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

Company Skills Requirements and Foresight

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Content

1. Introduction

In 1950, the European Coal and Steel Community (ECSC), which is considered as the forerunner of the European Union (EU), was established to unite European countries economically and politically in order to secure lasting peace. [1] Therefore, steel, along with coal, were the two main strategic industries in which a common European project was first launched, even before stablishing the European Economic Community. Even today, with some 500 active production centers in 24 Member States, the steel industry represents an important asset for the European economy. With an annual production of about 160 million tons of crude steel and an annual turnover of 170 billion euros, Europe is currently the largest importer of steel and the second largest producer of steel in the world after China. [2] European steel contributes to a number of transforming industries, in particular the automotive, construction and infrastructure, robotics, advanced machinery and tools and household appliances. It provides more than 320,000 direct jobs and 1.5 million indirect jobs. [2]

Recently, the steel industry has been facing rapid and constant changes due the next industrial revolution: Industry 4.0. Rapidly growing digitalization has been profoundly transforming the dynamics of most industries, including the steel industry. The manufacturing models are changing through the use of smart technologies such as robotics, artificial intelligence (AI), internet of things (IoT) and machine learning etc. The development of these technologies enable a new phase of automation that results in innovative and more efficient processes, products and services. [3,4]

Technological developments urging with digitalization will prompt a larger shift in demand for workforce skills as it transform occupations and is likely to accelerate skill shifts compared with the historical trend. Therefore, Industry 4.0 and sustainability appear to be the main drivers leading the evolution of skills needed in the European steel industry. [5]

A competent, multi-skilled workforce that can handle the adoption of advanced technologies is a major key condition to overcome the Industry 4.0 challenge. It can only be achieved through addressing and foreseeing the future skills requirements of the sector and updating the qualifications, knowledge and skills of its workforce.

The transition towards Industry 4.0 will require workers to develop a solid understanding of complex organisational and technological processes as well as interact with digital interfaces and analyse larger amounts of data in their day-to-day decisions. [5] There will be high demand for workers with finely tuned technological, social and emotional skills—skills that in cases, machines are a long way from mastering. [6] The mix of physical and manual skills required in occupations will change depending on the extent to which work activities can be automated. General equipment operation (skills used by manufacturing workers), inspecting and monitoring skills will decline faster than other physical and manual skills. [6] All of these skills shifts and changes will be investigated in detail in this work.

In accordance with the technological and economic developments, ESSA WP3 (Industrial Requirements) focuses mainly on the function of jobs within the steel industry whereas WP4 (VET System Requirements) emphasizes occupational profiles in general. Our work is aimed be a sectorial and academic guideline for WP4 to prepare convenient, and well-developed VET training programs to deliver the needed skills.

Therefore, considering the future technological and economic developments summarized in WP2 (see deliverable D2.1 'Technological-and-Economic-Development-in-the-Steel-Industry-ESSA-D6.1.pdf') and skills development concepts stated in other recent sources (reports like Steel Sector Careers [5] and McKinsey [6], several book chapters and scientific articles), WP3 addresses the near future changes in the professional skills requirements of the steel industry facing Industry 4.0 and provides ideas and hints from varied perspectives to deal with the current skills requirements and as well as the future skills requirements urging with digitalization. It offers concrete examples to demonstrate how the steel company departments (particularly Human Resources (HR) Department), curricula developers, qualification providers and other stakeholders can use the

generated profiles for job profile definitions during the assessment, career development and curriculum design, in order to support an organisational change process including digital transformation. Additionally, this work package offers a brief guidance on how to connect the profiles to other frameworks, e.g. ESCO the European Classification of skills, competences and occupations. Finally WP3 will establish conclusions for their integration into the European Blueprint through analyzing the overall results and assessing their impact the steel companies' organization and their staff.

2. Industry Skills Requirements

The steel industry has currently undergone rapid and constant changes due to the emerging digitalization, coming with new challenges. The application of new technologies in this sector already supports and can further sustain the optimization of the entire production chain, whereas the steel production is already automated to a certain extent and often the systems work in an isolated way. Despite the fact that steel sector has always been considered a mature sector with a low level of technological development, and most of workers (although experienced in industrial and metallurgical issues) lack of the recent technological skills, the steel industry is in the process of becoming smart and more agile evolving towards industry 4.0 and most of steel companies are digitizing their processes, incorporating ICT and Industry 4.0 technologies to melting, casting, rolling and finishing sub-processes.

Furthermore, the steel industry expectations from digitalization include, first of all, the optimization and the interactions of the individual production units, within the entire production chain (and beyond), leading to reach the highest quality, flexibility, and productivity. Adaptive online control, through-process optimization, through-process synchronization of data, zero-defect manufacturing, traceability, intelligent and integrated manufacturing will be the most important digitalization trends in the future. Digitalization offers a range of opportunities to increase quality of finished products, reduce lead time and increase productivity by improving the overall production efficiency of a plant [5]. Digital technologies, through the continuous adjustment and the optimization of the processes online, aim to improve the flexibility and the reliability of processes, to maximize the yield, to improve the product quality and the maintenance practices. Such technologies further contribute to increase the energy efficiency and to monitor and control the environmental performance of processes in an integrated way. Real-time decision making in steel production chain considering technological, economic and environmental aspects at the same time is only possible through the integration of new IT, automation and optimization technologies. Additionally, Predictive Maintenance techniques can be implemented by equipment monitoring combined with intelligent decision methods. Machine Learning and Data Mining techniques can be used to anticipate maintenance work before something goes wrong. Moreover, the maintenance can be scheduled, and many checks can be made remotely, resulting in significant improvements in the equipment maintenance. Furthermore, the Knowledge Management represents a key factor for the improvements to be achieved in the digitalization process. In order to overcome the barriers due to heterogeneous distribution over the individual staff members, human obliviousness, and knowledge erosion by leaving staff members, new approaches based, for instance, on the methodology knowledge-based decision support system is in development.

Due to the introduction of the mentioned technologies and systems, the skills and competences needed for the job profiles related to the steel sector are changing continuously. These technological developments will transform the steel industry occupations and force the sector to improve quality and relevance of skills to meet the industry needs. Therefore, there is an urgent demand for addressing and updating the required qualifications, skills and knowledge of its workforce in order to build the highly qualified, multi skilled personnel that can handle the new technology introduced by Industry 4.0.

The first objective of this WP3 is to identify and specify these new skills and training needs within the steel sector, considering a framework of growing digitalization, to be incorporated into VET and tertiary education training curricula, making 'definition of recent and future skill needs and redefinition of professional profiles' the first WP3 task.

After clarifying the industrial changes and tasks, it is possible to interpret the data on the expected evolution of skills needs.

An important conclusion from the report of Steel Sector Careers is the concept of key exogenous factors that are expected to change in a steel company. [5] These factors will substantially affect the tasks that steel professionals will be required to perform, which in turn will influence the skills required to perform these tasks. They can be described as follows:

Tools & Technologies – Automation and smart devices will increase the amount of real-time

information available in the production area, allowing workers to make more informed decisions in short timespans to deal with complex situations. The advances in robotics will allow collaborative robots to become more and more autonomous and relieve workers from simple and repetitive tasks. At the same time, human intervention will become more important in the maintenance and supervision of machines. [5]

Organisation & Structure – The integration of early artificial intelligence tools is also causing organisations to become more collaborative and team-oriented, as opposed to the traditional top-down hierarchal structures [7]. Decisions will rest with small and agile teams of operators led by high-skilled engineers.

Working Environment – With an already high degree of automation, many steel plants are state-of-the-art facilities, with little human intervention and human resources is concentrated mainly in the control rooms, where operators can coordinate the various operations of the plant. Furthermore, the advances in technology might also favour scenarios where operators will be able to supervise production remotely. This would bring substantial changes in the shift models and would enable trends towards home office working.

According to these factors, more and more monotonous tasks will be absorbed by assistant systems and machines, while operators can perform more qualified work, and most importantly, make decisions based on the integrated data that machines will provide. Teamwork will become increasingly important, not only between co-workers, but also between workers and assistant systems.

