional network with more than 60 schools, companies and governments. The goal of which is to achieve future international competitiveness of the regional manufacturing and maintenance industry, well-trained technical staff and a culture of open innovation.

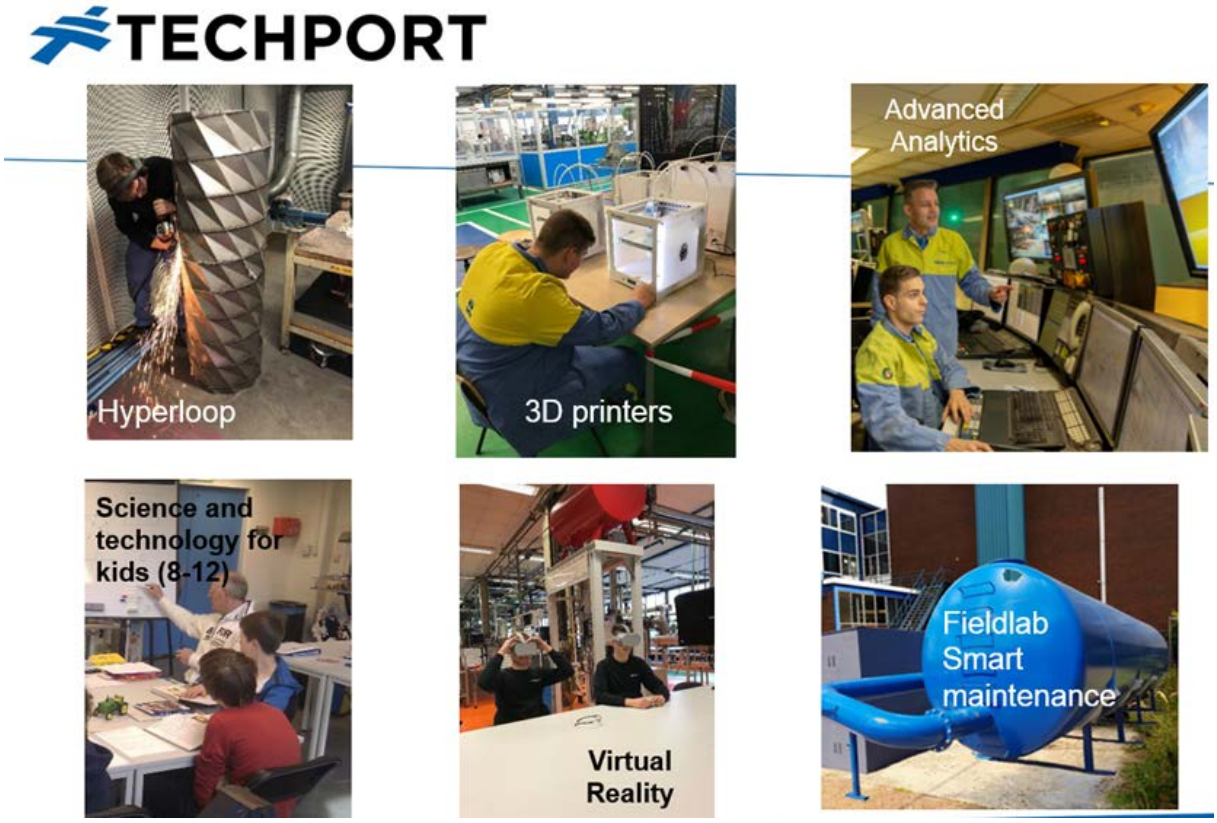



**Figure 24: Techport (Tata Steel Ijmuiden)**

**Why working together in a regional ecosystem?**

For Tata Steel it is very important to have an adequate amount of new talents available on the regional labour market to work at our company due to the aging and mobility of our workforce. However, besides quantity, it is also very important that the current and new workforce are capable of delivering the transitions that our company and the steel sector in general is facing, for instance the developments in Smart Maintenance and the Energy Transition.

To stay competitive as a company we cannot face a shortage of well-educated human capital nor can we lose out on our workforce to keep innovating and continuously improve. Therefore, we need to invest in current and future human capital; in their skills, in their ability to adapt to new ways of working and to deliver improvements and innovations themselves, working together with others. This is something Tata Steel cannot do alone and we need our region: schools, other regional companies and support of (regional and local) government.

We have learned that to create a successful partnership in the region to strengthen and develop a regional ecosystem, a success formula has been involving different partners:

- Educational providers: They deliver expertise in education and help us with educational programs with good quality and – where needed – also formalization (recognition by government and on labour market). Secondly, they are important for attracting new talent to the sector and interest them in technology. Schools are a very good place to reach new potential and interest them. Also, educational providers can help businesses with translating innovation and new technologies into what an employee or student needs to know or do differently and help prepare them for the future.

- Businesses, small and large in the region are part of the production and supply chain. First of all, also the business (and their employees) in our region need to be able to adapt fast to new innovations and not follow behind, as they are also part of our chain and therefore important for our competitiveness and future prospects. Furthermore, labour markets in our country are mainly regional. Therefore, we need to retain the talent for the region together. Thirdly, in collaboration between business we have learned that innovation can flourish and that we can learn from each other. And lastly, a large company as Tata Steel has the scale of really test prototypes and new innovative ideas. One of the challenges start-ups face is to be able to scale up their idea. In the partnership of Techport we are able to bring fully test prototypes of small businesses in the region on a larger scale.
- Governments are also fully involved in our partnership as they are important for agenda setting, putting a strong and viable labour market and well-trained human capital on the political and economic agenda. Secondly, governments can give a boost to the scope and size of the network and can stimulate potential partners to join. And lastly, governments can help with "injection" subsidies to enable regions to start a partnership and to develop activities, after development being carried on by the partners themselves.

**What do we do? Promote, learn, work, innovate**

The partnership focuses mainly on four action lines, namely:

1. Technology promotion (especially among young people): many children loose interest in technology after a certain age. In different events and activities (challenges, career events, assignments) business show how careers in technology look like and let them experience it as well. An important specific target group are girls as they are under-represented in technological education programs and careers. There are special events and programs to also reach this big potential group.
2. Attractive technology education: make sure that with by working together closely as education providers and business, curricula stay up to date and entail enriched context of technology and innovation.
3. Attractive jobs in technology is about recruitment (traineeships for instance) and how we are able to retain talents in our region by a live long learning and development programs and possibilities for mobility between companies in de region and keep upskilling our workforce in de region.
4. Innovation: we work together in Techport with different partners on different activities. For starters we bring in use cases from the companies involved around smart maintenance. We then test prototypes in these cases and try to build a business case for the prototype. Furthermore, we test new technologies in fieldlabs, not only for learning more about the technology itself but also to get more insight in the skills gap employees or students have concerning this new technology.

**Lessons learned**

A couple of lessons we learned so far about working together closely is:

- A clear agenda helps: it gives all partners a clear idea and scope of the partnership.
- Bring in content: a partnership/working together is not a goal but a means to a goal.
- Government support can boost and strengthen partnerships and collaboration in the region.

- Try to build a structural network, with explicit commitment (for instance in kind contributions of companies)
- To get companies to join and/or to really get involved in projects; build a business case. If you can show what a business will miss out on or what it can deliver in money and time, businesses are willing to invest.
- Do not over-ask smaller businesses: They are important for your region (human capital, innovation etc) but do not always have the time (or money) to be a big contributor. Nevertheless, it is very important that they stay connected and can join trainings and activities.

### *3.5 Train the trainers*

Cedefop's skills forecast (2020)[5] states teaching professionals as one of the most in demand future occupations up to 2030. Because no education and training system is better than its teachers and trainers, ESSA recognises this by train the trainer programmes and offers being part of the steelHub of the Online Training Eco-System and also of the Regional Training Eco-System approach. Developing train the trainer programmes as off-the-shelf solutions based on the demand-side (what training needs arise out of the use of new technologies) and supply-side analysis (what are companies/ providers offering). ESSA is looking to provide an overview of methodologies of trainer developments and specific training courses for trainers (e.g. on new training methodologies and technologies): (1) improving digital skills for trainers, (2) content around new technologies for training courses, (3) enabling non-trainers (peers, leaders) to train. We will elaborate requirements, strategies, guidelines for train the trainer programmes to train trainers and middle managers, people delivering skills training to steelworkers in relation to the gaps missing in VET delivery and/or within firms or more widely, including guidelines for delivering the strategy or programmes.

Regarding the 'train the trainers' approach, we ESSA has been considering for instance active learning methodologies which have been proven as more efficient than the traditional methods. These methodologies which provides learning based on tasks, problems, projects, challenges, case studies, etc. have the aim to engage and motivate the involved learners and they are referred as learner-centred methodologies. Their goals are the construction of meaningful learning, the provision of an active process of knowledge construction, keeping the learners' attention, emphasizing their independence and inquiry, and, in the last term, improving the pass rates. Problem Based Learning (PBL) and Project-based learning (PjBL) are methods widely used in the world of education. Their objective is to enhance "self-directed learning" skills, by changing the usual lecturer role of teachers towards a mentoring role. Thus, PjBL has a wider and a more complex scope and often includes the design and creation of a product, and requires a multi-disciplinary and multi-subject approach, while PBL is more specific and it is often based on a single-subject. PjBL may use scenarios, but often involve real world, fully authentic tasks and settings, while PBL often uses fictitious scenarios as "illustrated problems" or real-life situations that correspond to real case studies. Real Case Solving (RCS) is a variant of the PBL where learners solve real cases and actual problems of the companies through the application of the PBL methodology. During the 'train the trainers' process, for each different case, the most appropriate of these active learning methodologies can be easily adapted. Furthermore, trainer job profiles and roles, upskilling and training methods have to be adjusted, esp. for

- Active learning methodologies based on tasks, problems, challenges, etc.

[5] https://www.cedefop.europa.eu/en/publications-and-resources/data-visualisations/skills-forecast

- Enhancing "self-directed learning" skills, changing the usual lecturer role towards mentoring.

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 to change the perspective from "physical" or classical internal or external teacher responsible for transfer of knowledge to the "role" of trainer, part of the management, experienced workers etc. Actions to be done:

1. **Requirements / demands / good practice** could be extracted from our work so far:
    - What kind of train the trainer measures are needed because of the technological, economic development (WP2)
    - What does the industry require and have in place (WP3)?
    - What kind of approaches are shown by the VET systems (WP4)?
    - New strategies and guidelines and new skills (related to teaching activity) (WP5)
2. **(New) Training arrangements** for train the trainer:
    - **Hybrid teachers**: external but also internal (workplace but also schools/courses)
    - New allocation of **on the job learning and learning support of digital information tools**, e.g. tablets, apps.
    - **Peer training and learning:** trained workers (e.g. by the software developers of new digital solutions) train their colleagues on the job
    - **New leadership**: shift managers, managers getting the role of trainer/mentor/coach/facilitator, esp. for improving and distribution of transversal skills
    - **Online training**: gamification, ...
    - **Case Study and simulation:** Learning by doing methodology.
3. List of **training for trainers** already in place (examples for train the trainer → as part of the Online and Regional Training Eco-System)
4. The train the trainer **methodology** (company internal and external) has to be updated:
    - company job shadowing for trainers (VET teachers)
    - use of mentors within the company for on the job training (informal training)
    - enable professionals in the companies to teach and share their knowledge
    - module development
    - training database (viability, input of data, related to requirement of potential users → steelHub)
    - operating instructions (internal, external), use of tablets (new equipment) (→ facts4workers project https://facts4workers.eu/)

The next step of the ESSA Blueprint is to collect train the trainer modules and integrate them in the **steelHub** of the Online Training Eco-System (ESSA OTS). In parallel within ESSA train the trainer modules relevant for on-site training in companies and VET schools of the Regional Training Eco-Systems (ESSA RTS) will be collected. For collecting good practices as representative examples of the different approaches / measures will be distribute to a template, with the objective to have online and on-site train the trainer modules in our steelHub database.

| Training Approach | Measure / Method | Online / On-site | Kind of Provider | Organisa-tion | Description | Links |
|---|---|---|---|---|---|---|
| Online training | | | | | | |
| On the job learn-ing | | | | | | |
| Dual Training | | | | | | |
| Peer Learning | | | | | | |
| New potential trainers | | | | | | |
| Managers as trainers | | | | | | |
| Developers as trainers | | | | | | |
| others | | | | | | |

**Table 10: Template for collecting train the trainer measures and modules**

### *3.6 Image - Recruitment - Talent Management*

The image of the Steel Industry is still a major challenge for recruiting and retaining a high skilled workforce. This was currently emphasised also by the Steel Sector Careers Blueprint but it is noted that students and job-seekers with no contact or experiences with the steel sector rate the image more negative than the respondents having already knowledge of the Steel Industry. However, redundancies, shift working, low salaries for low skilled work, and environmental impact are arguments against a job in the Steel Industry. This has to be reflected in image and recruitment campaigns and talent management strategies.


**Figure 25: Image of the steel industry (SSC)**

Image improvement together with the increase in competitiveness and a decrease in the environmental footprint is key for the Steel Industry. This impacts directly and indirectly on the future workforce: Getting talented people for the most in demand jobs, recruiting and retaining talents and high skilled workers.

### 3.6.1 Most in-demand jobs in the steel industry in the next 5 years

Not only training and new learning arrangements are of relevance for adjusting the skills and competences of the steel workforce. Not at least activities and campaigns to improve the **image** of the steel industry for **recruiting and retaining talents** could be linked to skills adjustment strategies deriving from the technological foresight and related skills requirements. The development of strategies 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, as well as strategies increasing the workforce mobility and diversity (e.g. increasing the attractiveness of the steel industry for women) are relevant to overcome the aging workforce.

Therefore, digital and green transformation by new Industry 4.0 technologies could be an opportunity to enhance and change the image of the steel industry and to attract talents 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"[6] 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.

Steel industry activities have to improve the employer attractiveness by **internal** own activities supported by policy. A broad range of these measures are already existing and in place (ESSA workshop results, see as well Steel Sector Careers Blueprint):

- Trade fair appearances (contact points)
- Emphasizing social aspects like social security, work-life balance
- Attractive payment with benefits
- Using and visualising contemporary HR instruments such as new leadership, coaching, mentoring, mobile work, part time contracts
- Positioning steel industry as a great employer, e.g. via LinkedIn, Twitter, publish news at regional level but also national wide to raise awareness of steel industry
- Address the global and a local steel industry perspective
- External advertisement via own employees, steel workers as ambassadors to attract people
- Use early contacts via internships, trainees for job options in the company, maximum utilization of working students and internships to spread practical knowledge and recruit talented people
- Operate expectation management among young employees at all levels
- Share with society the value of Steel industry in Europe, increase attractiveness for technical professions, fight against image as being dirty or not sustainable (e.g. spread special reports, showing investments in sustainability) addressing neighbourhood stakeholders; create an image of "green steel", promoted by society; politics must support, steel is environmentally friendly and sexy, but only with backing,
- Integrate the customer perspective in the "big picture"
- Permanent location security strategy vs $CO_2$, dumping etc., communicating that there will be steel production in Europe in the future (convincing people to come to European Steel companies)

[6] https://www.cedefop.europa.eu/files/9143_en.pdf

- Overcoming the trend to focus on academic professions - difficulty in winning "good" applicants for skilled workers, strengthen VET careers
- Reflect on regionalism: job offers "in the region", regional roots and strength, working with local NGOs in the neighbourhoods and city halls to support a good relationship, organize workshops with company and stakeholders
- Positive lobbying from internal and external players: good examples of work of "young" people (ambassadors)
- Secure future viability: credible future strategy and vision, hydrogen and $CO_2$ reduced green steel image must have a market, "an ecologically oriented company on its way to transformation"
- Promote "positive" media, follow and expand social media strategy -> mass medium for potential applicants
- Digital transformation attracting candidates with digital affinity
- Steel industry as a secure employer with career development and long-term employment perspective, even in times of crises.

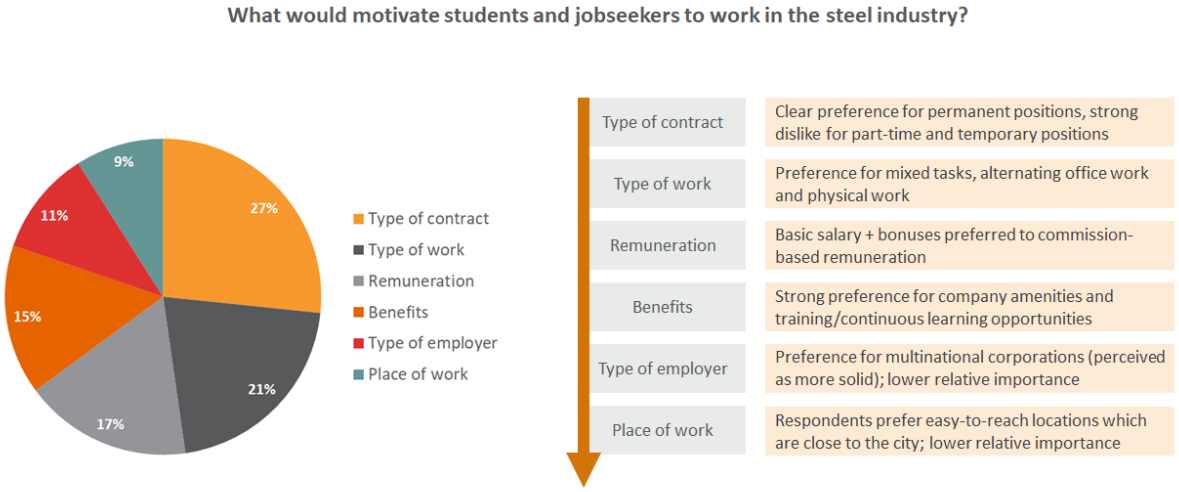



**Figure 26: Motivation of students and job-seekers to work in the steel industry (survey of the Steel Sector Careers Blueprint)**

The Steel Sector Careers Blueprint lists about 20 jobs related to the labour market that will be important for the steel sector with a VET perspective (see figure below). Additionally, in ESSA it appears as result of the technological development and foresight that a lot of job profiles in most of the production and maintenance areas are and will be affected by a wide range of Industry 4.0 technologies. In contrast to other Blueprints (which are mainly focusing on disruptive game changers), in the steel and steel processing industry ESSA supposes that there will be no (or very less) new occupations and job profiles based on the technological development. It is more an upskilling of the existing workforce (not at least because of recruitment difficulties, discussed further below).