Overall, the profiles that are sought by the industry are not expected to be replaced altogether, but they will be expected to perform more tasks with a much broader scope. Workers will need to have a wider knowledge and need to be able to do more because there are less and less specialised single jobs. Instead, the industry tends to need people who are able to work in multiple parts of the plant and on multiple operations throughout the career. [5]

As pointed out by McKinsey's research and Steel Sector Careers report, the main observed consequence of the mentioned technological changes is that the demand for technological skills will grow rapidly as companies deploy automation, robotics, AI, advanced analytics, and other new technologies. [5,6,8] This surge will affect demand for basic digital skills as well as advanced technological skills such as programming. [6] Awareness of data security and protection will acquire importance as will trust in new technologies. [5]

Accompanying the adoption of advanced technologies into the workplace will be an increase in the need for workers with finely tuned social and emotional skills—skills that machines are a long way from mastering. [5,6] So, the demand for social and emotional skills will grow also rapidly.

As mentioned, while automation and digitalization of work processes increase, workers will be required to take charge of less automatable and more complex tasks, whose completion necessitate solid literacy, numeracy, problem-solving, and ICT skills together with soft skills of autonomy, coordination and collaboration. [4,9] Flexibility and transferability will become key, as nearly all steel shop workers will move away from monotonous and repetitive jobs and incorporate more varied tasks. [5] Work activities that require only basic cognitive skills will particularly decline as automation advances. The decline will be more important, as machines increasingly take over straightforward data input tasks and cause a drop in the need for basic data processing. Demand for cognitive skills will generally shift from basic to higher ones. [6] As a result, higher cognitive skills such as creativity, critical thinking, teamwork, problem-solving, decision-making will increase in importance through 2030, together with an aptitude for continuous improvement and lifelong learning. [5,6] There will be higher demand placed on all members of the workforce in terms of managing complexity, complex information processing and higher levels of abstraction for obtaining simplified representation of the bigger wholes. [4] Skills like critical thinking, problem-solving and decision-making are perceived as crucial, which reflects the new roles that steelworkers will take on in the flat organisational structure of collaborative and team-oriented industrial environments. Abilities such as critical thinking and independent problem solving were deemed important in several reviewed technical positions such as steel fabricators, welders, production operators and control technicians. [5] Moreover, there will be a

need to coordinate between virtual and real machines as well as between manual and robotic systems, hence employees will be expected to act more on their own initiative, have excellent communication skills and be able to organize their own work. [4] The importance of managerial skills increases significantly on a five-year forecast. [5] Other types of higher cognitive skills—such as advanced literacy and writing (language proficiency), transversal (soft) skills and quantitative and statistical skills—will not see a similar increase in demand, the need for them could remain stable or even decline to 2030. [5,6]

The mix of physical and manual skills required in occupations will change depending on the extent to which work activities can be automated. General equipment operation (skills used by manufacturing workers) and inspecting and monitoring skills will decline faster than other physical and manual skills. So, the demand for physical and manual skills, which include general equipment operation, will also drop, but it seems that still will remain the largest category of workforce skills in 2030 in many places, accounting for an important percent of the total hours worked. [6]

As a consequence of the increased focus on sustainable steelmaking, environmental awareness, green skills are projected to become highly important among European companies over the next five years. This can be explained by the efforts that the industry is making to meet the EU's 2050 environmental targets. It appears to be more common for companies to expect shop floor workers to have competences in resource efficiency, material reutilisation and recycling. Green skills are considered key to maintain the competitive edge of the European manufacturing industry. [5]

Figure 1 shows the results of the survey carried out by the McKinsey Global Institute in order to contrast the importance of skills needed today with those required in the future. [6] The results are in consistence with the Steel Careers Report and other references: Overall, employers expect to need more of the social and emotional, higher cognitive, and technology skills in the future, and less of the basic cognitive and physical and manual skills. [6]

Companies will need to make significant organizational changes at the same time as addressing these skill shifts to stay competitive. The survey highlights a new emphasis on continuous learning for workers and a shift to more cross-functional and team-based work. [6] As tasks change, jobs will need to be redefined and companies will need to become more agile. There is also a concern that lacking the skills needed for automation adoption will hurt the future financial performance. [10]

Competition for high-skill workers will increase, while displacement will be concentrated mainly on low-skill workers, continuing a trend that has exacerbated income inequality and reduced middle-wage jobs. Companies say that high-skill workers are most likely to be hired and retrained, and to see rising wages. Firms in the forefront of automation adoption expect to attract the talent they need, but slower adopters fear their options will be more limited. [11, 12]

Firms can collaborate with educators to reshape school and college curricula. Industry associations can help build talent pipelines, while labor unions can help with cross-sector mobility. [13]

One of the main observed consequences is that workers have great difficulties to the increasingly automated, robotized and digitized processes i.e. a more highly skilled workforce is required, and skill needs are emerging. This is not only an issue of the steel sector, but a general trend. Thus, the World Economic Forum predicts that "by 2020, more than a third of the desired core skill sets of most occupations will be comprised of skills that are not yet considered crucial to the job today." [14]

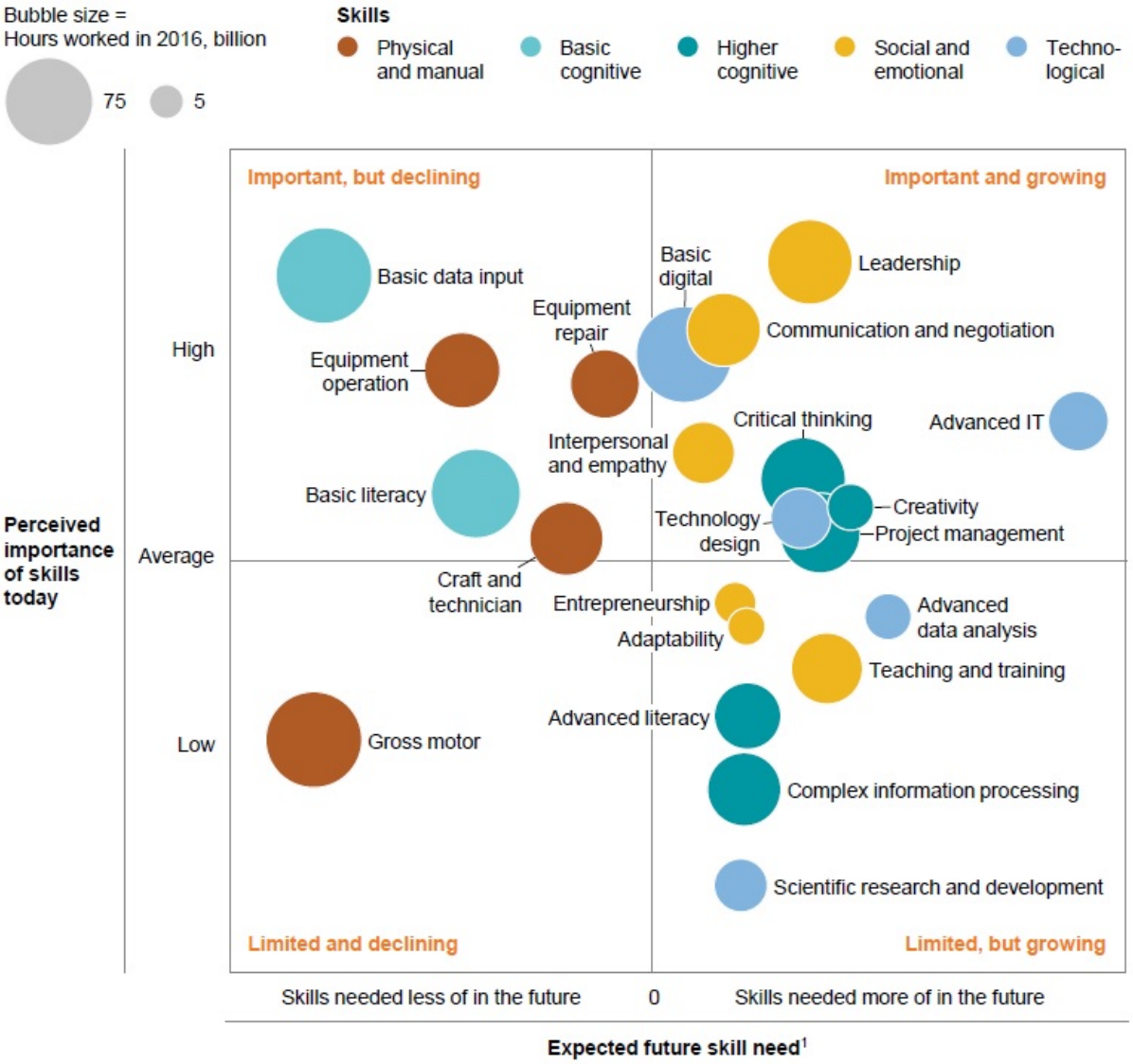

Figure 1: Skills of today vs skills of tomorrow. The results demonstrate that the technological, social and emotional skills will become even more important. [10]

The general trend observed points to a greater need for technological knowledge and less administrative and technical knowledge, therefore the ESSA project will serve steel companies to specify and identify these skills and knowledge needs, adapting them to their future scenarios. By comparing existing and future skills demands and needs of the steel industry the main result of this WP will be obtained: an identification of workforce gaps that will be set as a basis for next tasks, particularly WP4.