**Figure 27: Most demanded jobs in the steel sector**
**(https://ec.europa.eu/docsroom/documents/37352)**

ESSA focuses on a general upskilling of the existing workforce and specific job profiles (see **chapter 2**). However, the company workshops stressed the view on the development of

- **Production specialist** or "Production Craftsmen" who control or monitor running systems and repair defective systems and "Industrial Clerks" with a high level of technical understanding of production processes
- **Employees, professions with (improved) IT skills:**
  - **Analysts** who are heard in the team - teams that listen to the analysts; skilled workers with good IT skills and IT specialist (application development and system integration); programmer / computer scientist
  - **Process** technologists, automation engineer, measurement and control technicians
  - **Metallurgists**.
- **Executives, leadership**: People at the workplace who can lead and motivate, HR professionals driving digitalization.

There might be a further differentiation of "simple" machine operators (happy to work eight hours monotonously on Conti shifts) on one side and employees who are more directly involved in digital optimisation of the production process, decentralised decision making and problem solving as well as higher digitalised maintenance specialists. Both perspectives are in place: incremental upskilling of the existing workforce and reduced performance and job loss (deskilling). Additionally, there is a need of jobs for employees with reduced performance: jobs and concepts needed for employees who may no longer work in continuous shift or physically demanding jobs. In the past, many easy jobs for these workers were given. But due job losses (due to automation), it gets more and more difficult to find other opportunities for them or to find digital tools to help these people to stay in the production line.

However, **flexible employees** are needed, aware of that tomorrow's jobs can be different and skills adjustments are needed (changing job profiles and skills).

### 3.6.2 Image and Recruiting Campaigns

The Steel Sector Careers Blueprint (SSC) listed the most relevant elements named by students and job-seekers to work in the Steel Industry (see figure below). Among them, the type of contract, type of work and remuneration, and exciting career opportunities play an important role. Additionally, it would be important to show that careers in the steel sector are respected (and respectable), exciting, require digital skills, are not second-tier and that steel producers are making efforts to enhance the digitalisation and sustainability of steel production.


**Figure 28: Conditions to work in the steel industry (Steel Sector Careers Blueprint)**

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"[7] and the "Green Steel" initiative[8] 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.


[7] https://www.estep.eu/assets/Uploads/ec-rtd-he-partnerships-for-clean-steel-low-carbon-steelmaking.pdf
[8] https://www.estep.eu/green-steel-for-europe/


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).

| How can "steel industry" present itself to target groups to be attractive? | Main challenges |
|---|---|
| • Image campaigns<br>• Extend social media activities: show what young skilled workers do<br>• show women as skilled workers on-site and at offices<br>• Strong presence in the media world<br>• Send ambassadors to schools<br>• Retain good interns to the company<br>• Maintain face-to-face events and face-to-face discussions (at universities / schools)<br>• "Honest work at an excellent employer" (but authentically presented)<br>• Image: We create green steel!<br>• Create a "green" image for trade fairs and events<br>• Launch projects and invite students<br>• Concentration on comprehensive schools / junior high schools for future professional specialists<br>• Show CSR activities (especially in the neighborhood) and that it is still, in difficult times, present<br>• Launch "family days" to involve relatives to work activities<br>• Be partner with local media (e.g. discussing safety issues) | • Image of the steel industry as an "old and dirty economy" complicates attractive employer branding and manifests the steel industry as a dying dinosaur.<br>• Future strategy of H2 and digital transformation must be clearly highlighted and communicate through different channels. Positive steel industry transformation must be communicated in the press and led by politics.<br>• Political backing for "green steel" in European Union and Member States necessary.<br>• Active sourcing of candidates continues to gain importance. Maintaining contacts with cooperation institutions (school, university etc.)<br>• Reality check for young applicants / trainees: expectation management. After vocational training danger of disillusionment in the continuous shift work.<br>• Technical professions („blue collar workers") must become more attractive, since these workers control the running systems / maintenance systems<br>• Quality and quantity issue: The steel industry needs experienced specialists in terms of quality and at the same time many workers in simple production work<br>• Flexible workers with the ability to adapt personal skills are needed.<br>• Successful recruiting starts in many places: e.g. employees as ambassadors, early affiliation of young people, show future viability of steel to point out interesting careers in steel industry<br>• Two different strands: Short-term fixes (activities) and long-term fixes (getting into contact with young people) |

**Table 11: How to make the steel industry more attractive**

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 of the Steel Sector Careers Blueprint (newsletter, factsheet, posters, brochure, infosheet) are available for download in various languages (EN, ES, DE, FI, FR, IT, NL, PL) at Steel Sector Careers.


**Figure 29: More opportunities than you can imagine campaign**
(Steel Sector Careers Blueprint 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 support 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)[9]. 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.

[9] https://corporate-media.arcelormittal.com/media/ololslbt/poland-sustainability_report_2019.pdf


**Figure 30: AMP community engagement sustainability report 2019**

### 3.6.3 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 retention of young qualified talents will mark the operations of the coming years.

Therefore, ESTEP Focus Group 'People' together with EUROFER launched an EU-wide survey answered by 268 talents identified by steel companies estimating their values, ambitions and needs. The survey points out clearly that the talents attach importance to personal carrier development. 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. 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.

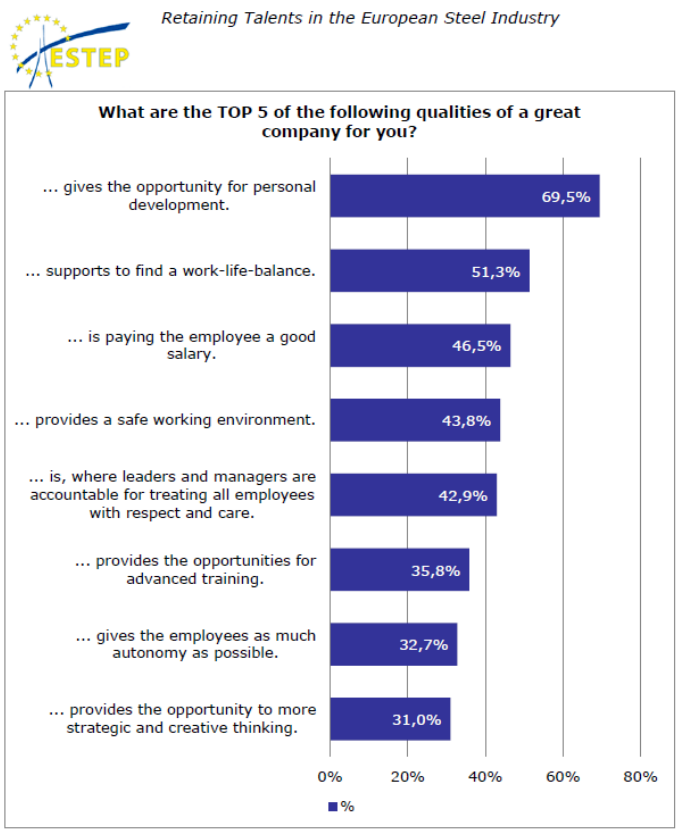



**Figure 31: Talent management in the steel industry – results of a ESTEP survey**

The report shows as well that if the talents could be hired and they got first experiences in their new job in the Steel Industry that their expectation have been satisfied to a great (43% of the talents) or somewhat extent (53%), only 3% were very little or not at all satisfied. This is very much in line with the result of the Steel Sector Careers result, that the image of the Steel Industry is improving when gathering experiences with the sector. The ESTEP Talent Management Report further stress that the employed talents claim with 89% their experiences made in the Steel Industry are strongly helpful in other industries (transferable skills) and 77% would like to advise a job in the Steel Industry to a friend (Echterhoff/Schröder 2015, p. 19)[10].

The talents are very compatible with the skills requirement (for digital skills in general, but especially found in ESSA). Among the cognitive competence list the five top ranking competences in which the respondents would like to develop were strategic thinking (68% of the respondents indicated willingness to have competence development in this area), change management (62%), decision making (60%), effective communication (54%) and innovation (52%).

[10] Veit Echterhoff / Antonius Schröder 2015, page 9, 268 Talents of European Steel Companies, report available under https://www.estep.eu/assets/Uploads/ESTEP-WG5-Report-TalentSurvey.pdf

### 3.6.4 Communication Recommendations by the Steel Sector Careers Blueprint

**Emphasise the prominence of steel in every aspect of modern society**


Interviews

"Steel companies are carrying out cutting-edge research to meet the EU's targets on climate, and trends such as Industry 4.0 create new and stimulating challenges for anyone interested in ICT and technological research."


Best practice

#lovesteel campaign launched by World Steel


Target audience

ICT and environment science graduates who have not worked in the sector before

**Showcase the role of steel in reaching circular economy and sustainability goals**


Surveys

The belief that steel companies make efforts to increase their sustainability has an effect on the willingness to work in the sector. (linear regression)


Desk research

"Nowadays, the vast majority of steel by-products are being reused and repurposed, and 40% of the European steel production is based on the recycling of scrap steel. In addition, research on high-strength steels has led to a 25% to 40% weight reduction in the steel products used in cars, buildings and packaging, leading to significant cuts in emissions and energy use."


Target audience

Jobseekers interested in sustainability and green economy

**Showcase the industry's efforts towards health and safety**


Interviews

"Steelmaking is still considered a dangerous occupation."


Surveys

67% of Survey 2 respondents agree that there is a high risk of work accidents in the steel sector.


Target audience

All

**Give visibility to high-skilled positions that do not require physical strength and highlight task variety**


Interviews

"The development of automated processes has already impacted steel production chains, reducing manual labour and physical stress."


Surveys

"Steel careers are still perceived as manual and physically demanding."
"Students and jobseekers attribute great importance to positions that combine sedentary work with physical work." (CBC analysis)
"The willingness to work in the steel sector could be strengthened by showing that steel careers require digital skills, offer exciting challenges and growth opportunities and are adequately remunerated." (linear regression)


Target audience

All, with a specific focus on the groups for which physical work represents a disincentive to consider the steel industry

**Help jobseekers understand how advances in AI and robotics will reshape the work organisation of the industry**


Interviews

"Many roles that in the past required on-site presence and repetitive working shifts will be more flexible and allow to alternate on-site presence and home working."


Surveys

Several people, including the 'hopefuls' regard shift work as a serious constraint." (cluster analysis, Cluster 4)
The belief that working in the steelmaking industry is a prestigious occupation is an important determinant for the willingness to work in the steel sector. (linear regression)


Target audience

Those who have not worked in the sector before

**Establish partnerships with innovative steel companies to show what modern plants look like**


Surveys

Out of the sample of students, graduates and jobseekers, 71% consider jobs in the steel industry as very manual/physical and only 24% agree that working conditions in steel plants are generally good.


Interviews

"Many modern steel plants are state-of-the-art facilities using cutting-edge technology. These days, working in a steel plant is more like working in either a laboratory or control room".


Target audience

All

**Carry out campaigns promoting careers in metallurgy and STEM-related studies in primary schools and high schools**

Desk research

Since one of the causes of skills shortages seems to be the lack of students enrolling in relevant STEM-related studies, steel companies should tackle the challenge of talent shortage early on, engaging with primary schools to increase the attractiveness of STEM and bring pupils closer to manufacturing.

Best practices

PET IJMond, Becas Robótica Educativa and Aula STEM, "Machina et Schola", Olympiades des Sciences de l'Ingénieur, 3-19

Target audience

Primary school and high school pupils

**Encourage companies to use their employees as ambassadors in communication campaigns**

Surveys Interviews

- The steel sector is widely seen as low-skilled, characterised by manual and repetitive work
- There is a general lack of awareness of the career variety offered by the steel industry
- Many respondents interested in ICT and R&D would be willing to work in the industry if offered suitable positions

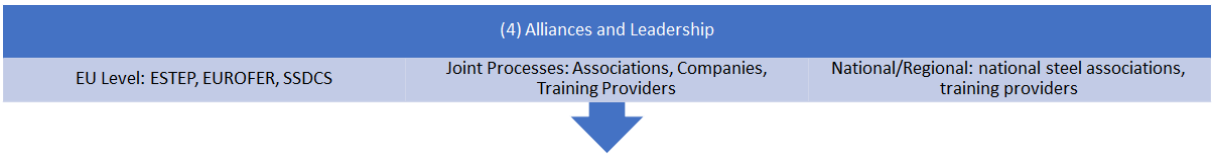
Target audience

- Primary target: Cluster 1 – moderately willing to work in the industry, low attractiveness
- Secondary target: Cluster 2, Cluster 3 – low willingness to work in the industry, low attractiveness

Best practice

Why #Ilovesteel campaign launched by World Steel

# 4 Alliances and Leadership




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 the 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 (16 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. What is needed is a sustainable European Steel Skills Alliance (ESSA) **beyond the project life span** with reliable leadership governance and systematically linking the European Blueprint with the European, national, and more relevant, the regional level of steel regions (see Rollout of the Blueprint, next chapter). Therefore, ESSA will have to be run further embedded in existing structures of ESTEP, EUROFER, the Sectoral Social Dialogue Committee on Steel (SSDCS), and industriALL on the European level first. Within these governance structures cross-stakeholder activities have to be initiated and launched, as well as internal integration of skills adjustment within the activities of the associations, companies, and training providers.

### *4.1 ESSA Partnership as the Ground for a European Steel Community Involvement*


The partnership comprises about 40 partners. The project consortium consists of 24 partners:

- **Steel companies:**
  thyssenkrupp Steel 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), ArcelorMittal Spain Training Centre
- **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, Wirtschaftsvereinigung Stahl 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, RINA/CSM, Visionary Analytics VA

completed by 16 **associated partners**:

- ESTEP European Steel Technology Platform, industriALL (European Industry Union), EIT Raw-Materials, 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, ArcelorMittal Italy, Fédération Métallurgie CFE-CGC, Metalowców NSZZ „Solidarność", UK Steel, SAAT Consulting.

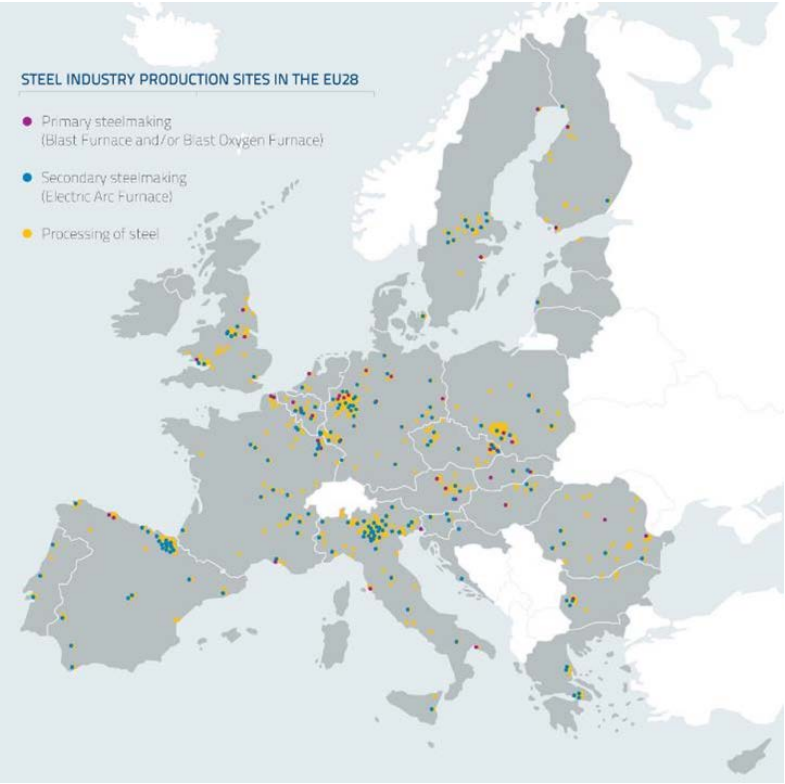



**Figure 32: Steel industry production in the EU**

Affiliated organisations to the above are also included and will provide access to their respective members. The partnership is directly involving **12 EU countries**: Belgium, Czech Republic, Finland, Germany, Italy, Lithuania, Netherlands, Poland, Spain and UK, completed by France and Sweden (associated partners). Nevertheless, via EUROFER, industriALL, CIELFFA, and steel company subsidiaries in other countries ESSA is **covering the whole steel industry member states** in Europe, including steel processing and the SME perspective.

To broaden the perspective beyond the Steel Industry ESSA integrated institutions in the partnership not focusing (only) on the sector, e.g. EIT RawMaterials and the Council of European Professional Informatics Society (CEPIS) completed by several European networks (this cooperation has to be elaborated and defined, establishing concrete links with ESSA) (see Table 8: Interconnected Platforms to the ESSA Observatory).

The dedicated main roles are:

- **Steel companies:** defining skills needs, developing training tools, good practice exchange, feedback on blueprint and implementing, testing of tools and programmes, involving company related training organisations, roll-out to other company sites
- **Training providers:** defining skills demands and answers to it, developing training tools and strategies for the blueprint, leadership and train the trainer programs, developing new methods and learning arrangements
- **Steel associations / social partners:** setting-up the Skills Alliance; feedback, assessment of the blueprint strategies and tools, dissemination, involving national VET organisations, roll-out of the Blueprint on the European and national level
- **Research institutions:** management of the project, research on technological, economic, skills development, VET system integration, strategy development for the Blueprint
- **External experts:** integration of technological and skills expertise.

This already huge partnership is engaged in supporting measures for the transfer, implementation, monitoring, cooperation and dissemination (EU and Member State Level) as well as for national roll-out preparation in collaboration with other blueprint developing sectors.

- Steel companies and social partners (associations and unions) are central and are engaged 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.
- 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 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 EQF, ECVET, etc.). A contribution to policy recommendations (including collaboration with EU and Member State Stakeholders, national funding institutions) will also be coordinated by the research institutes.
- 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 participating organisations, or stakeholders, have been selected because each is – in different ways – strategically committed to the European steel industry. Key stakeholders, including those directly involved in the project and those to which the project relates, have been identified) and will be drawn upon for the identification and analysis of the intelligence related to the execution of the Blueprint and for the design and development of the network beyond the finite funding period of the project.

### *4.2 Linking ESSA Foresight Observatory with Existing Steel Sector Platforms and Associations (ESTEP, EUROFER, SSDCS, industriALL)*

The European Steel Technology and Skills Foresight Observatory (ESSA ETF) will take over the leadership of the ESSA Alliance cooperating closely with the existing associations and platforms, mainly ESTEP, EUROFER, SSDCS, and industriALL. Under the head of ESTEP FG People, the Observatory will coordinate its activities closely and in collaboration with the European steel platforms and associations:

- Strategies for gaining political support, mobilizing human resources and engaging stakeholders for the Blueprint and Skills Alliance
- Blueprint implementation, operation and monitoring on the European Level
- Communication and involvement strategy for skills adjustments (e.g. new skills demands and development and upload of training measures in the steelHub)
- Rollout of new informations, tools, measures to the steel regions
- Implementation and transfer plans elaborated with the national steel associations
- Setting-up of adhoc or regular sub-committees for hot topics – mainly incorporated in existing committees
- National/regional rollout: national steel associations, training providers
- Organising joint processes of associations, companies, training providers to optimise skills adjustment strategies and VET strategies, tools, curricula across:
    - Associations: linking European and national, regional VET cooperation, …
    - Companies: joint training programmes, …
    - Training Providers: exchanging best practices, advertising the steelHub, …

### *4.3 Division of Responsibilities and Leadership*

The ESSA governance structure based in the ESSA Foresight Observatory will be further developed in the transfer and implementation test phase 2021. Core of the governance structure is an integration of stakeholder representatives of all steel relevant areas (as described above), ensuring a quadruple helix perspective (industry, policy, education and science, and as much as possible civil society (mainly at the regional level, where people live and work)) and a continuous social innovation process to establish and improve new social practices in skills adjustments.

The transfer of the results into practice includes a new coordination and **distribution of responsibilities**. Responsibilities but also duties and interaction for continuous learning have to be *newly balanced and interrelated* between industry, VET systems, and the individual learner, supported by new policy frameworks, for instance:

- Steel industry focusing on company specific short-termed adjustment of skills needs
- VET systems on basic and transversal competences and skills relevant across sectors
- Individuals by improving self-learning capabilities and a lifelong learning attitude, empowering individual lifelong learning capabilities, …
- Policy by developing new innovative frameworks supporting lifelong learning (e.g. through individual learning accounts, …).

Future development of education and training programs might focus also on different responsibilities, tasks and procedures of the workforce and the executives (based on the results of company workshops):

**Workforce appeal:**

- Work independently in complex topics with digital media
- Admitting the lack of skills of employees
- Identify issues proactively, don´t be driven by development
- Personal responsibility of learning, sharpen the individual responsibility of the employees as regards to training
- Closing skills and knowledge gaps independently by oneself
- „Find one´s feet" quickly, even under tendencies of rationalization and shorter cycles of innovations - that means: learn the strings on your own
- Understanding high costs, understanding promising measures
- Open feedback culture
- Culture of lifelong learning ("Learning oriented company"): understanding of training as benefit to employability

However, self-responsibility requires guidance: It is theoretically possible to take over responsibility for closing the open skill gaps, however on the practical side, it is quite difficult. Pull factors (schemes for career progression) and push factors (fundamental training) are needed. Otherwise, one gets lost in the system. The capacity of people to select learning targets autonomously is limited, difficult without guidance. Empowering courses at the beginning are important to provide people the basic cognitive tools to identify their learning targets. This includes also a new responsibility and role for the executives (mainly related to the workforce appeal above).

**Executives roles:**

- Have confidence in employees
- Lead confident
- Conditions for self-learning require active role of executives (impart confidence and implement self-learning).
- Need of cultural change, executives should become mentors, ambassadors.
- Stay role model – identify and break new grounds
- Open feedback culture
- Identify issues proactively - don´t be driven by development
- Identify significant changes of the future and control the demand for training in time
- Identify the needed skills of employees
- Provide orientation how to achieve sustainable success
- Demand Performance
- Important role of white collar to fill skill gaps of the blue collar

### *4.4 Strategic Orientation*

The strategic orientation of the ESSA Alliances and Leadership is completing the more top-down vison for a Skills for Industry Strategy (2020)[11] with alliance building within a social innovation process integrating the steel sector stakeholders as much as possible to ensure a bottom-up perspective. Related to this some proposed actions of this EU study are covered by ESSA in this way:

- European Steel Technology and Skills Foresight Observatory (ESSA ETF) will include the appointment of "Skills Leaders" at European, national, and regional level, increase cross-border collaboration, set-up of a one-stop-shop (including the steelHub and Online Training Eco-System), incentivise VET upskilling, promotion campaigns (including talent development and detection among women), certification measures, empower VET systems to review their curricula rapidly and easily, develop new partnership models, discussing of new skills funding branding (e.g. Lifelong Learning and Skills Insurance Plan).
- Regional Training Eco-systems will check the proposed "Set-up of Territorial Skills Councils, definition and implementation of Territorial Skills Strategies", fostering the concept of "Lifelong Learning Centres" - "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"

However, as already said new alliances and related leadership as well as division of responsibilities are still in its first phase and will be developed and tested during the planned transfer and implementation phase of ESSA in 2021.

[11] http://skills4industry.eu/skills-industry-curriculum-guidelines-40

# 5 Rollout

Because of the differences in VET systems and skills needs in the European countries and regions, ESSA is not a one size fits all solution but an orientation framework to be adjusted and linked to the steel region level. ESSA will integrate also the national level (because the public responsibility for VET is often placed at the national government level) but the regional level is the most important one from a practical perspective. A common strategy for continuous improvement and adjustment of skills, competences, and occupations institutionalised in Regional Training Eco-Systems is needed where people live, work and learn. Additionally, SMEs and steel *processing* companies are more often focused on a region than big global steel companies, and this is a good way to address them as well. Same applies for the *integration of (national) unions*: They are more active at the company and regional level (and not so interested in European solutions, also being handicapped by language barriers).

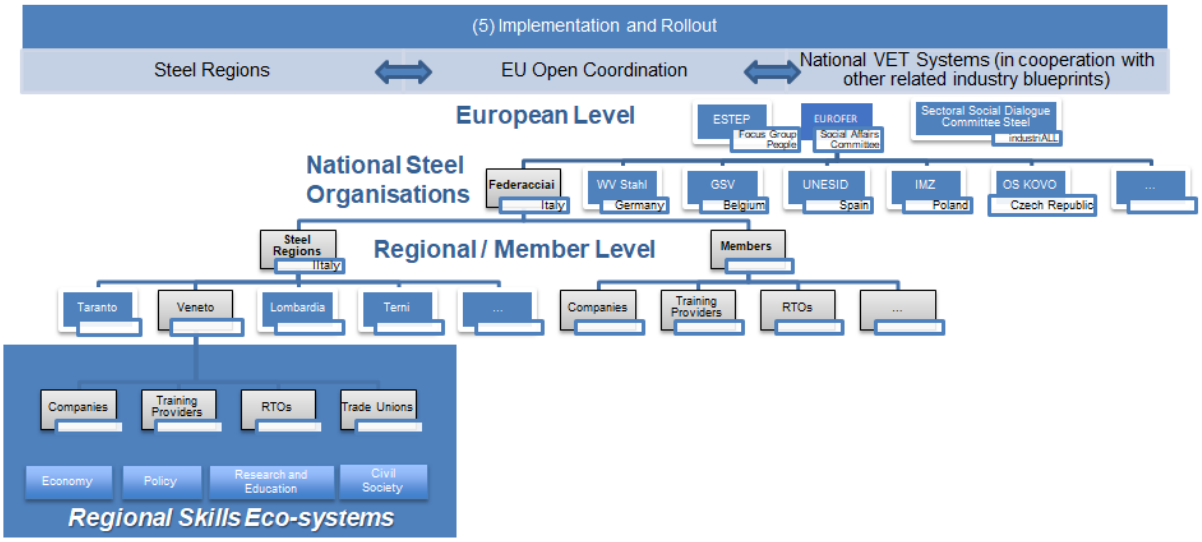



**Figure 33: European – national – regional rollout**

Because of the differences in VET systems and skills needs in the European countries and regions, ESSA is not a one size fits all solution but an orientation framework to be adjusted and linked to the steel region level. ESSA will integrate also the national level (because the public responsibility for VET is often placed at the national government level) but the regional level is the most important one from a practical perspective. A common strategy for continuous improvement and adjustment of skills, competences, and occupations institutionalised in Regional Training Eco-Systems is needed where people live, work and learn. Additionally, SMEs and steel *processing* companies are more often focused on a region than big global steel companies, and this is a good way to address them as well. Same applies for the *integration of (national) unions*: They are more active at the company and regional level (not so interested in European solutions, also being handicapped by language barriers).

While the rollout of the ESSA Blueprint will be mainly developed and checked in the first pilot implementation phase of ESSA in 2021 first contours are already available. With the European Open Coordination method, the European ESSA Blueprint will be offered as a general 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). Whilst most steel-relevant education is provided by companies in-house

and on the job, stakeholders acknowledge the importance of seeking collaborations between the industry, public bodies and education providers (as stated by the Steel Sector Careers Blueprint). 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".

The rollout 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.

The **national VET Systems** will be in cooperation with other process industry related Blueprints (such as Construction, Automotive, Manufacturing, Textile, …). A common strategy should prepare the results, offers and demands of different Blueprint for supporting and integration in the national VET systems. This approach will reduce the burden, time and effort of the national VET institutions as well as it will increase the lobby and influence of the single Blueprints.

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 future sector-based Pact for skills and the Blueprint for Sectoral Cooperation (focusing on the sectors put forth by the new EU industrial strategy) and 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.

For the rollout of the ESSA Blueprint a template for gathering the European Steel Regions was developed identifying a first set of steel regions in Italy and Poland with the support of the national steel federations. 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)

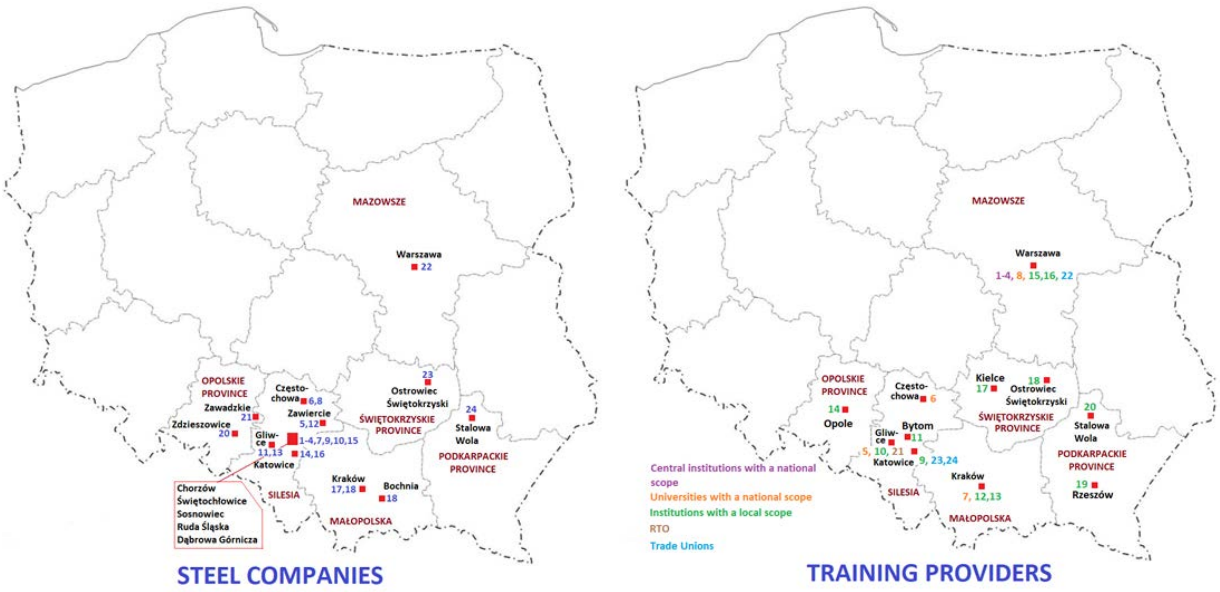



**Figure 34: Steel regions (example Poland)**

If existing in the selected **steel regions** ESSA will collaborate with the European **Centres of Vocational Excellence** (CoVEs)[12], the **European Smart Specialisation Platform**[13] and the European Cluster Collaboration Platform[14]. Already identified steel collaboration clusters are:

EUROPEAN CLUSTER COLLABORATION PLATFORM .eu

**SIDEREX BASQUE STEEL CLUSTER**
(Basque Country, Spain)

**Steel Innovation Cluster / Polo del Acero**
(Aviles, Spain)

**Triple Steelix / Jernkontoret**
(Norra Mellansverige, Sweden)

**Regional Dialogues** have to be done to set up the Regional Training Eco-systems, to be checked what kind of support is needed from the national level (steel associations, training providers, VET institutions, policy, funding) and the EU level.

[12] https://ec.europa.eu/social/main.jsp?catId=1501&langId=en
[13] https://s3platform.jrc.ec.europa.eu/
[14] https://www.clustercollaboration.eu/

## Steps Foreseen

Within the first implementation phase the necessary parameters for a sustainable integration of existing European and national/regional structures will be elaborated, 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 additional offers will be checked, esp. train the trainer modules, and integrated further in the **steelHub** of the Online Training Eco-System (ESSA OTS). More pilot training modules and offers from the steel companies and training providers will be collected and integrated in the steelHub (Online Training Eco-system) in line with the ESSA approach. Steel industry relevant training measures of other (mainly Erasmus and Leonardo) projects will be checked for an integration in the Online and Regional Training Systems, e.g. for Greening Technical VET (GET VET) and Equality and Diversity Learning in the European Steel Industry (EDLESI) as well as train the trainer modules. On the job, on-site training in companies and VET schools are mainly part of the Regional Training Eco-Systems (ESSA RTS) to be established.

Beside the already running 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.

The European Steel Technology and Skills Foresight Observatory (ESSA ETF) will be implemented 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 Ecosystems. 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.