3. The European STEEL SECTOR Profiles Family Tree

Stakeholders and experts consider that job profile family tree is a valid view which can be used to facilitate navigation and demonstrate relationships between job profiles. It also gives us a clear idea about the organizational structure that the family belongs to.

The job profile family concept is principally analogous to a human family where characteristics from one generation pass to the next but are also incorporated with new characteristics. [15] We can think it as viewing a subject from a distance through a camera lens and making an outline of that subject. As we gradually focus the lens we can see progressively and more sharply and can better understand the detail of the subject we are viewing. Likewise, the family tree provides us a distant viewpoint with a clear outline but with inner details that are intentionally generalized. During the development of job profiles, the family provides us an additional perspective and the option to modify content and to incorporate detailed granularity to meet specific requirements while maintaining the original profile outline. [15] Thus, utilizing the family tree, the profiles may be used for reference or alternatively as a base to develop further profile levels. [15]

In the first version of European STEEL SECTOR Professional Role Profiles the concept of a STEEL SECTOR family tree was introduced. Therefore, as the first step, professional role profiles were elaborated in a family tree for all the production and maintenance functions in steel companies. The final version of this family tree aimed to be used as reference for the whole steel sector.

For the STEEL SECTOR, there is a big complexity when trying to define the Profiles Family Tree. Structured from two production processes “Blast furnace” and “Electric arc furnace”, products could be different depending on the markets to which they are aimed and the final application. Downstream, twenty-six main STEEL SECTOR Profile Level 1 families can be found and currently more than 200 profiles will intend to reflect the European STEEL SECTOR Profile Family Tree. This concept allows to adapt the core components of the level 2 profiles as needed to user generated profiles with higher level of detail (see figure 2)

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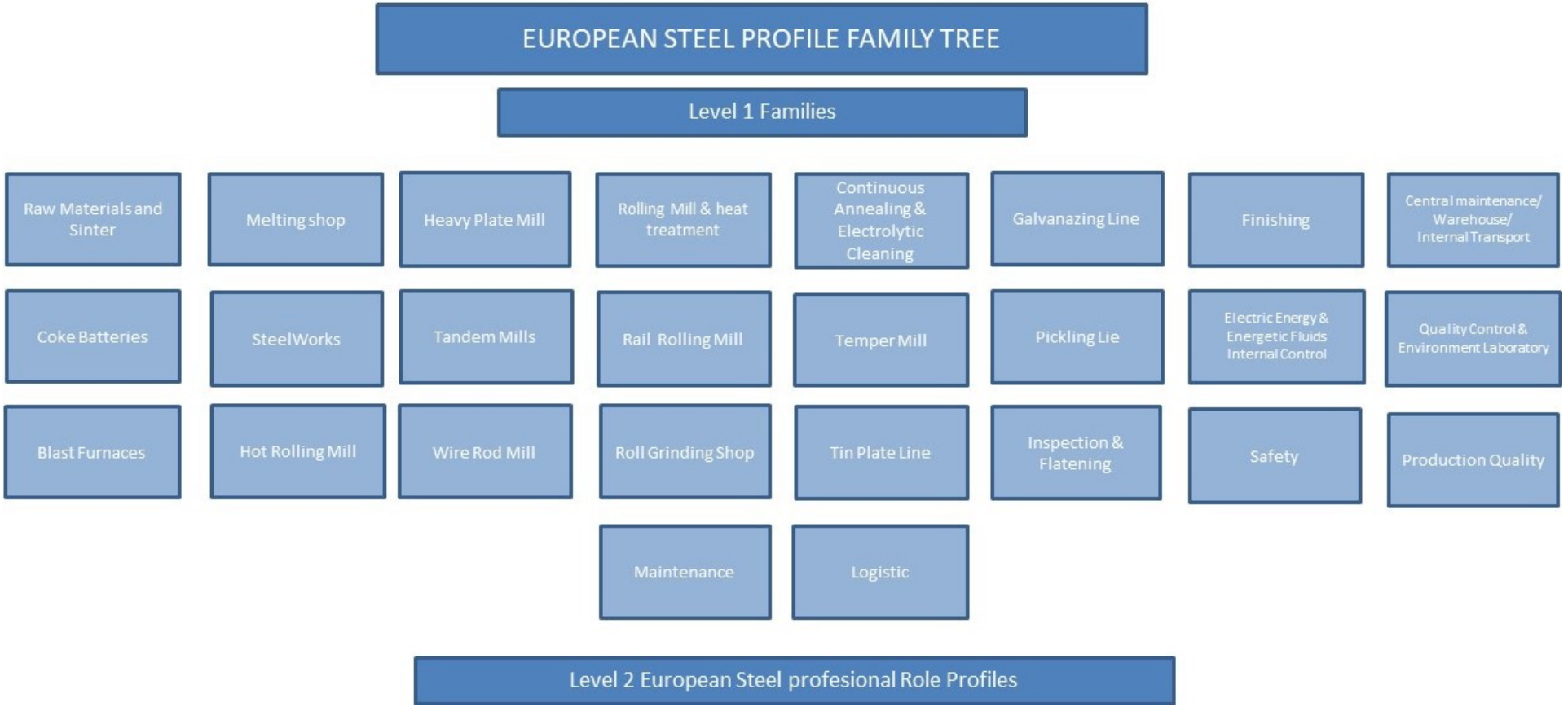


Figure 2: European STEEL SECTOR Professional Role Profiles: twenty-six families (level 1) at the top of the European STEEL SECTOR Profile Family Tree

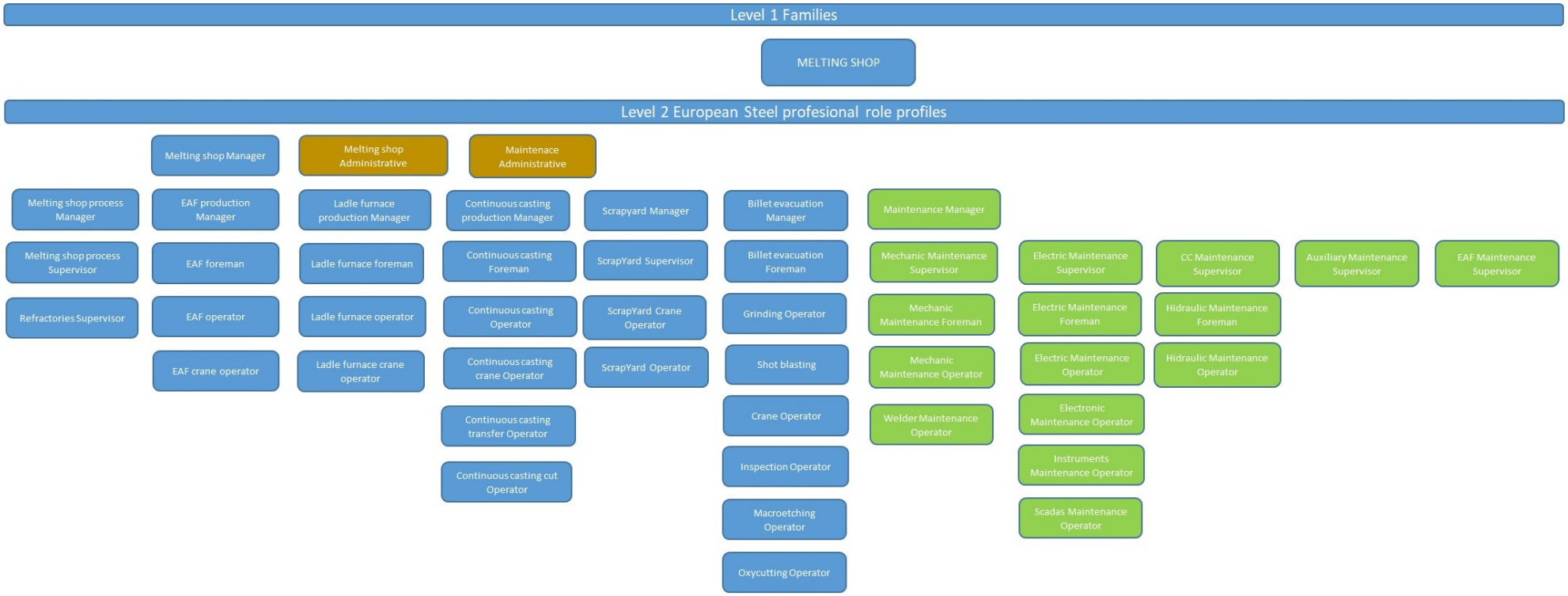


Figure 3: European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Melting Shop Family at the downstream of the European STEEL SECTOR Profile Family Tree

There are a huge range of different job titles across the Steel Sector profession 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 (see ANNEX 1). 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 job described and its associated tasks and responsibilities. Therefore, a standardisation, reduction and merger of similar profiles in the whole job family tree is required. We need to reduce the number of job profiles in the family tree by finding common ground between as many of them as possible and merging them.

The family tree approach is highly useful from a sectorial-organizational point of view; nevertheless, it is unnecessarily complicated for VET framework providers during the generation of lifelong learning training programs.

In order to cope with this complexity and achieve effective occupation and skills profiles we need to generate a common ground for the profile database, from the point of view of both companies and VET trainers. Occupation and skills profiles should combine the company and training perspectives. Thus, this common ground would allow to simplify and consolidate the Professional Role Profiles in the STEEL SECTOR.

The ESCO approach

As the European STEEL SECTOR Profile Family Tree provides a structured information during the generation of the occupation and skills profiles which will be the foundations for WP4 and will set the ground for the Blueprint development (WP5), it was agreed by the ESSA partners that in order to create competent occupation & skill profiles, the European STEEL SECTOR Profile Family Tree needs to be consolidated and simplified. In this way, it will ensure a constant view on the changing skills needs in the STEEL SECTOR, linked to the main drivers, emerging technologies and trends that are influencing the change.

The STEEL SECTOR Profile Family Tree, completed with the contribution of the partners, has been evaluated and consolidated in order to reflect the whole families and profiles covering the European Steel Industry. The ESCO data base profile has been used for comparison and consolidation.

In order to explain the ESCO approach, we need to give a brief definition of ESCO; ESCO is a European Commission sponsored EU-initiative that provides a common European classification of Skills, Competences, Qualifications and Occupations. (https://ec.europa.eu/esco/portal/home) In other words, it as a dictionary, describing, identifying and classifying professional occupations, skills, and qualifications relevant for the labour market and education and training. And it is directly linked to the International Standard Classification of Occupations (ISCO) which is classification of occupation groups managed by the International Labour Organization (ILO), since the information and data in ESCO is based on an original work published by the ILO under the title ”International Standard Classification of Occupations”, ISCO-08.

ESCO is designed to improve communication between the education and training sector and the European labour market and is structured in three interrelated data pillars, Occupations, Skills and Qualifications.

According to the European Qualifications Framework (EQF) and European e-Competence Framework (e-CF), skills, knowledge and attitudes are components of competences. Competences are therefore defined as the ability to use skills, knowledge and attitudes to achieve results. Skills and knowledge are mainly regarded separately, even though some sources define skills as the ability to apply knowledge, describing skills as a synonym for competences.

Skills: In general, skills can be defined as capabilities to complete a task.

ESCO applies the same definition of "skill" as the European Qualifications Framework (EQF): "skill means the ability to apply knowledge and use know-how to complete tasks and solve problems". Skills can be described as cognitive (involving the use of logical, intuitive and creative thinking) or practical (involving manual dexterity and the use of methods, materials, tools and instruments). (https://ec.europa.eu/esco/portal/escopedia/Skill)

Knowledge: According to the e-CF, knowledge represents the set of know-what, such as programming languages or design tools, while the EQF describes knowledge (theoretical and factual) as the assimilation of information (body of facts, theories, practices and principles) through learning

ESCO applies the same definition for knowledge as the European Qualifications Framework (EQF). According to this, "knowledge means the outcome of the assimilation of information through learning. Knowledge is the body of facts, principles, theories and practices that is related to a field of work or study. Both skills and competences rely on factual and theoretical knowledge, the difference lies in the way this knowledge is applied and being put into use.
(https://ec.europa.eu/esco/portal/escopedia/Knowledge)

Attitude: With skills and knowledge being the main components of competences, attitudes can be regarded as the glue that keeps them together. Attitudes are described as the cognitive and relational capacity as well as the motivation to do something

Qualifications: Qualifications are understood as "the formal outcome of an assessment and validation process, which is obtained when a competent body determines that an individual has achieved learning outcomes to given standards" (https://www.cedefop.europa.eu/node/11256

Competences: are defined as demonstrated ability to apply knowledge, skills and attitudes for achieving observable results in e-CF.

ESCO applies the same definition of "competence" as the European Qualification Framework (EQF): "competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development". They are described in terms of responsibility and autonomy.
(https://ec.europa.eu/esco/portal/escopedia/Competence)

Tasks: as the actions necessary to turn a set of inputs into valuable outputs. Tasks can be considered as the content of jobs. In essence: Tasks are what needs to be done and skills define the capacity to do them.

In ESCO database, each occupation comes with an occupational profile, in which the knowledge, skills and competences that are relevant for the respective occupation are listed. ESCO's skills pillar contains knowledge, skills and competences.

Since in ESCO profiles ´´competence", "skill" and "task´" are usually referred as same concepts and there is no clear distinction between them , we modified these concepts and generated profiles based on "TASKS" and "SKILLS" in order to achieve a more common ground and reduce the complexity.

The European STEEL SECTOR Professional Role Profiles have therefore been created in a generic and simple way, in order to enable reference and use by all types of organisations, whatever their size and their structure. In consequence, the STEEL SECTOR Profiles provide high level outlines of typical STEEL SECTOR Professional Roles; easy to break down to the next context specific application level, for instance job descriptions.