# Annex

***List of Figures***

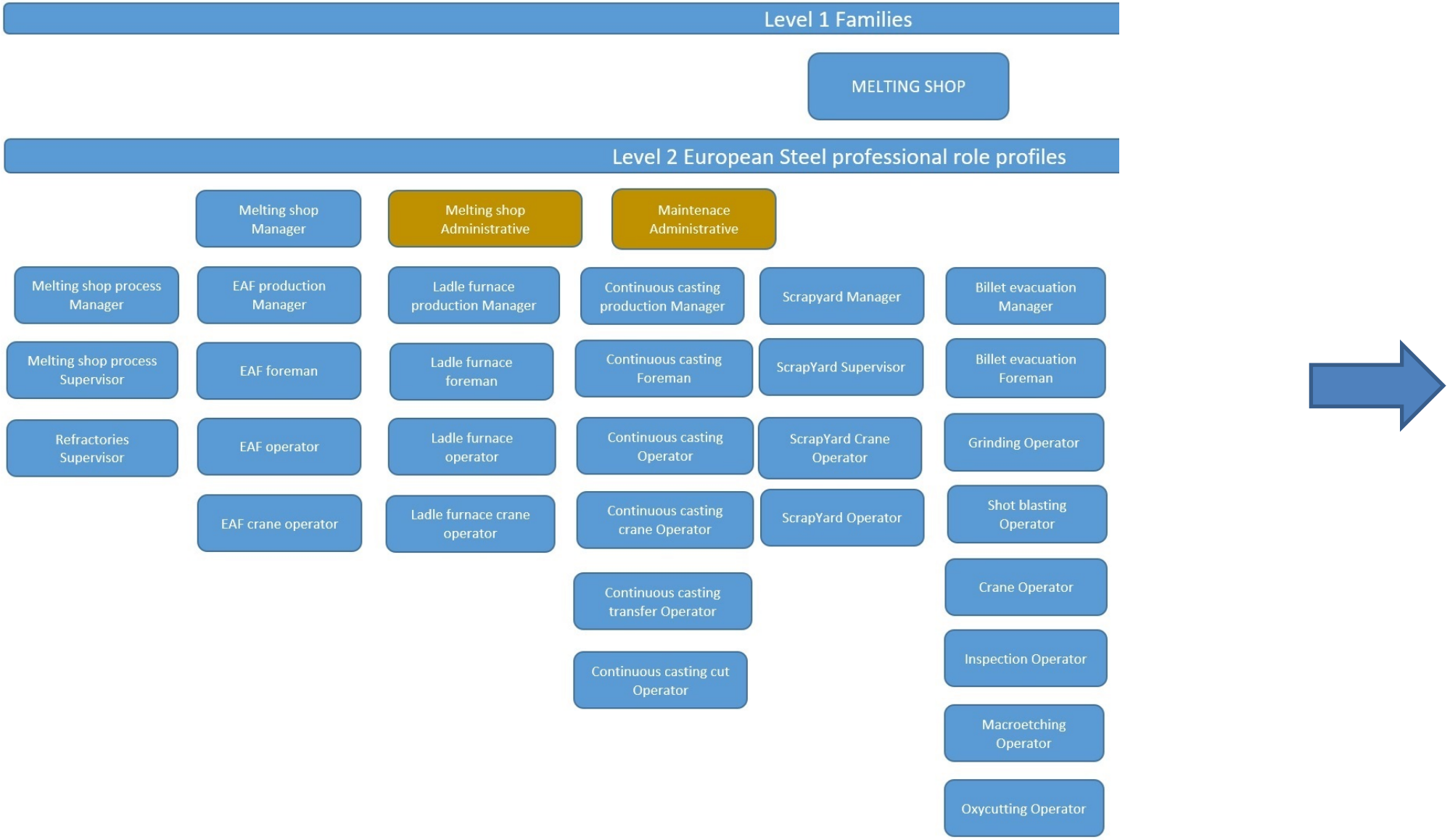
***List of Tables***

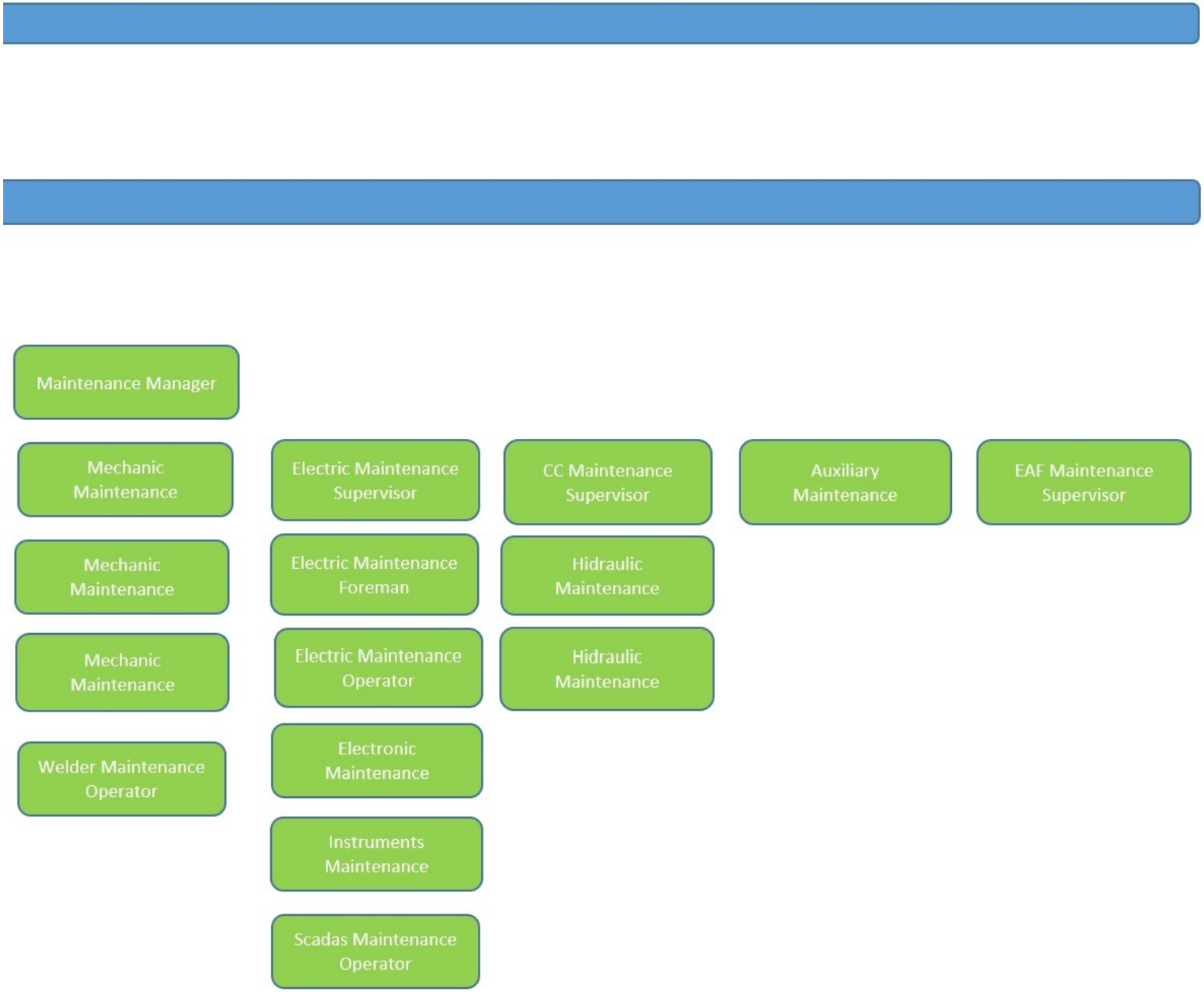
***List of Abbreviations***

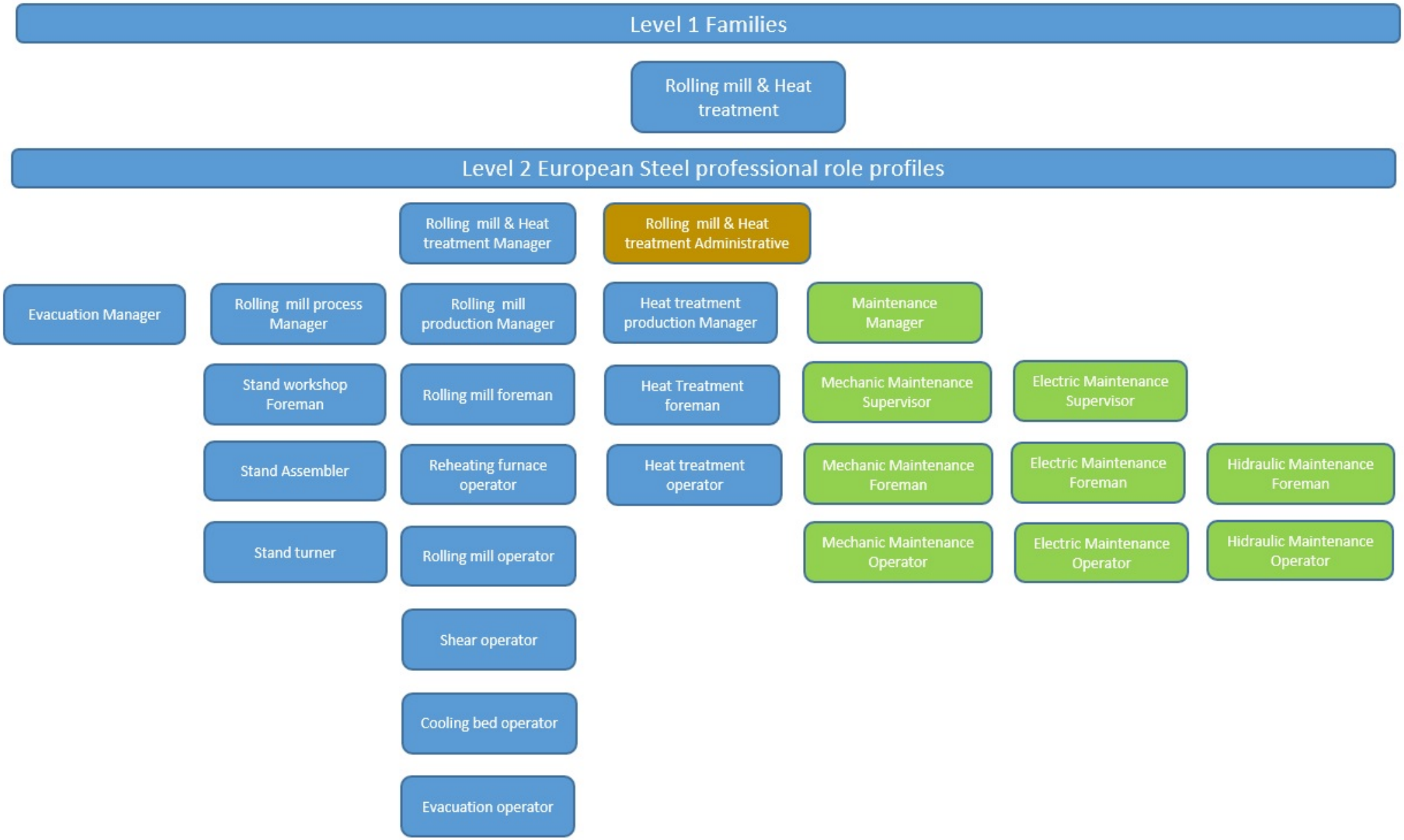
| Abbreviation | Meaning |
|---|---|
| **AI** | Artificial Intelligence |
| **BOF / BF** | Basic Oxygen Furnace - Blast Furnace |
| **BTEC** | Business and Technology Education Council |
| **CEDEFOP** | European Centre for the Development of Vocational Training |
| **CFE-CGC** | French Confederation of Management – General Confederation of Executives |
| **CIELFFA** | European Federation of the National Associations of Cold Rolled Narrow Steel Strip Producers and Companies |
| **COCOP** | Coordinating Optimisation of Complex Industrial Processes |
| **CSR** | Corporate Social Responsibility |
| **DB** | Database |
| **EAF** | Electric Arc Furnace |
| **E.N.T.E.R.** | European Network for the Transfer and Exploitation of EU Project Results |
| **ECVET** | European Credit System for Vocational Education and Training |
| **EFRE** | European Regional Development Fund |
| **EIT** | European Institute of Innovation and Technology (e.g. RawMaterials) |
| **eLLa4.0** | excellent Leadership and Labour 4.0 |
| **EQF** | European Qualifications Framework |
| **EQAVET** | European Quality Assurance in Vocational Education and Training |
| **ESCO** | European Skills, Competences, Qualifications and Occupations |
| **ESF** | European Social Fund |
| **ESSA** | European Steel Skills Agenda |
| **ESSA ETF** | European Steel Technology and Skills Foresight Obersvatory |
| **ESSA OTS** | Online Training Ecosystem |
| **ESSA RTS** | Regional Training Ecosystem |
| **ESTEP** | European Steel Technology Platform |
| **EU** | European Union |
| **EUROFER** | European Steel Association |
| **H2** | Hydrogen |
| **HR** | Human Resources |
| **HTSM** | High Tech Systems & Materials |

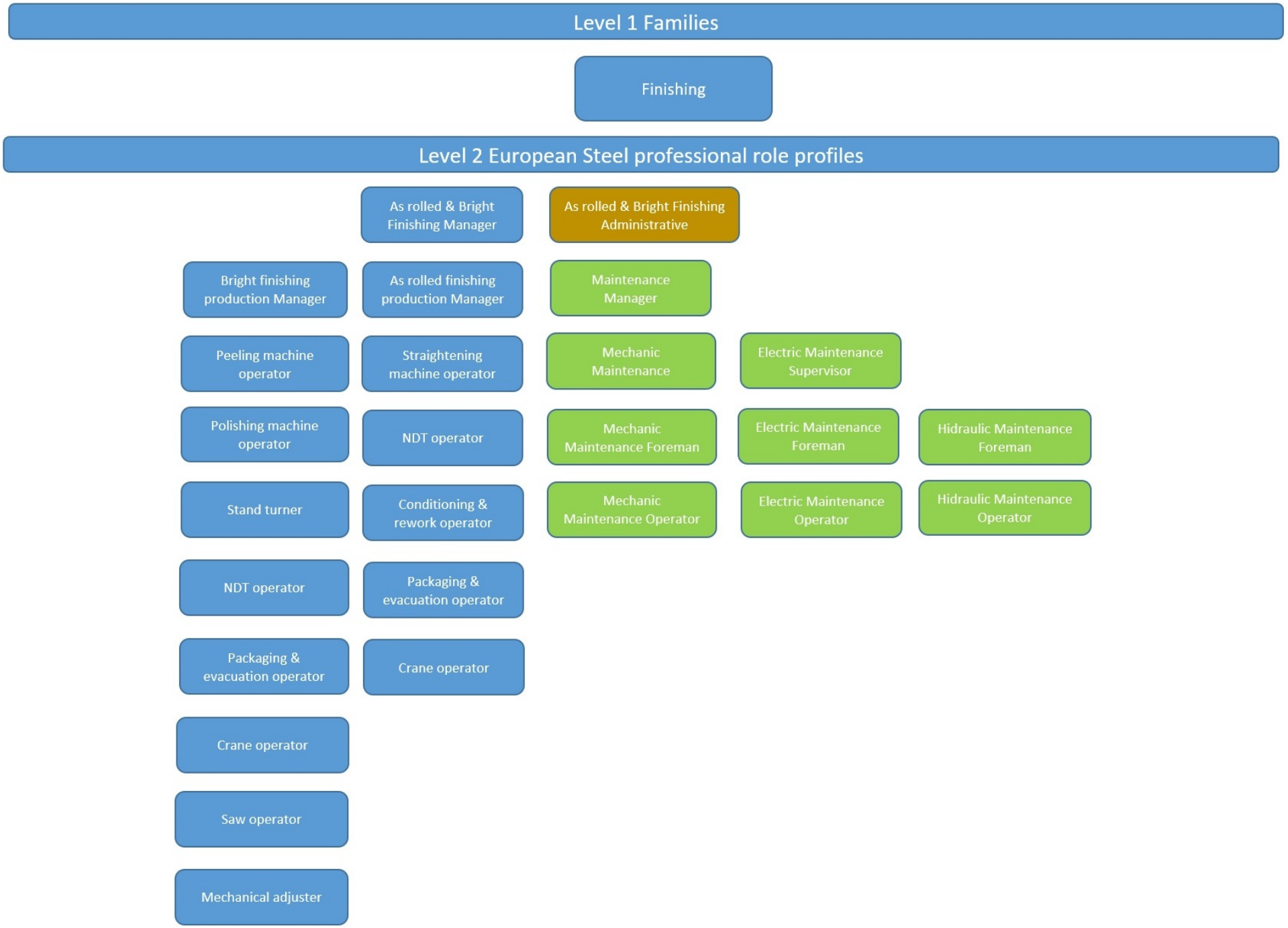
| | |
|---|---|
| **ICT** | Information and communications technology |
| **ILO** | International Labour Organization |
| **IMZ** | Institute for Ferrous Metallurgy |
| **IoS** | Internet-of-Services |
| **IoT** | Internet-of-Things |
| **ISCO** | International Standard Classification of Occupations |
| **IT** | Information Technology |
| **IVET** | Initial Vocational Education and Training |
| **KET** | Key Enabling Technology |
| **KPI** | Key Performance Indicator |
| **LMS** | Learning Management System |
| **LTI** | Learning Tools Interoperability |
| **NGO** | Non-governmental organisation |
| **NVQ** | National Vocational Qualification |
| **OPEX** | Operational expenditures |
| **PBL** | Problem-based Learning |
| **PjBL** | Project-based Learning |
| **pre-VET** | pre Vocational Education and Training |
| **R&D** | Research & Development |
| **RCS** | Real Case Solving |
| **RFCS** | Research Fund for Coal and Steel (RFCS) |
| **ROBOHARSH** | Robotic workstation in harsh environmental conditions to improve safety in the steel industry |
| **RTO** | Research and Technology Organisations |
| **SCORM** | Sharable Content Object Reference Model |
| **SME** | Small and medium-sized enterprises |
| **SPIRE** | Sustainable Process Industry through Resource and Energy Efficiency |
| **SSC** | Steel Sector Careers |
| **SSDCS** | Sectoral Social Dialogue Committee on Steel |
| **STEM** | Science, technology, engineering, and mathematics |
| **TRL** | Technology Readiness Level |
| **VET** | Vocational Education and Training |

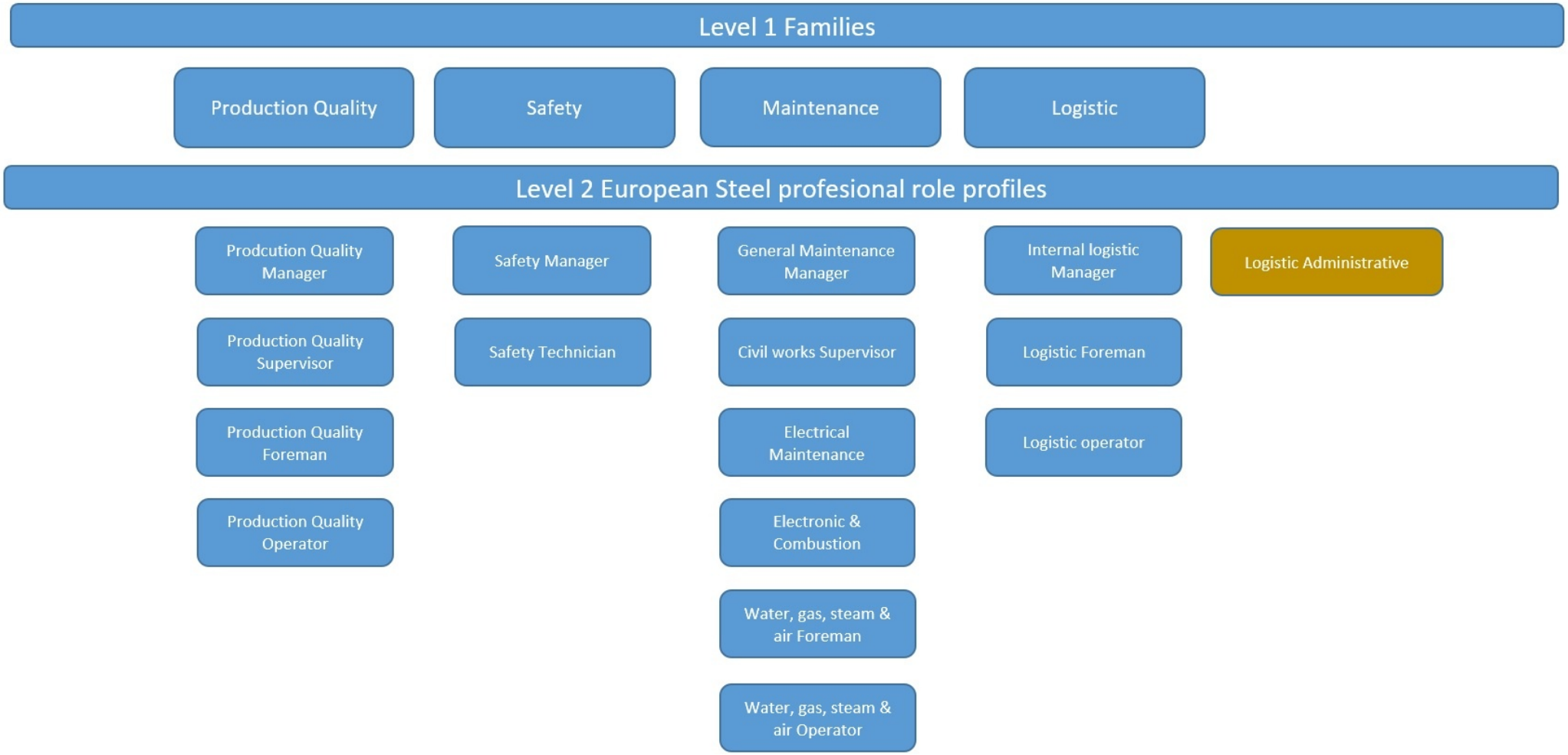
***Job Families Overview (blue: production, orange: administration, green: maintenance)***