MELTING SHOP		
iscoGroup	Ocupation ESCO	STEEL SECTOR ROLE PROFILES
1219	department manager	Blast Furnace Manager
2141	process engineer	Blast Furnaces Process technician
3119	process engineering technician	Blast Furnaces Process professional
1321	industrial production manager	Blast Furnaces Production Manager
3122	machine operator supervisor	Blast Furnaces foreman
3135	metal furnace operator	Blast Furnaces Operator
	machine operator	Blast Furnaces Joint operator
8343	mobile crane operator	Loads and unloads operator
	Refractories Coordinator	Blast Furnaces refractory lining coordinator
	Refractories Supervisor	Blast furnace refractory lining Supervisor
	Refractories Operator	Blast furnace refractory lining foreman
		Iron Pig coordinator
3122	machine operator supervisor	Iron Pig desulphurisation Supervisor
	machine operator	Iron Pig desulphurisation operator
	mobile device operator	hot-metal transfer car overturning operator
1219	department manager	Melting shop Manager
2141	process engineer	Melting shop process Manager
3119	process engineering technician	Melting shop process Supervisor
1321	industrial production manager	EAF production Manager
3122	machine operator supervisor	EAF foreman
3135	metal furnace operator	EAF operator
8343	mobile crane operator	EAF crane operator
	Refractories Supervisor	Refractories Supervisor
1219	department manager	SteelWorks Manager
1321	industrial production manager	Converter Production Manager
3122	machine operator supervisor	Converter Shift Manager
	machine operator	Converter Operator
3122	machine operator supervisor	Blowing supervisor
	machine operator	Transfer pig iron Operator
	machine operator	Torpedo tipping Operator
3122	machine operator supervisor	Oxigen converter gas recovery system Supervisor
	machine operator	Oxigen converter gas recovery system Operator
1321	industrial production manager	Secondary Metallurgy & Ladle Production Manager
3122	machine operator supervisor	Secondary Metallurgy Supervisor
	Secondary Metallurgy operator	Secondary Metallurgy operator
	Refractories Supervisor	Ladle & Refractory Supervisor
	Refractories Operator	Ladle Preparation Operator
1321	industrial production manager	Continuous casting Production Manager
3122	machine operator supervisor	Continuous casting Shift Manager
3122	machine operator supervisor	Continuous casting Supervisor
8121	casting machine operator	Continuous casting operator
7223	oxy fuel burning machine operator	Oxycutting Operator
		Slabyard and forwarding Manager
		Slab yard and forwarding Shift Manager
		Slabyard and forwarding Supervisor
		Slabyard Operator
	product engineering technician	Solid Steel Product Technician
1321	industrial production manager	Ladle furnace production Manager
3122	machine operator supervisor	Ladle furnace foreman
		Ladle furnace operator
8343	production plant crane operator	Ladle furnace crane operator
1321	industrial production manager	Continuous casting production Manager
		Continuous casting Foreman
8121	casting machine operator	Continuous casting Operator
		Continuous casting transfer Operator
7223	oxy fuel burning machine operator	Oxycutting Operator
8343	mobile crane operator	Crane Operator
		Billet evacuation Manager
		Billet evacuation Foreman
		Grinding Operator
		Shot blasting Operator
		Inspection Operator
		Macroetching Operator
7223	oxy fuel burning machine operator	Oxycutting Operator
8343	mobile crane operator	Crane Operator

	Blast furnace process steel production
	Electric Arc furnace process steel production
xxxx	ESCO existing occupations
xxxx	Not existing occupations to be added to ESCO database

Table 1: Relationship map between ESCO Occupation titles and STEEL SECTOR Professional Role Profiles, defined by ISCO group numbers.

For ease of reference, an example relationship map between ESCO Occupation titles and STEEL SECTOR Professional Profiles in both directions is provided above (figure 3).

It is important to note that the relationship between the two structures does not represent an equivalence but could be the starting point to create such equivalence between ESCO and the titles in the STEEL SECTOR.

The Steel Sector Professional Role Profiles will be defined for three groups that take into account the main manufacturing processes of steel manufacturing companies: liquid steel production and semi product production, rolling mill and operations to obtain the finished product.

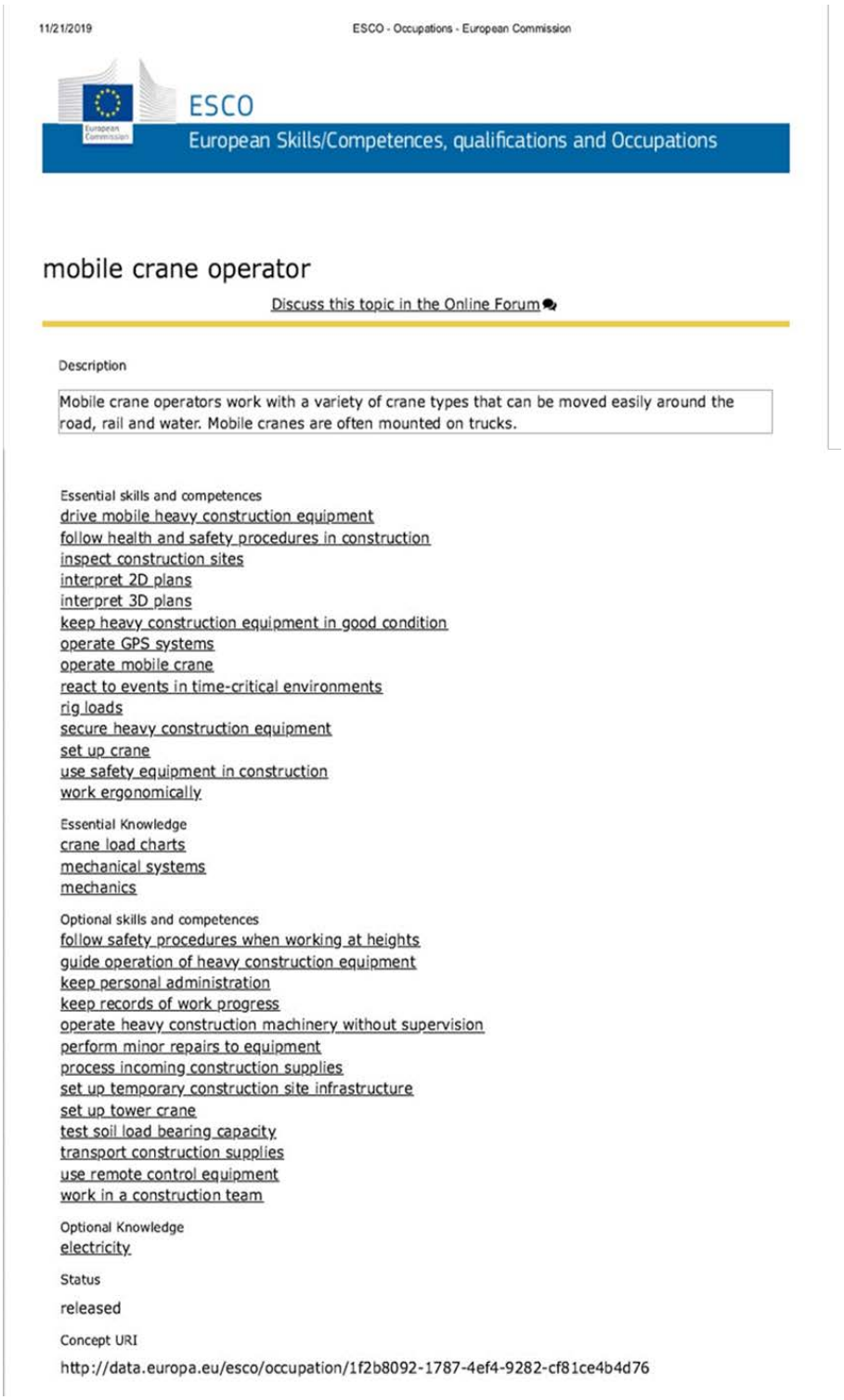
The Professional Role Profiles are the base for the next profiles description, defining the needed skills for those profiles. Those profiles should be understandable to both companies and VET system institutions. Therefore, it has been decided to take the occupations defined by ESCO database related with the STEEL SECTOR as the basis for the profile description.

One of the issues that arise is that not all the STEEL SECTOR titles, or profiles are covered by the ESCO occupations database and new occupations must be created during the profile definition task. In this way, the work developed during the compilation of the profiles in the STEEL SECTOR industry will feed the ESCO database, enriching it with new occupations and descriptions. To align the ESSA profile description with the ESCO database a joint meeting took place to coordinate a common development process. As a result of the meeting, ESCO and ESSA project & WP3 leaders concluded that the data from the ESSA job profile descriptions will be integrated in ESCO database when needed. It is foreseen not to elaborate a standalone database for the steel industry but to integrate it in existing databases like ESCO (see Deliverable D3.1).

With regard to professional profiles, the majority of interviewees involved in the STEEL SECTOR CAREER study agreed that the changes brought about by new trends will affect the skills required across already existing positions rather than cause the emergence of entirely new profiles. The only exception to that is administrative functions, which are expected to be fully incorporated by machines or by management-level positions. [5]

4. The European Steel Sector Professional Role Profiles description

The potentiality for the equivalence between ESCO and the titles in the STEEL SECTOR opens the door to the automatization of the description of the European Steel Sector Professional Role Profiles taking the ESCO description of occupations as the basis for a full description of the Steel Sector Professional Role Profiles. As an example, the ESCO “mobile crane operator” description has been taken.



11/21/2019 ESCO - Occupations - European Commission

ESCO

European Skills/Competences, qualifications and Occupations

mobile crane operator

Discuss this topic in the Online Forum

Description

Mobile crane operators work with a variety of crane types that can be moved easily around the road, rail and water. Mobile cranes are often mounted on trucks.

Essential skills and competences

drive mobile heavy construction equipment
follow health and safety procedures in construction
inspect construction sites
interpret 2D plans
interpret 3D plans
keep heavy construction equipment in good condition
operate GPS systems
operate mobile crane
react to events in time-critical environments
rig loads
secure heavy construction equipment
set up crane
use safety equipment in construction
work ergonomically

Essential Knowledge

crane load charts
mechanical systems
mechanics

Optional skills and competences

follow safety procedures when working at heights
guide operation of heavy construction equipment
keep personal administration
keep records of work progress
operate heavy construction machinery without supervision
perform minor repairs to equipment
process incoming construction supplies
set up temporary construction site infrastructure
set up tower crane
test soil load bearing capacity
transport construction supplies
use remote control equipment
work in a construction team

Optional Knowledge

electricity

Status

released

Concept URI

http://data.europa.eu/esco/occupation/1f2b8092-1787-4ef4-9282-cf81ce4b4d76

Figure 4: ESCO “mobile crane operator” description

ESCO gives a description of this occupation that could fix with the mission of the Profile “crane operator” in the STEEL SECTOR industry with only small modifications.

ESCO shows also as a good alternative to match the Essential and Optional skills and competences and Knowledge for the Steel Sector Professional Role Profiles.

Using the ESCO database for Occupations, DEUSTO University has developed a software that will allow automating the description of the different profiles of the STEEL SECTOR. Although, the result of this first description of the profiles should be checked and refined through the knowledge of the Steel Sector industrial partners that are collaborating on the WP3.

The European STEEL SECTOR Professional Role Profiles are constructed consistently to provide a common template. A standard template makes it easier for users to compare different profiles and provide a fast start for developing new profiles or contributing to designing new job descriptions.

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

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

The main principle applied to constructing the profiles was to focus on the most essential characteristics that accurately represent the profile and effectively differentiate one profile from another.

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

PROFILE TITLE	PROFILE NAME		
Summary Statement			
Mission			
TASKS	Current	Future	
Main task/s	ESCO description	(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level	Future Level
Technical, subject related skills / knowledge			
Technical	General equipment operation	2	1
	General equipment repair and mechanical skills	2	2
	Craft and technician skills	2	1
	Gross motor skills and strength	4	4
	Inspecting and monitoring skills	1	1
SKILLS		Current Level	Future Level
Transversal skills			
Digital skills	Basic digital skills	3	4
	Advanced data analysis and mathematical skills	1	2
	Cybersecurity	1	2
	Use of complex digital communication tools	1	2
	Advanced IT skills & Programming	1	3
Green skills			
Social skills	Advanced communication and negotiation skills	2	3
	Interpersonal skills and empathy	1	2
	Leadership and managing others	3	4
	Entrepreneurship and initiative taking	1	2
	Adaptability and continuous learning	1	2
	Teaching and training others	2	2
Individual, personal skills	Critical thinking & decision making	3	3
	Personal experience		
	Adapt to change	1	2
	Work autonomously		
	Active listening	1	2
Methodological skills	Basic numeracy and communication	3	3
	Basic data input and processing	4	3
	Advance literacy	1	1
	Quantitative and statistical skills	1	1
	Complex information processing and interpretation	2	3
	Process analysis		
	Creativity	1	2
	Complex problem solving	2	3

1	Awareness/Basic Actor
2	Practitioner
3	Expert
4	Master

Figure 5: European STEEL SECTOR Professional Role Profiles template

Each profile element is described below.

PROFILE TITLE ***Define***	**Gives a commonly used name to a profile.** The names proposed for the job profiles must match the names indicated by ESCO for occupations. Profiles not described in ESCO occupations, should be defined as new names for job profiles. These new titles created for the STEEL SECTOR do not have to be in conflict with the names of ESCO occupations overlapping with existing ones.
SUMMARY STATEMENT ***Adapt from ESCO***	**Indicates the main purpose of the profile.** The purpose is to present a brief, concise understanding of the specified STEEL SECTOR Profile. It should be understandable by STEEL SECTOR professionals, STEEL SECTOR managers, Human Resource personnel and education and training institutions. The structure should consist of a short sentence (up to approximately 15 words). It should not repeat the entire STEEL SECTOR Profile name. It should provide a statement of the job's main activity. *Note:* Ensure that the statement discriminates between other profiles.
MISSION ***Adapt from ESCO or add***	**Describes the rationale of the profile.** The purpose is to specify the designated job role defined in the STEEL SECTOR Profile. It should provide the performance context of the job within an organisational structure. The following verbs *may be* used within the description or at least for structuring the thinking about how to express the mission: Guarantees, Ensures, Contributes
MAIN TASKS ***Adapt from ESCO or add***	**A list of typical tasks to be performed by the profile.** A task is an action necessary to turn a set of inputs into valuable outputs. Tasks are what needs to be done. Tasks may be associated with deadlines, resources, goals, specifications and/or the expected results; however, this depends upon the context of the task and they may be omitted, however the action must always be described. A task is defined by a short description using a verb and the objective or goal of the action. List no more than ten. Each task should contribute in defining a Profile.
SKILLS	**A list of necessary skills, technical and transversal** Some examples are provided by ESCO data base.

At this point, it would be helpful to explain the different types of skills.

Economists, other researchers, and organizational practice experts use different definitions when discussing workforce "skills". To understand the nature and magnitude of the coming skill shift, it is useful to take a business-oriented approach to the definition. Following this approach, we include both intrinsic abilities (for example, gross motor skills and strength, creativity, and empathy) and specific learned skills, such as those in advanced IT and programming and advanced data analysis. This will allow us to build a comprehensive view of the changing nature of workforce skills and provide a sufficient level of detail to motivate concrete actions and interventions.

We end up with a set of skills across six broad categories: essential technical, methodological, social, individual and personal, green and digital skills. Within each category are more specific skills. For instance, within social skills, we include advanced communication and negotiation, interpersonal skills and empathy, leadership and managing others, entrepreneurship and initiative taking, adaptability and continuous learning, and teaching and training others. We have also separated digital skills from methodology skills, although some of the former require methodology capabilities. [6,16]

While workers use multiple skills to perform a given task, for the purposes of our quantification, we identified the predominant skill used. [6,16]

Referring to the template, described each topic may be addressed and converted to the 'language of the sector' to form the basis of a profile that will inevitably contain different content but formatted in an easy to understand structure.

A standard template makes it easier for users to compare different profiles and provide a fast start to developing new profiles or contributing to designing new job descriptions: Adopting the structure and format of the professional profiles template but using different content to establish significantly different roles either related or even unrelated to Steel Sector is possible.

The biggest change will take place in technological skills, both in advanced skills such as programming, advanced data analysis, and tech design, for example, and also in more basic digital skills relating to the increasing prevalence of digital technologies in all workplaces. Other skills will also see a significant increase in demand, including various types of social and emotional skills. A shift will take place from basic to higher cognitive skills. Demand for physical and manual skills as a predominant skill set will continue to decrease, although these skills will remain a major component of the workplace of the future. [6,16]

After identifying the needed skills for the steel sector, WP3 is responsible for creating the link between these skills and knowledge definitions in ESCO database so that WP4 will have a reference through the process of creating VET training systems. As we can see from the table below, we picked up some of the skills which are already present at the professional job profile description template (Figure 1) and found out their associated knowledge from ESCO database.

SKILL	ESCO KNOWLEDGE
Basic digital skills	develop digital content
	manage digital archives
	use digital illustration techniques
	create digital files
	create digital images
	use digital instruments
	apply digital mapping
Advanced data analysis and mathematical skills	use specific data analysis software
	perform data analysis
	perform online data analysis
	conduct analysis of ship data
	use methods of logistical data analysis
	execute ICT user research activities
	analyse big data
	process collected survey data
	perform safety data analysis
	implement data quality processes
	apply statistical analysis techniques
	data quality assessment
	collect financial data
	manage data for legal matters
	analyse data about clients
	statistical analysis system software
	web analytics
	make numerical calculations
	use mathematical tools and equipment
	use mathematical software
Use of complex digital communication tools	interact through digital technologies
	electronic communication
	use a computer
	use communication equipment
	use digital instruments
	signal processing
	ICT safety

Table 2: Identified skills and their linked knowledge in ESCO database (continues next page)

Training the trainers

Regarding the 'train the trainers' approach, we have been considering 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 - centered 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.