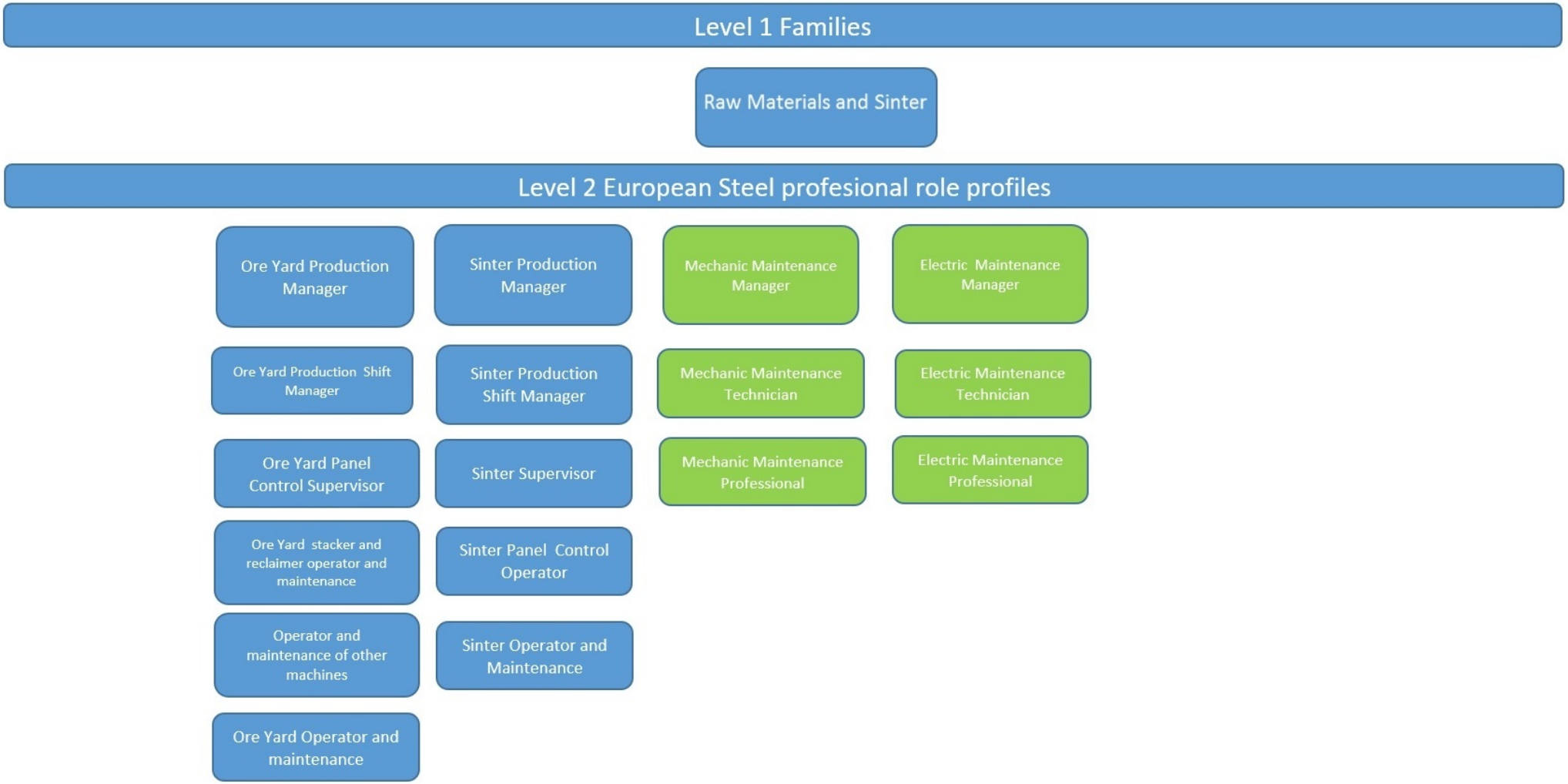


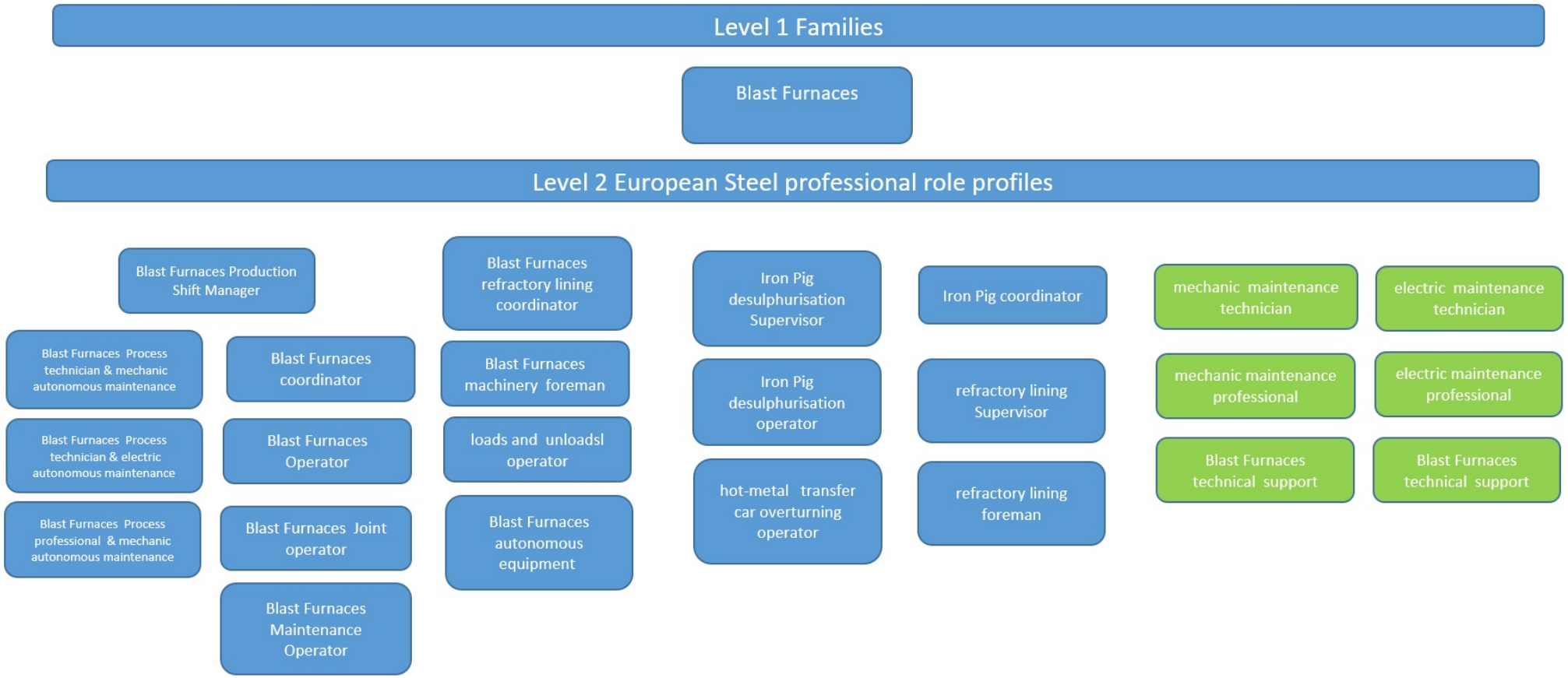

Maintenance Manager
Mechanic Maintenance
Mechanic Maintenance
Mechanic Maintenance
Welder Maintenance Operator
Electric Maintenance Supervisor
Electric Maintenance Foreman
Electric Maintenance Operator
Electronic Maintenance
Instruments Maintenance
Scadas Maintenance Operator
CC Maintenance Supervisor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

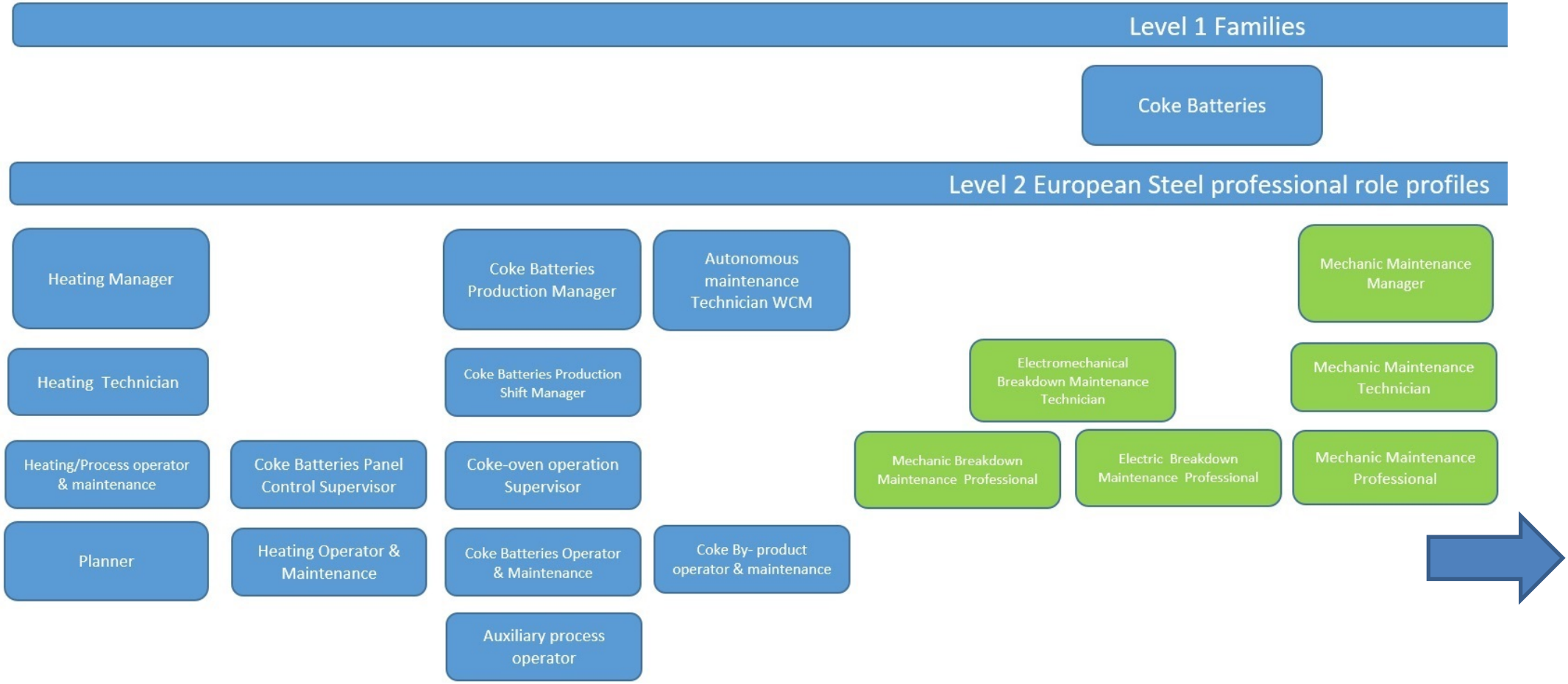

Level 1 Families
Rolling mill & Heat treatment
Level 2 European Steel professional role profiles
Rolling mill & Heat treatment Manager
Rolling mill & Heat treatment Administrative
Evacuation Manager
Rolling mill process Manager
Rolling mill production Manager
Heat treatment production Manager
Maintenance 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

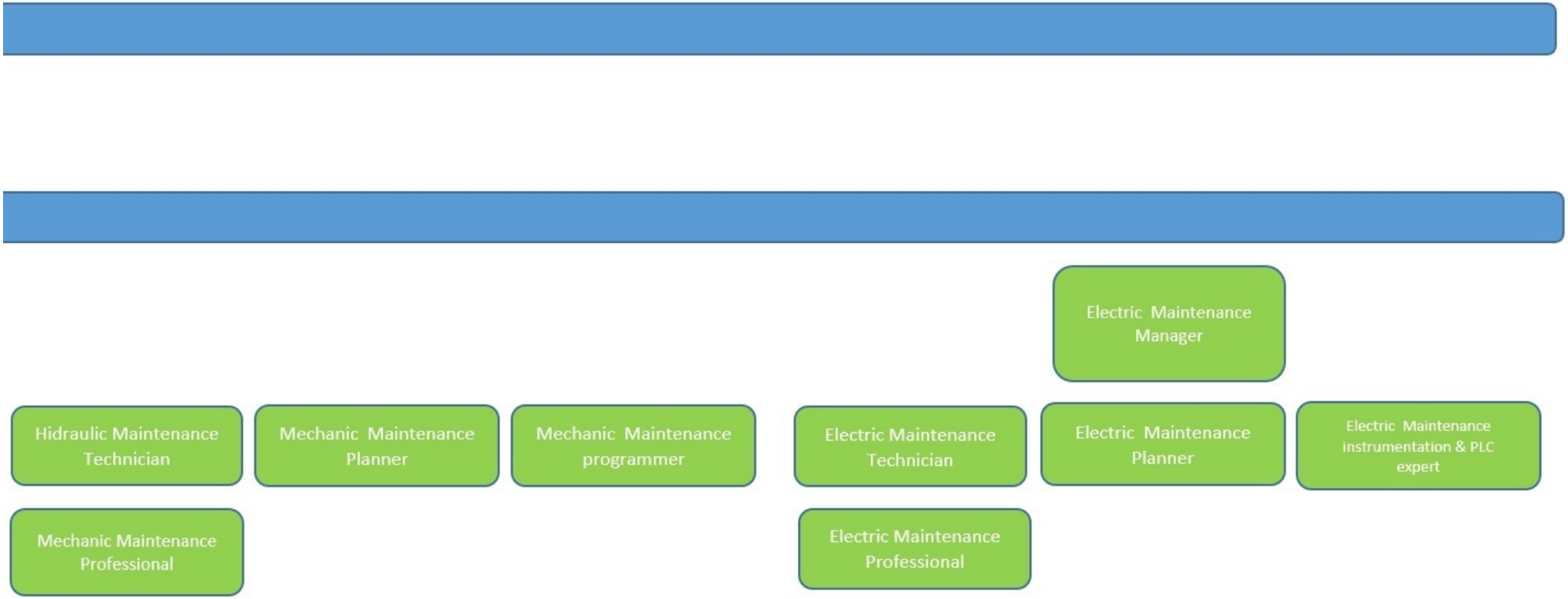

Level 1 Families
Finishing
Level 2 European Steel professional role profiles
As rolled & Bright Finishing Manager
As rolled & Bright Finishing Administrative
Bright finishing production Manager
As rolled finishing production Manager
Maintenance Manager
Peeling machine operator
Straightening machine operator
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

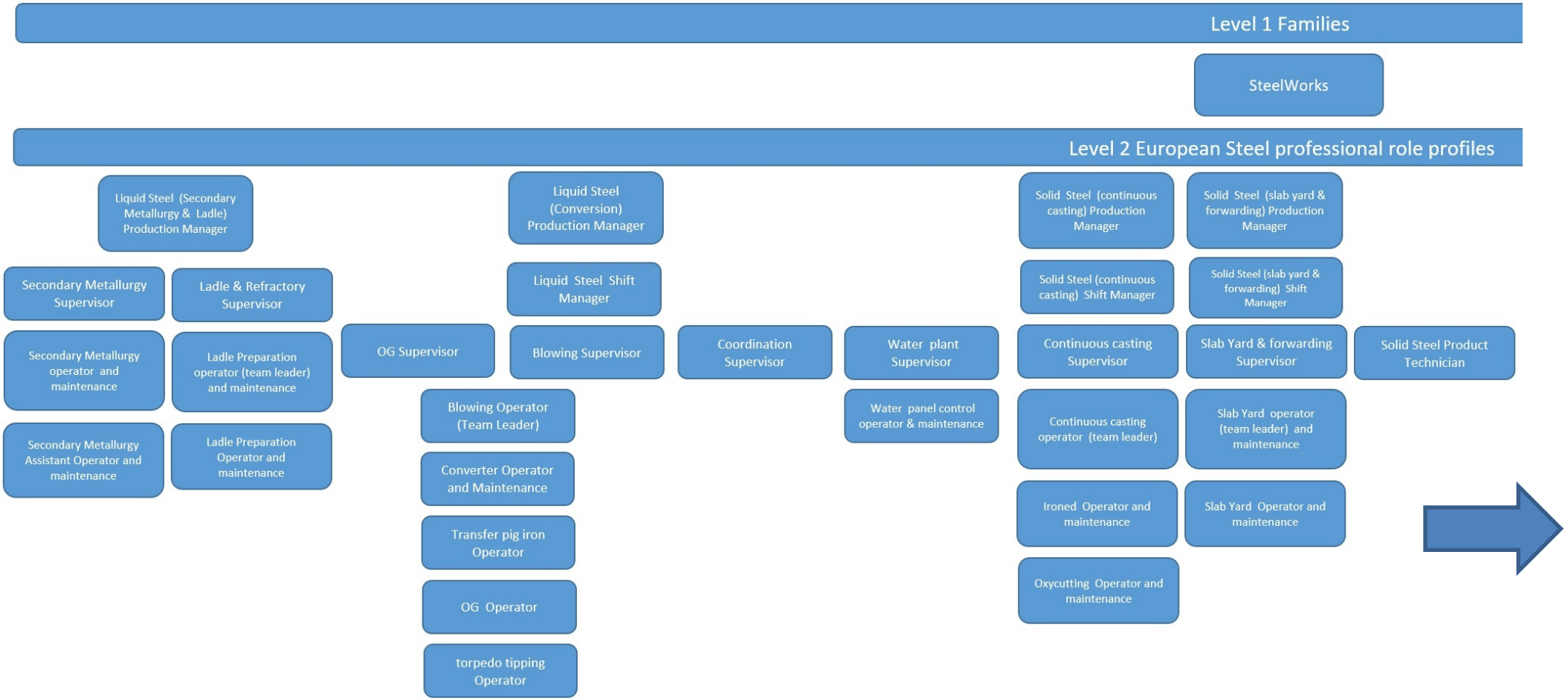

Level 1 Families
Production Quality
Safety
Maintenance
Logistic
Level 2 European Steel profesional role profiles
Prodcution Quality Manager
Production Quality Supervisor
Production Quality Foreman
Production Quality Operator
Safety Manager
Safety Technician
General Maintenance Manager
Civil works Supervisor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

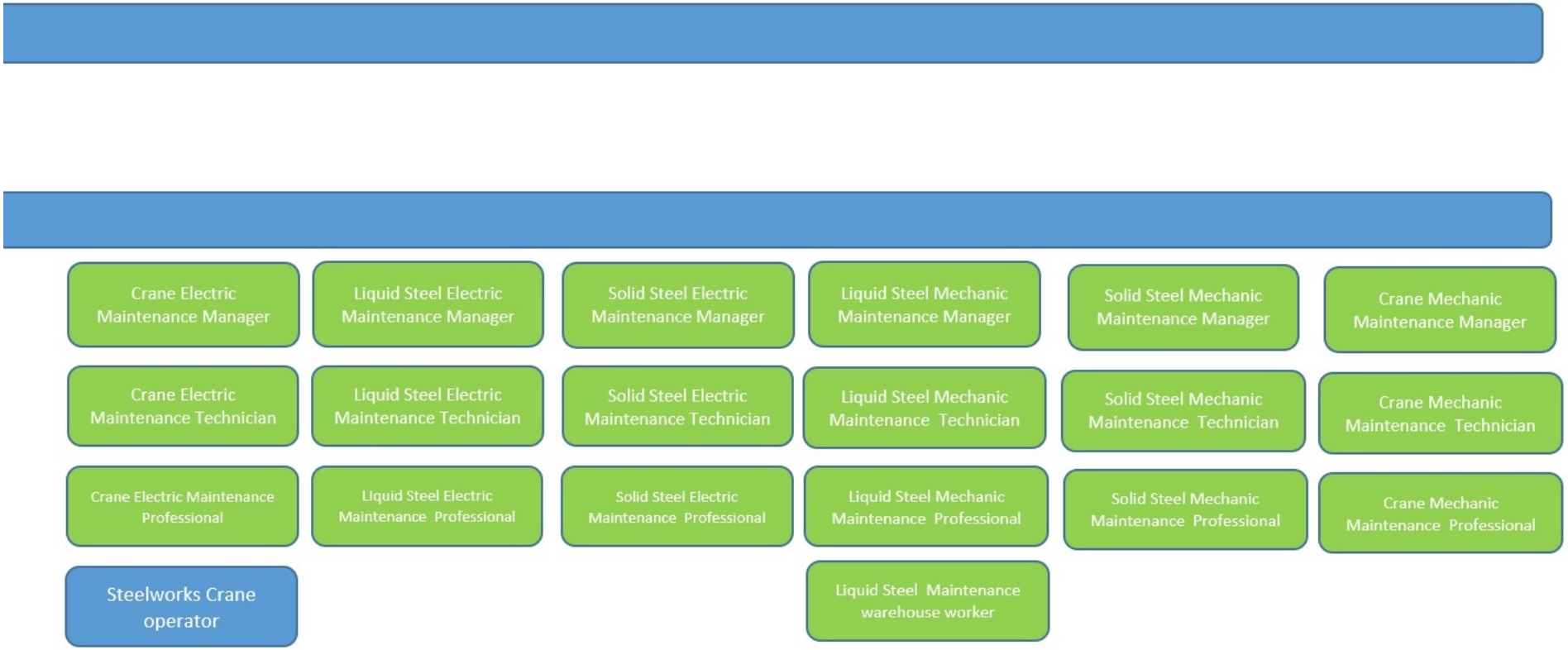

Level 1 Families
Raw Materials and Sinter
Level 2 European Steel profesional role profiles
Ore Yard Production Manager
Sinter Production Manager
Mechanic Maintenance Manager
Electric Maintenance Manager
Ore Yard Production Shift Manager
Sinter Production Shift Manager
Mechanic Maintenance Technician
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