Use in assessment and career

The European STEEL SECTOR Professional Role Profiles may be used to implement an effective competence assessment process for STEEL SECTOR people.

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 working tool can be developed integrating the skills and the organisation Job Profiles; they can be derived starting from the Role Profiles described in this work package.

Curriculum design

In the context of qualification development and VET system curricula design, the European STEEL SECTOR Professional Role Profiles can be used as

- A communication tool between employers and educators which improves consultation process and outcomes

- A starting point for more detailed Role Profiles and curricula design in specialised fields (e.g. STEEL SECTOR Security, Data and Big Data)

- Within VET system curricula

The European STEEL SECTOR Professional Role Profiles is also generated to be used in the process of curricula design. 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 STEEL SECTOR Profiles and the skills shift, 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 knowledge, skills and competence. The STEEL SECTOR Profiles in line as much as possible with the ESCO terminology and description can be used to provide 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.

This means that 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, an aligned European STEEL SECTOR Professional Role Profile 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.

5. Next Plan

Some changes on the professional profile description template will be proposed to project partners:

- In this newer version, optional skills are eliminated from the template.
- “Future skills” are removed since the skills that will be needed for the future are already incorporated within ´SKILLS”. It will reduce the complexity of the table.
- A generic, colour-based level system (with 4 levels) for skills will be proposed to ESSA partners. (4 levels: 1 = Awareness, 2 = Practitioner, 3 = Expert, 4 = Master). It is created through the analysis of McKinsey Institute Report on worked hours in steel sector.

The result of this first description of the profiles in the automated database should be checked and refined through the knowledge of the Steel Sector industrial partners that are collaborating on the WP3.

The steel job profile descriptions are in progress and the information needed to fill each profile description will also have to be incorporated into the steel job profile database. Therefore, the automatization process of the database is still in progress.

Moreover, integration of the data (not only from ESCO, CEPIS and but also from other sources like COSME, CEDEFOP, etc. and ESSA partners) into the common job profile database is aimed for the future.

Making the database interactive:

Our future plan is to be able to introduce the current and future skills that are not present in ESCO database, interactively to the ESCO database. Our aim is not only to be able to update the existing job profile descriptions in ESCO, but also to introduce new ESSA job profile descriptions related to steel sector into the ESCO database in an interactive way.

In this way, the work developed during the compilation of the profiles in the STEEL SECTOR industry will feed the ESCO database, enriching it with new occupations and descriptions.

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ANNEX

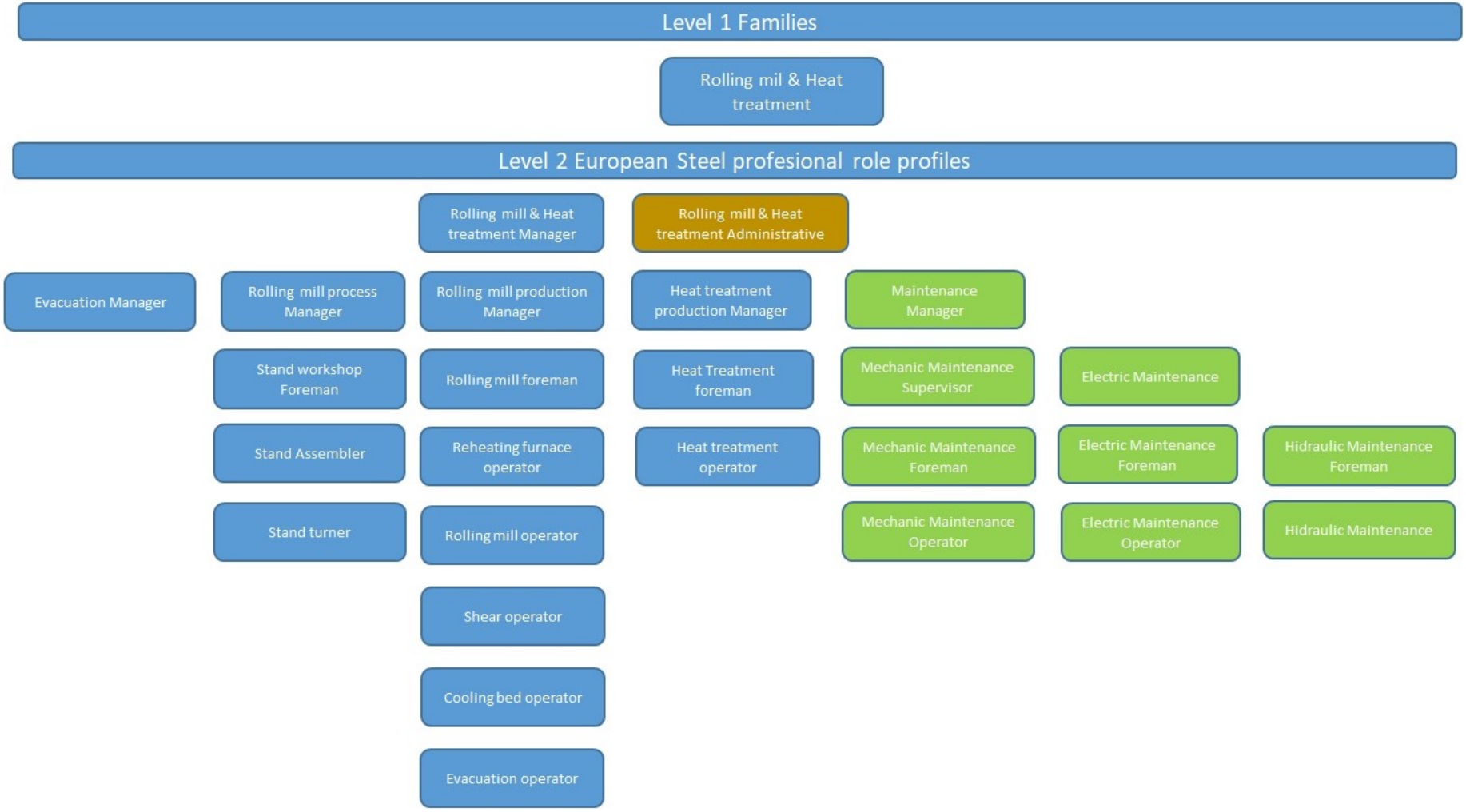
PROFILE TITLE	Industrial Production Manager		
Summary Statement			
Mission	Industrial production managers oversee the operations and the resources needed in industrial plants and manufacturing sites for a smooth running of the operations. They prepare the production schedule by combining the requirements of clients with the resources of the production plant. They organise the journey of incoming raw materials or semi finished products in the plant until a final product is delivered by coordinating inventories, warehouses, distribution, and support activities.		
TASKS	Current	Future	
Main task/s	manage supplies adjust production schedule assess impact of industrial activities manage budgets oversee production requirements control financial resources manage staff create manufacturing guidelines define quality standards oversee assembly operations manage resources meet deadlines adhere to organisational guidelines plan health and safety procedures liaise with industrial professionals schedule production *define manufacturing quality criteria* *check quality of products on the production line* *adapt production levels* *develop manufacturing policies* *analyse supply chain strategies* *assess supplier risks* *check quality of raw materials* *inspect material* *analyse goal progress* *develop business plans* *analyse production processes for improvement*	(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level	Future Level
Technical, subject related skills			
Technical	cleaning industry health and safety measures	2	2
	manufacturing processes	2	2
	industrial engineering	3	3
	industrial software	2	2
SKILLS		Current Level	Future Level
Transversal skills			
Digital skills	Basic digital skills	1	2
	Advanced data analysis and mathematical skills	1	2
	Cybersecurity	1	2
	Use of complex digital communication tools	1	2
	Advanced IT skills & Programming	1	2
Green skills			
Social skills	Advanced communication and negotiation skills	2	3
	Interpersonal skills and empathy	1	2
	Leadership and managing others	3	4
	Entrepreneurship and initiative taking	1	2
	Adaptability and continuous learning	1	3
	Teaching and training others	2	2
Individual, personal skills	Critical thinking & decision making	3	4
	Personal experience	2	3
	Adapt to change	1	2
	Work autonomously	2	3
	Active listening	2	3
Methodological skills	Basic numeracy and communication	3	4
	Basic data input and processing	4	3
	Advanced literacy	2	2
	Quantitative and statistical skills	3	3
	Complex information processing and interpretation	3	4
	Process analysis	3	4
	Creativity	2	3
	Complex problem solving	2	3
0	Novice		
1	Awareness/Basic Actor		
2	Practitioner		
3	Expert		
4	Master		