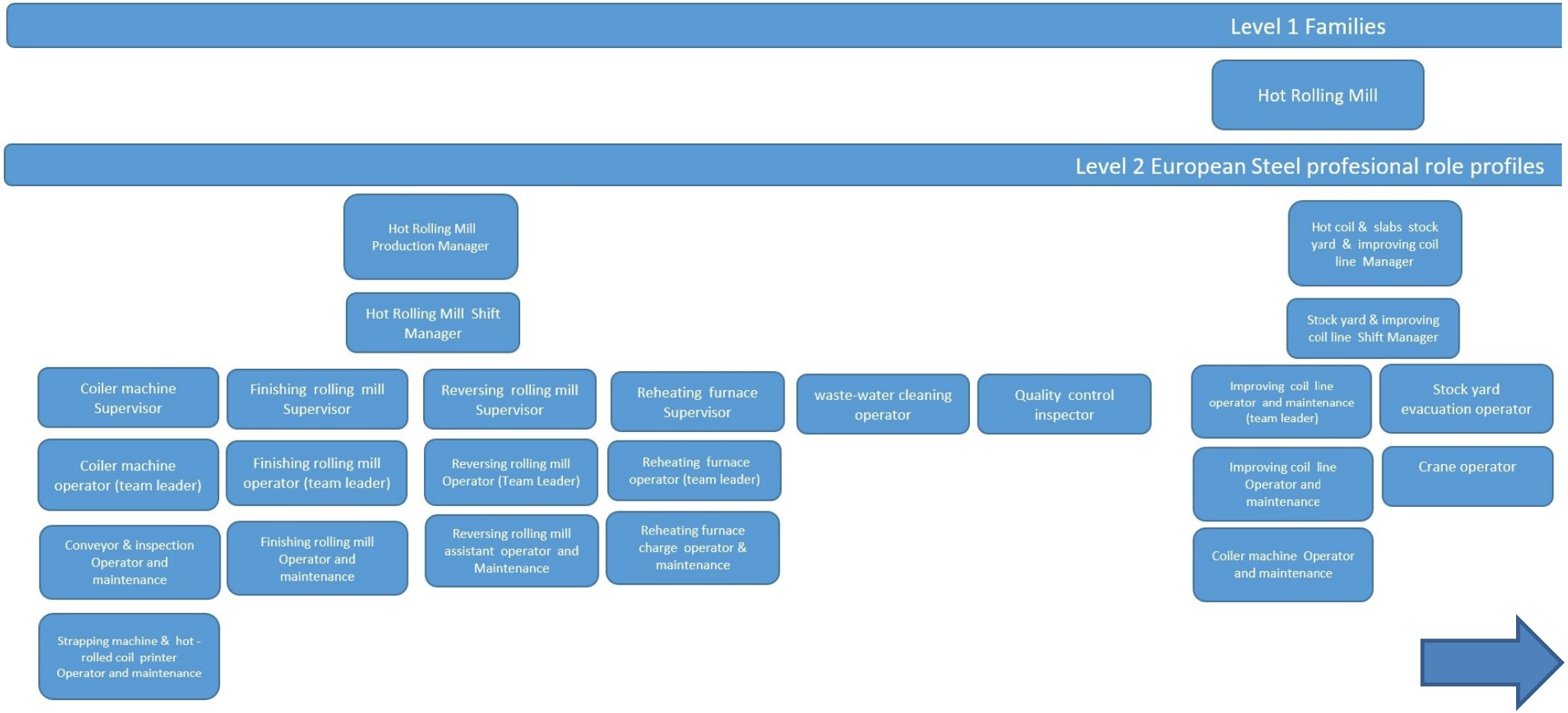

Level 1 Families
Blast Furnaces
Level 2 European Steel professional role profiles
Blast Furnaces Production Shift Manager
Blast Furnaces Process technician & mechanic autonomous maintenance
Blast Furnaces Process technician & electric autonomous maintenance
Blast Furnaces Process professional & mechanic 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

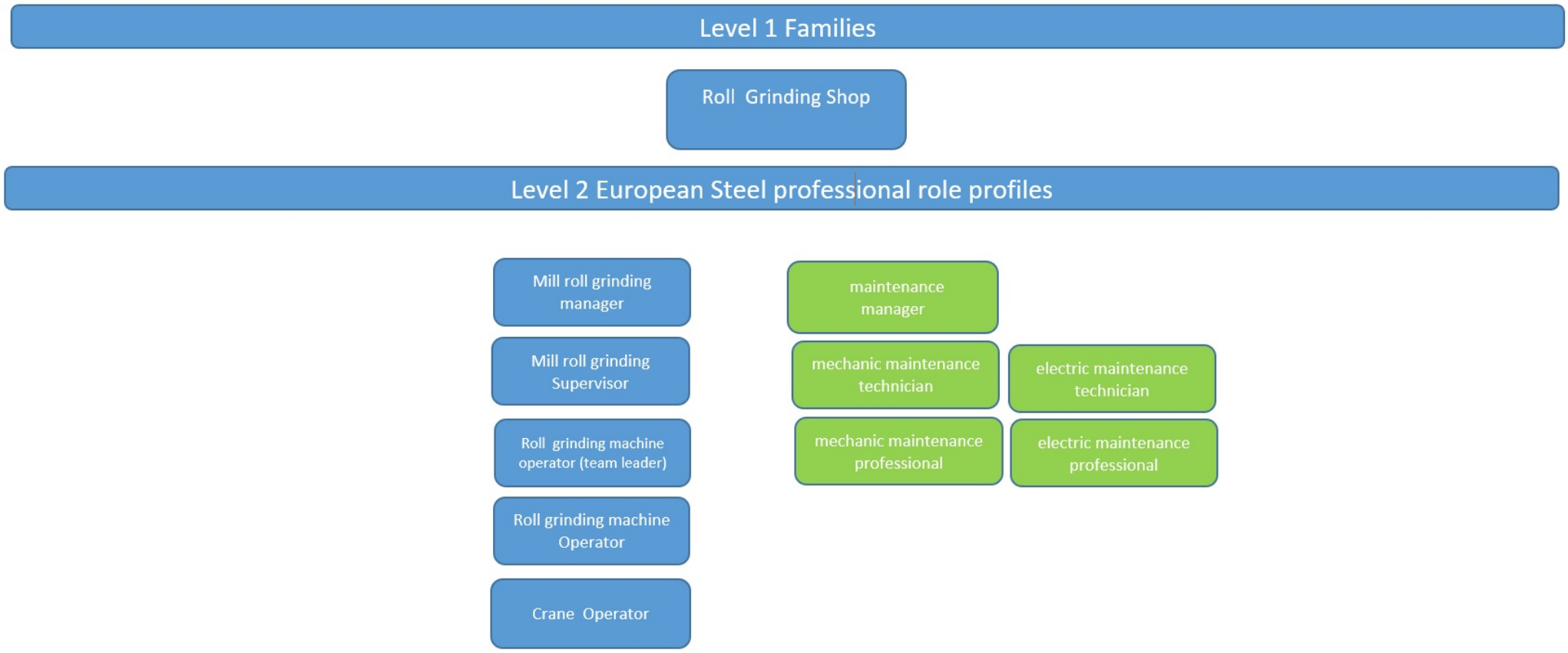

Level 1 Families
SteelWorks
Level 2 European Steel professional role profiles
Liquid Steel (Secondary Metallurgy & Ladle) Production Manager
Secondary Metallurgy Supervisor
Ladle & Refractory Supervisor
Secondary Metallurgy operator and maintenance
Ladle Preparation operator (team leader) and maintenance
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 (slab yard & forwarding) Production Manager
Solid Steel (continuous casting) Shift Manager
Solid Steel (slab yard & forwarding) Shift Manager
Continuous casting Supervisor
Slab Yard & forwarding Supervisor
Solid Steel Product Technician
Continuous casting operator (team leader)
Slab Yard operator (team leader) and maintenance
Ironed Operator and maintenance
Slab Yard Operator and maintenance
Oxycutting Operator and maintenance

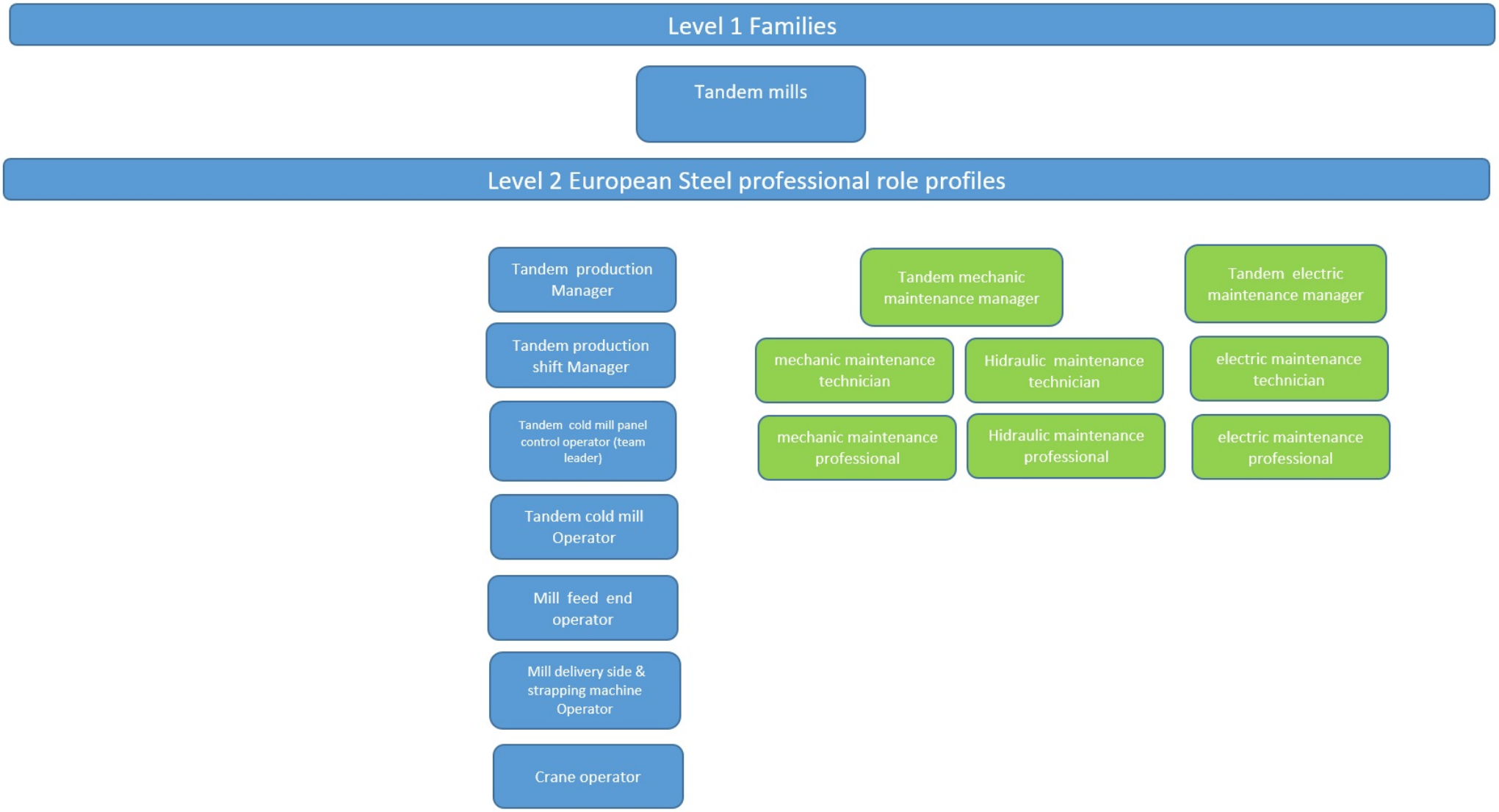

Crane Electric Maintenance Manager
Liquid Steel Electric Maintenance Manager
Solid Steel Electric Maintenance Manager
Liquid Steel Mechanic Maintenance Manager
Solid Steel Mechanic Maintenance Manager
Crane Mechanic Maintenance Manager
Crane Electric Maintenance Technician
Liquid Steel Electric Maintenance 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

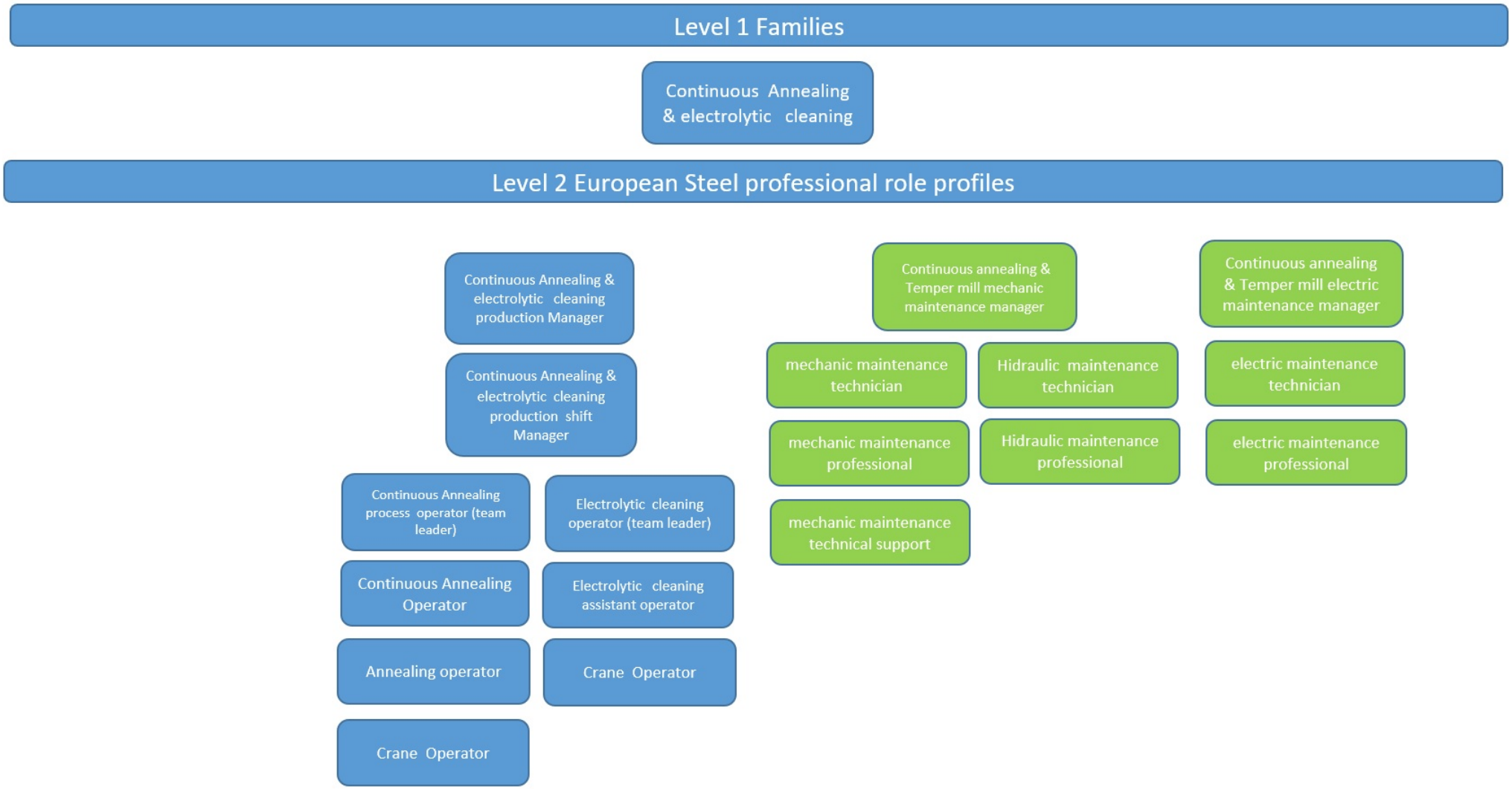

Level 1 Families
Hot Rolling Mill
Level 2 European Steel profesional role profiles
Hot Rolling Mill Production Manager
Hot Rolling Mill Shift Manager
Coiler machine Supervisor
Finishing rolling mill Supervisor
Reversing rolling mill Supervisor
Reheating furnace Supervisor
waste-water cleaning operator
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

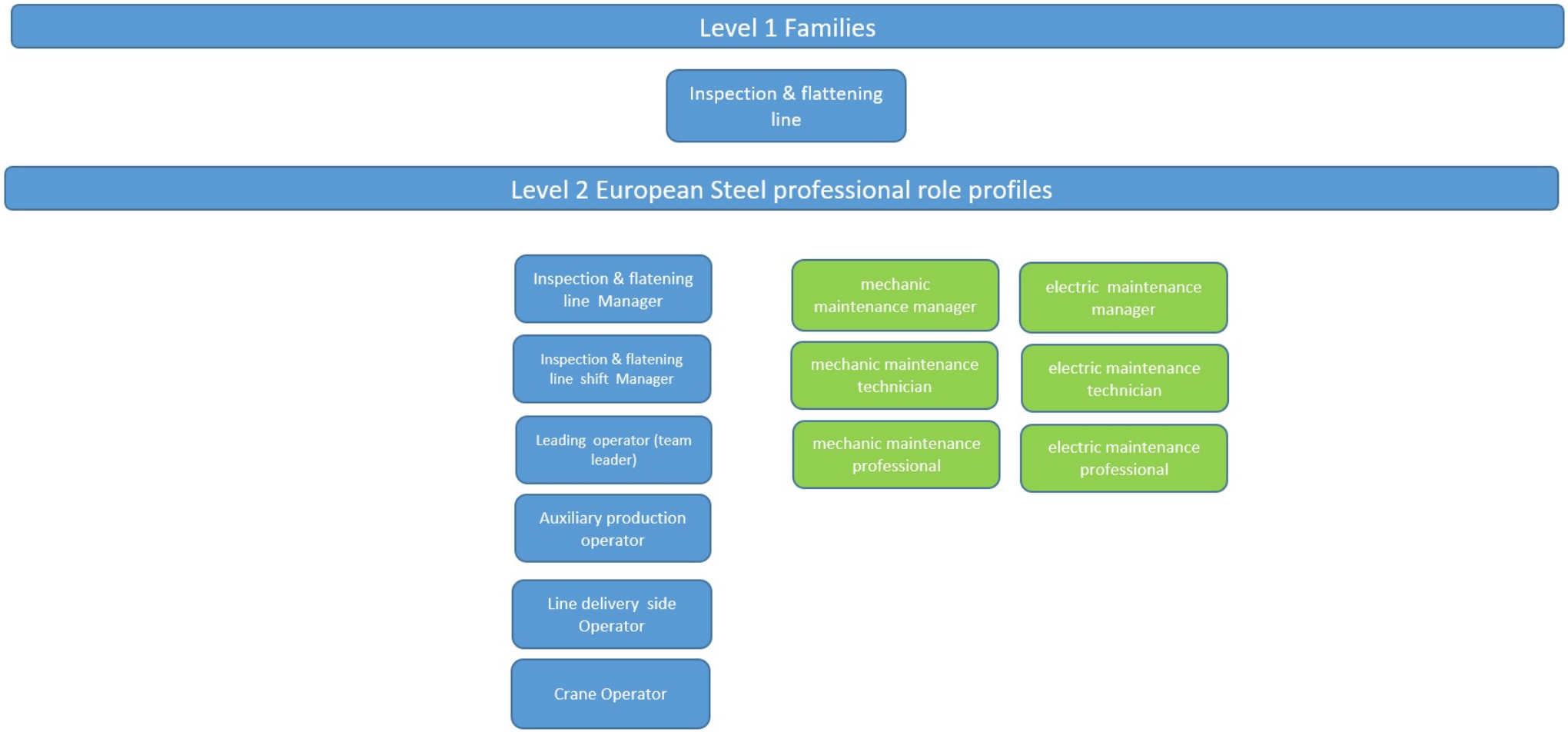

Level 1 Families
Tandem mills
Level 2 European Steel professional role profiles
Tandem production Manager
Tandem production shift Manager
Tandem cold mill panel control operator (team leader)
Tandem cold mill Operator
Mill feed end operator
Mill delivery side & strapping machine Operator
Crane operator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

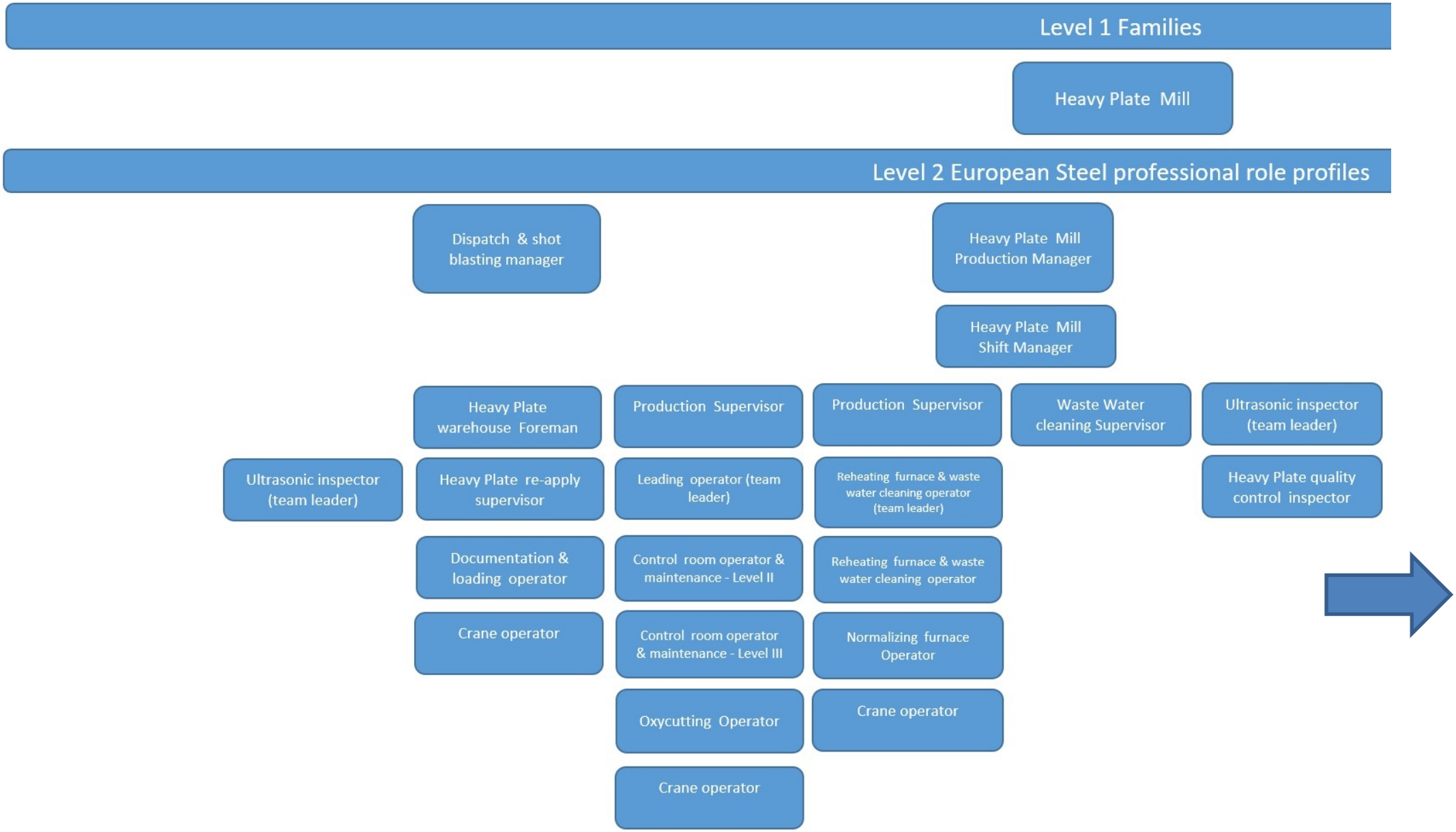

Level 1 Families
Continuous Annealing & electrolytic cleaning
Level 2 European Steel professional role profiles
Continuous Annealing & electrolytic cleaning production Manager
Continuous Annealing & electrolytic cleaning production shift Manager
Continuous Annealing process operator (team leader)
Electrolytic 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

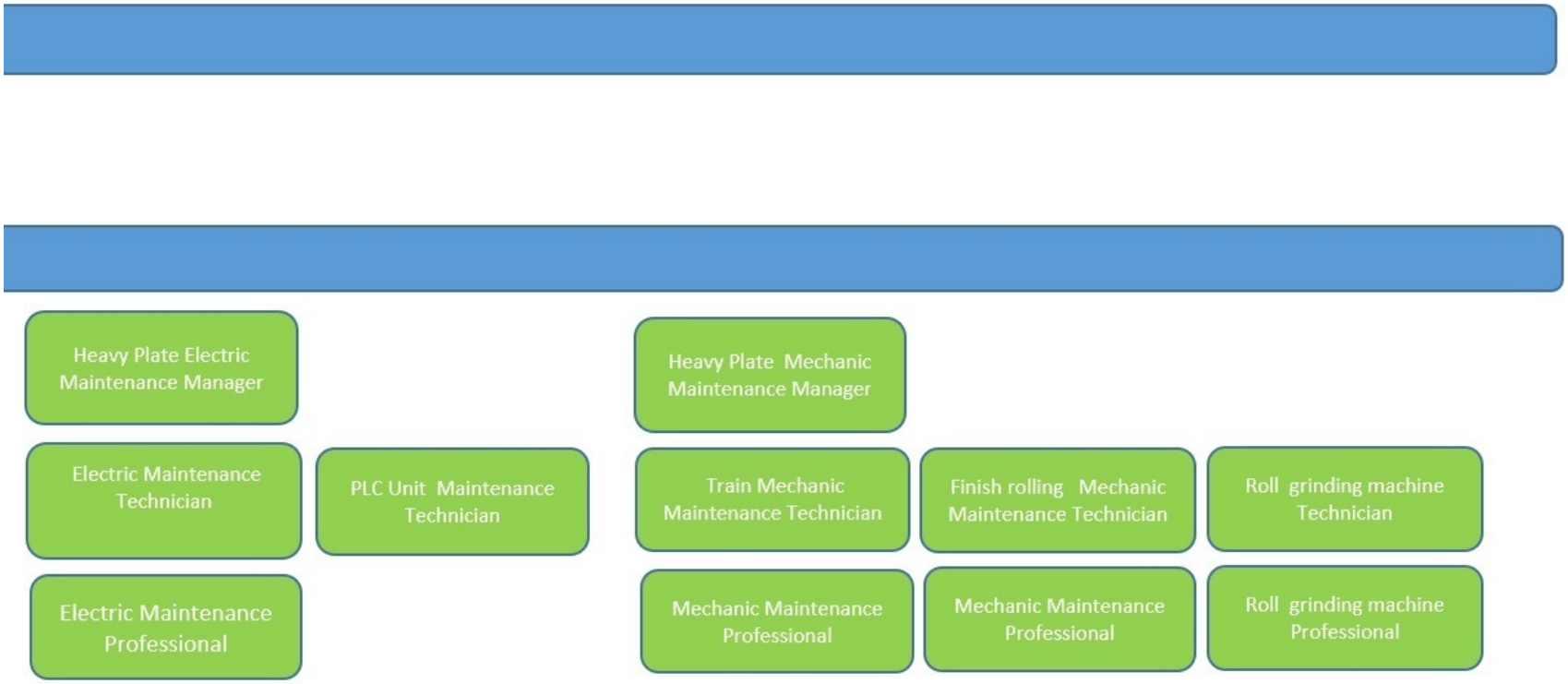

Level 1 Families
Temper mill
Level 2 European Steel professional role profiles
Temper mill production Manager
Temper mill production shift Manager
Tempering operator (team leader)
Tempering Operator
Crane operator

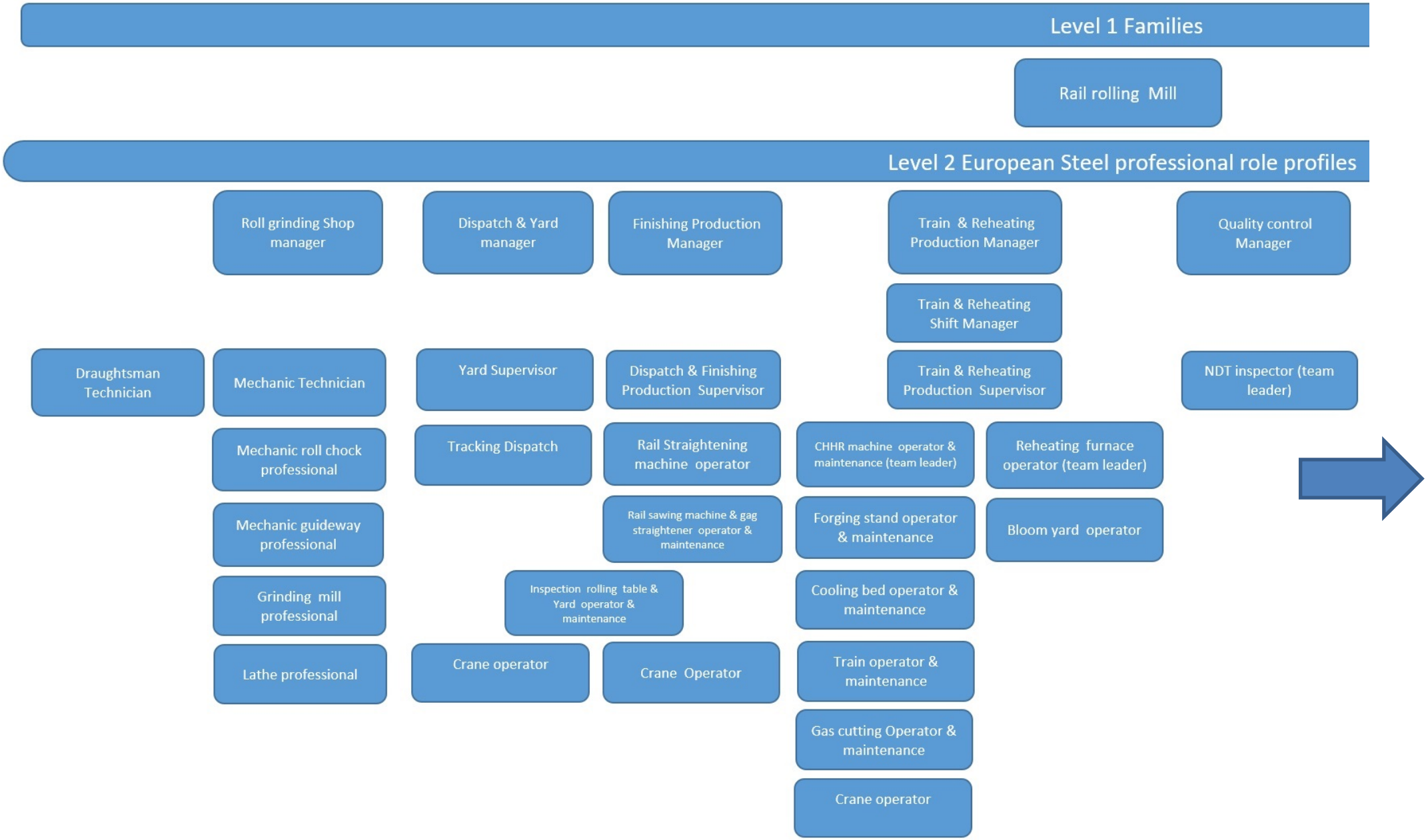

Level 1 Families
Tin Plate Line
Level 2 European Steel professional role profiles
Tin Plate production Manager
Tin Plate production shift Manager
Tin Plate process operator (team leader)
Tin plate process Operator
Tin Plate operator
Inspection line Operator
Crane Operator
Tin Plate mechanic maintenance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

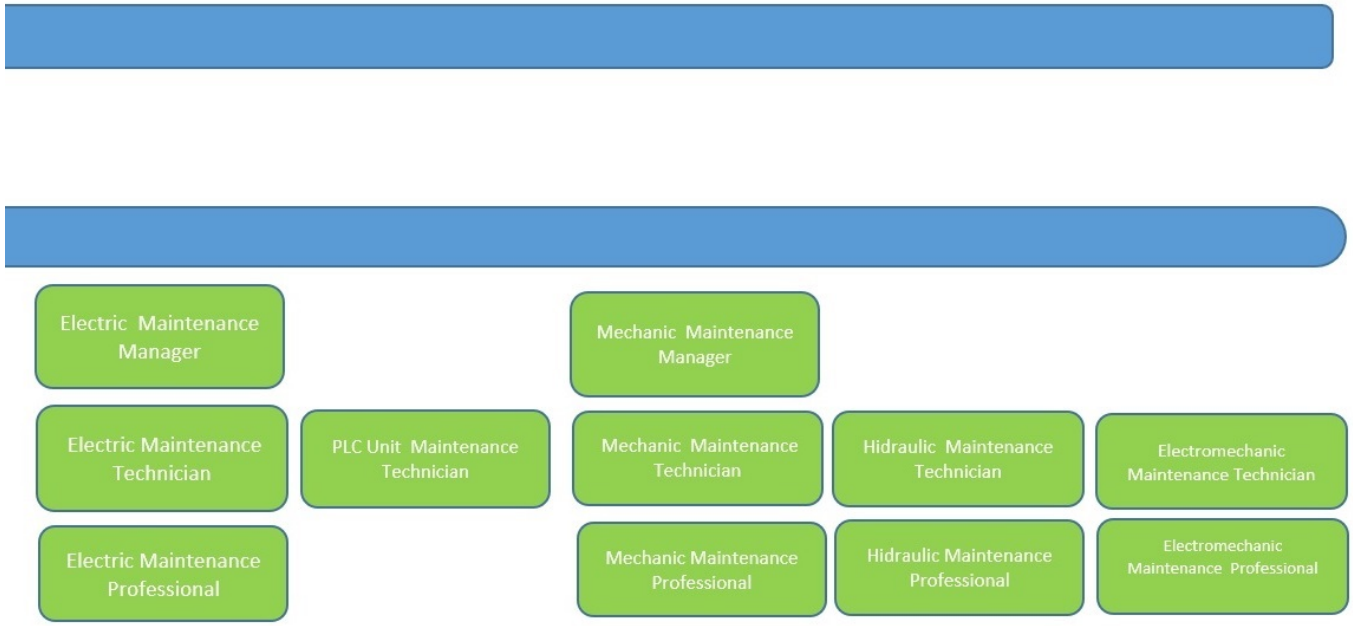

Level 1 Families
Galvanizing line
Level 2 European Steel professional role profiles
Galvanizing production Manager
Galvanizing production shift Manager
Leading operator (team leader)
Assistant leading operator
Inspection operator
Line feed end Operator
Line delivery side Operator
Welding machine Operator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

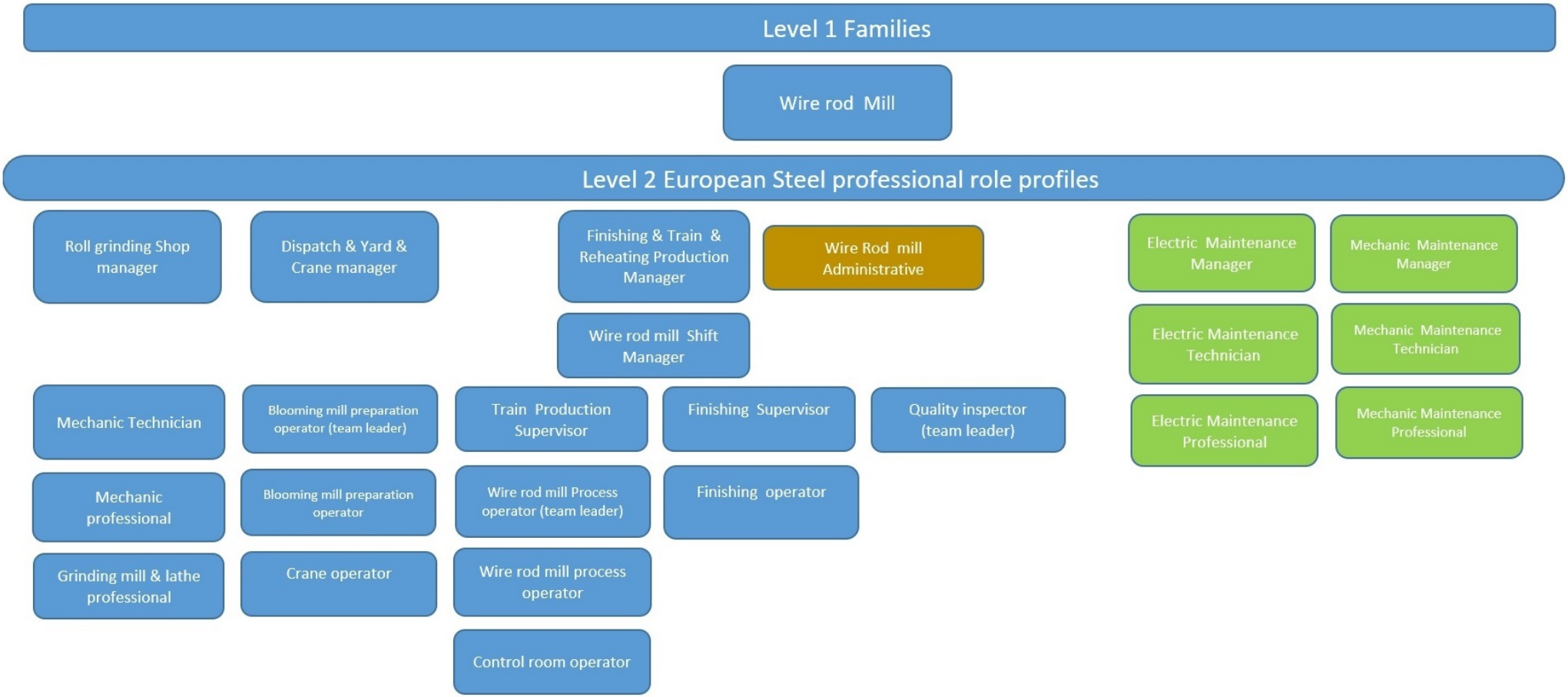

Level 1 Families
Inspection & flattening line
Level 2 European Steel professional role profiles
Inspection & flatening line Manager
Inspection & flatening line shift Manager
Leading operator (team leader)
Auxiliary production operator
Line delivery side Operator
Crane Operator
mechanic maintenance manager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

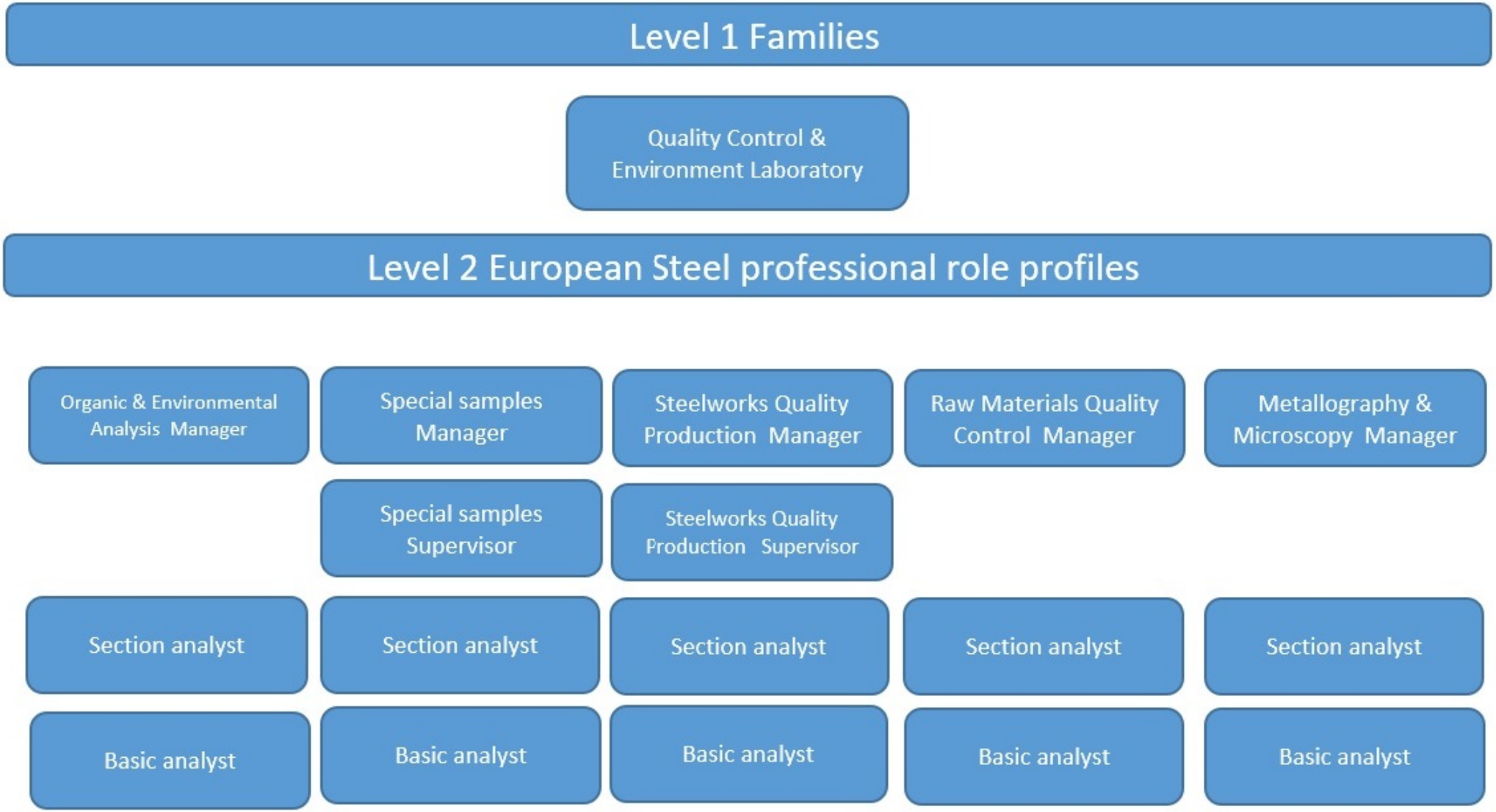

Level 1 Families
Heavy Plate Mill
Level 2 European Steel professional role profiles
Dispatch & shot blasting manager
Heavy Plate Mill Production Manager
Heavy Plate Mill Shift Manager
Heavy Plate warehouse Foreman
Production Supervisor
Production Supervisor
Waste Water cleaning Supervisor
Ultrasonic 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

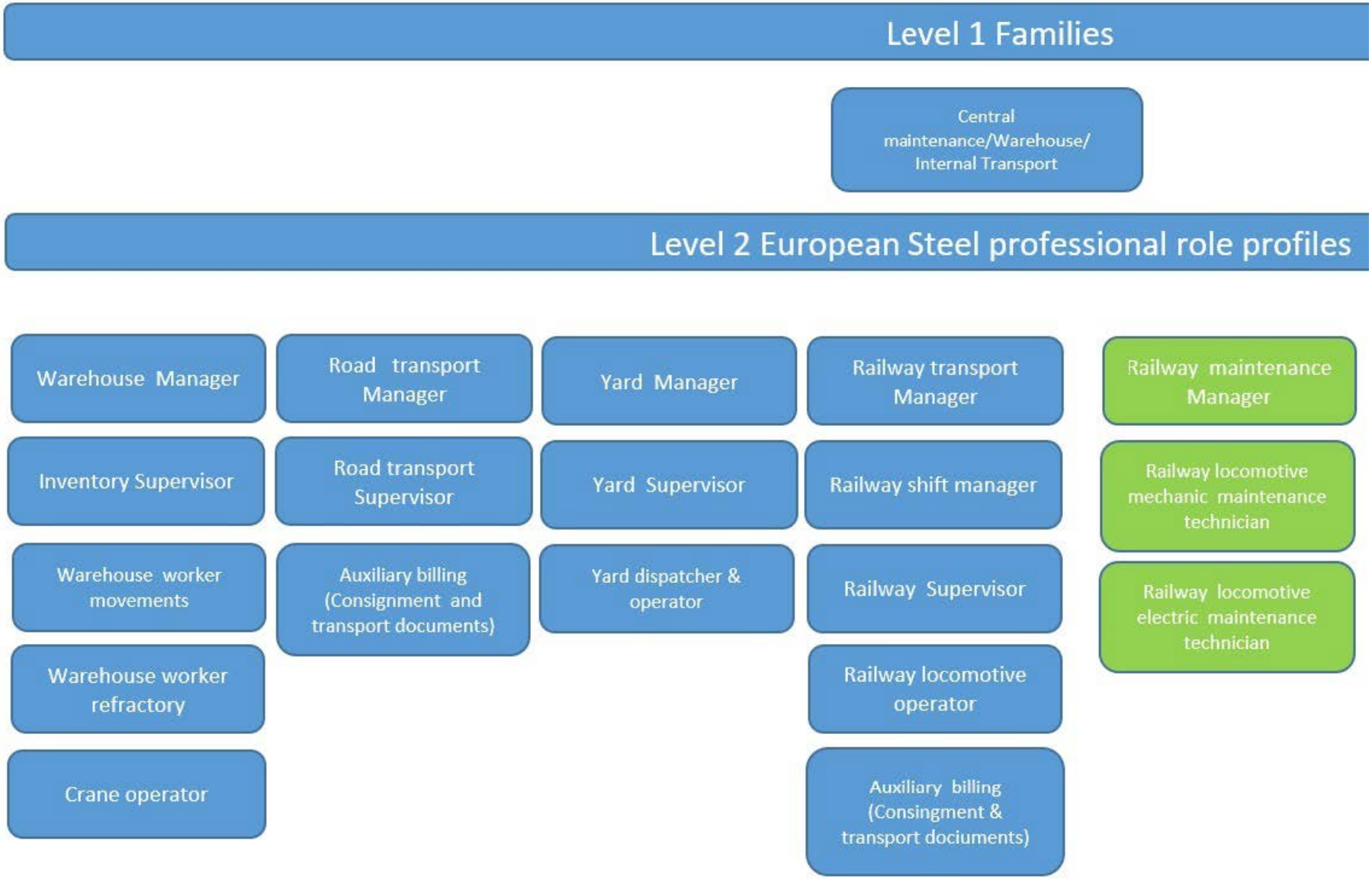

Heavy Plate Electric Maintenance Manager
Electric Maintenance Technician
PLC Unit Maintenance Technician
Electric Maintenance Professional
Heavy Plate Mechanic Maintenance Manager
Train Mechanic Maintenance Technician
Finish rolling Mechanic Maintenance Technician
Roll grinding machine Technician
Mechanic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

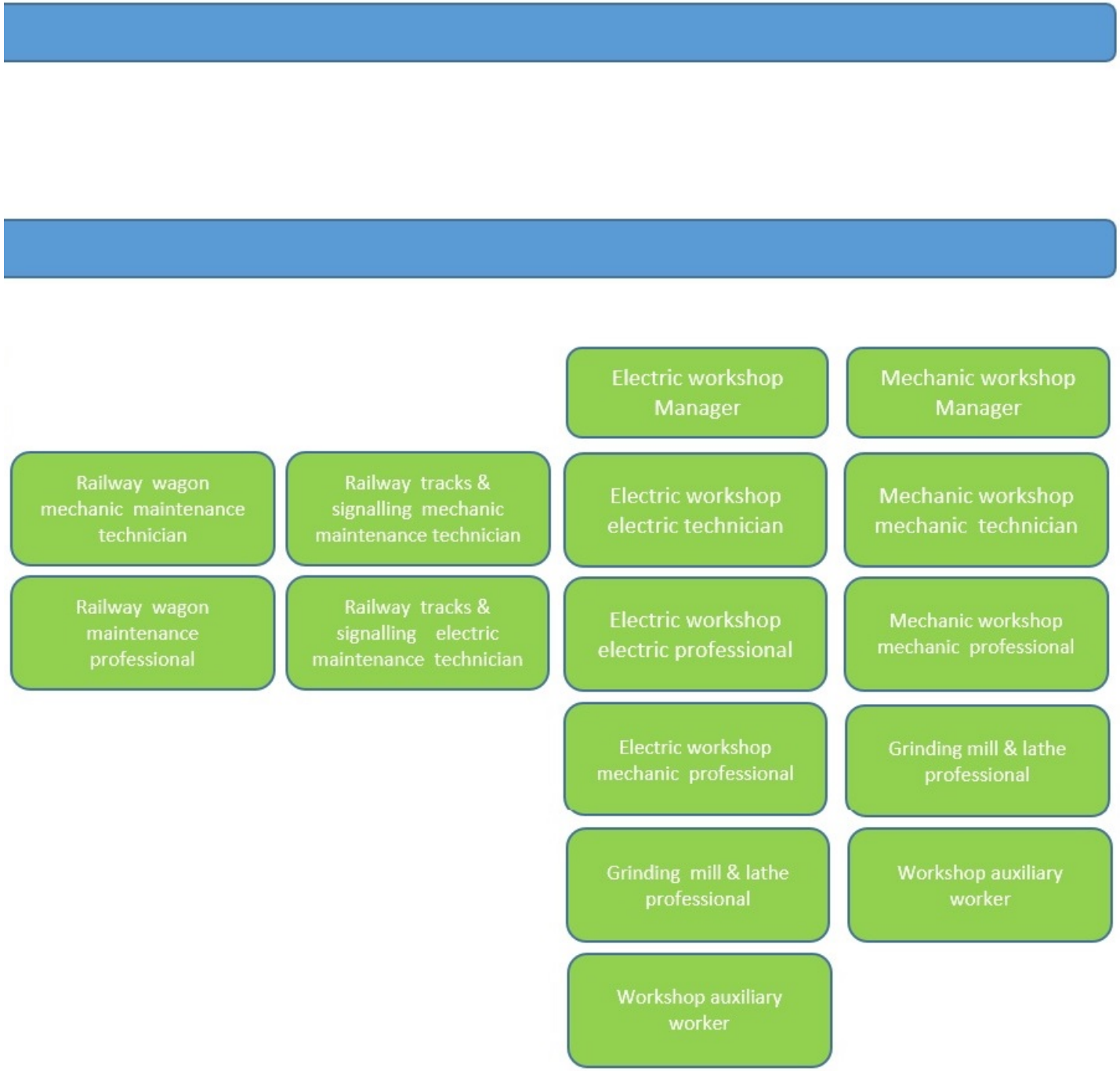

Level 1 Families
Rail rolling Mill
Level 2 European Steel professional role profiles
Roll grinding Shop manager
Dispatch & Yard manager
Finishing Production Manager
Train & Reheating Production Manager
Quality control Manager
Train & Reheating Shift Manager
Draughtsman Technician
Mechanic Technician
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

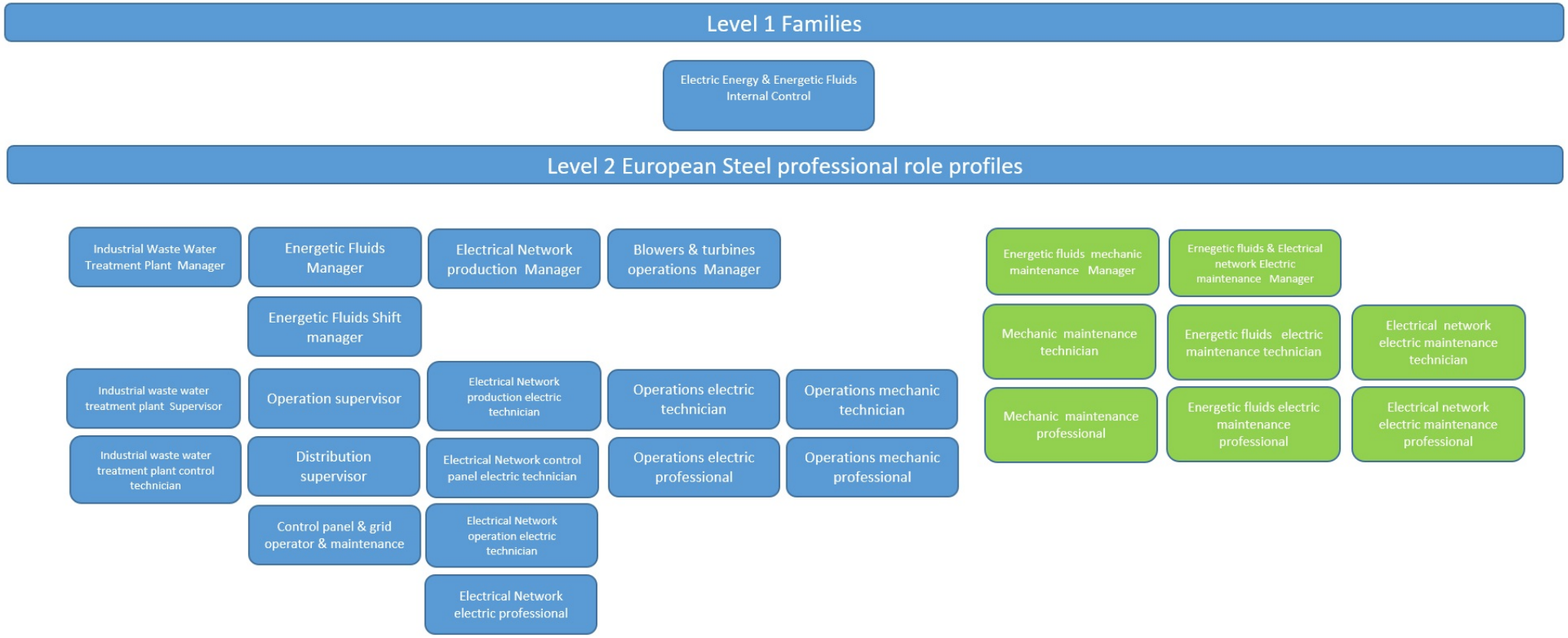

Electric Maintenance Manager
Mechanic Maintenance Manager
Electric Maintenance Technician
PLC Unit Maintenance Technician
Mechanic Maintenance Technician
Hidraulic Maintenance Technician
Electromechanic Maintenance Technician
Electric Maintenance Professional
Mechanic Maintenance Professional
Hidraulic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