PROFILE TITLE	Machine operator supervisor		
Summary Statement			
Mission	Machine operator supervisors coordinate and direct workers who set up and operate machines. They monitor the production process and the flow of materials, and they make sure that the products meet the requirements.		
TASKS	Current	Future	
Main task/s	create solutions to problems monitor machine operations oversee production requirements record production data for quality control monitor manufacturing quality standards ensure finished product meet requirements evaluate employees work communicate problems to senior colleagues consult technical resources schedule regular machine maintenance follow production schedule check material rescources report on production results set up the controller of a machine *ensure compliance with environmental legislation* *perform technically demanding tasks* *undertake inspections* *oversee quality control* *identify hazards in the workplace* *wear appropriate protective gear* *recruit personnel* *read standard blueprints* *perform machine maintenance* *integrate new products in manufacturing* *provide advice to technicians* *analyse the need for technical resources* *liaise with quality assurance* *advise on machine maintenance* *coordinate communication within a team*	(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level	Future Level
Technical, subject related skills			
Technical	production processes	4	4
	quality standards	4	4
	functionalities of machinery	4	4
	quality assurance methodologies	3	3
SKILLS		Current Level	Future Level
Transversal skills			
Digital skills	Basic digital skills	3	4
	Advanced data analysis and mathematical skills	2	3
	Cybersecurity	1	2
	Use of complex digital communication tools	2	3
	Advanced IT skills & Programming	1	3
Green skills			
Social skills	Advanced communication and negotiation skills	2	3
	Interpersonal skills and empathy	1	2
	Leadership and managing others	2	3
	Entrepreneurship and initiative taking	1	3
	Adaptability and continuous learning	1	3
	Teaching and training others	2	3
Individual, personal skills	Critical thinking & decision making	3	3
	Personal experience	2	2
	Adapt to change	1	2
	Work autonomously	1	1
	Active listening	1	2
Methodological skills	Basic numeracy and communication	2	3
	Basic data input and processing	3	2
	Advanced literacy	1	1
	Quantitative and statistical skills	2	2
	Complex information processing and interpretation	2	3
	Process analysis	3	3
	Creativity	2	3
	Complex problem solving	2	3
0	Novice		
1	Awareness/Basic Actor		
2	Practitioner		
3	Expert		
4	Master		

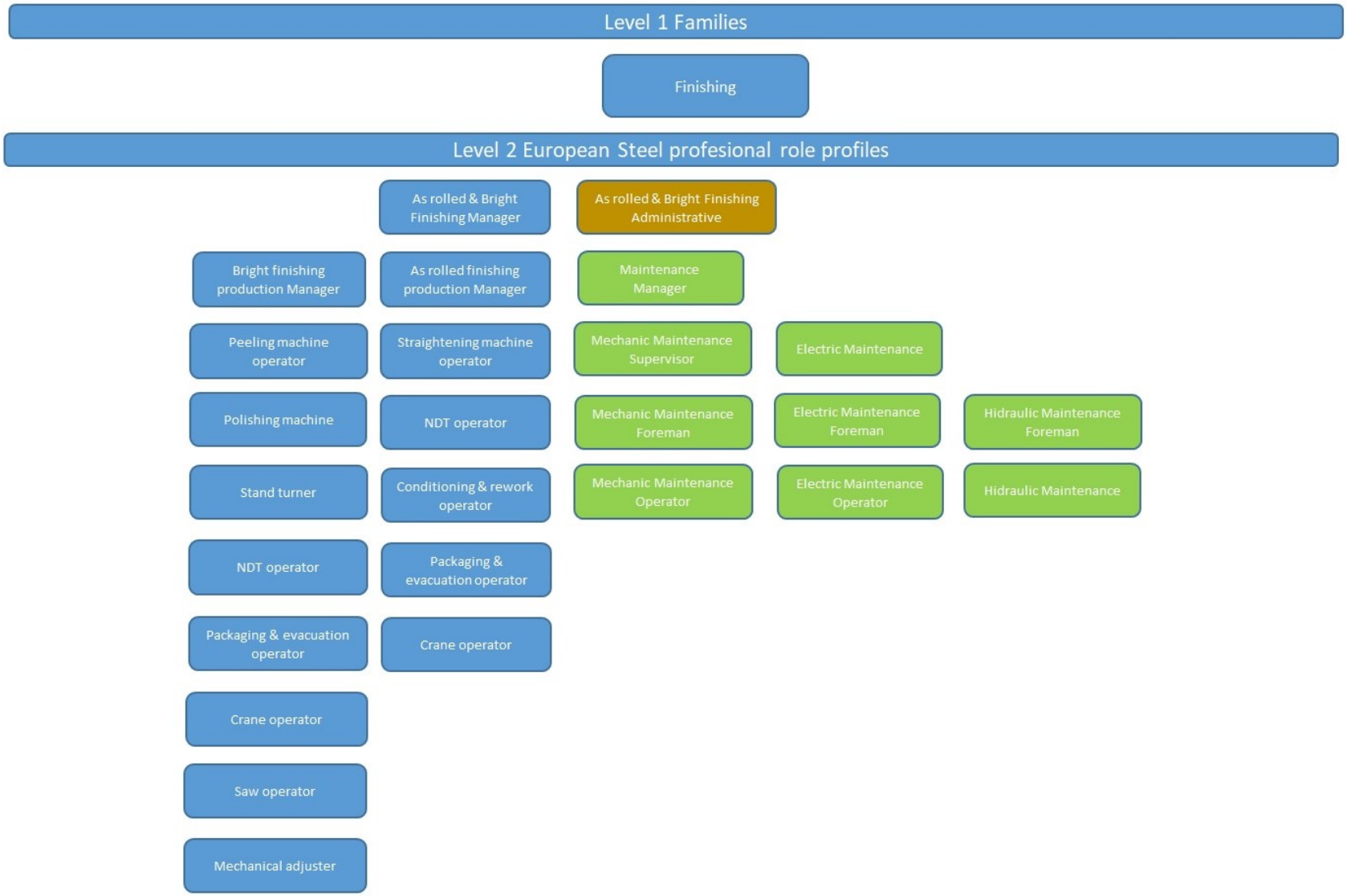
PROFILE TITLE	Mobile crane operator		
Summary Statement			
Mission	Mobile crane operators work with a variety of crane types that can be moved easily around the road, rail and water. Mobile cranes are often mounted on trucks.		
TASKS	Current	Future	
Main task/s	work ergonomically rig loads inspect construction sites set up crane follow health and safety procedures in construction operate GPS systems operate mobile crane interpret 3D plans drive mobile heavy construction equipment react to events in time-critical environments use safety equipment in construction secure heavy construction equipment interpret 2D plans rig loads *secure heavy construction equipment* *set up tower crane* *operate heavy construction machinery without supervision* *transport construction supplies* *work in a construction team* *use remote control equipment* *keep personal administration* *process incoming construction supplies* *perform minor repairs to equipment* *keep records of work progress* *guide operation of heavy construction equipment* *set up temporary construction site infrastructure* *follow safety procedures when working at heights* *test soil load bearing capacity*	(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level	Future Level
Technical, subject related skills			
Technical	mechanical systems	3	4
	crane load charts	4	4
	mechanics	3	4
	electricity	2	2
SKILLS		Current Level	Future Level
Transversal skills			
Digital skills	Basic digital skills	1	2
	Advanced data analysis and mathematical skills	1	2
	Cybersecurity	0	1
	Use of complex digital communication tools	0	3
	Advanced IT skills & Programming	0	1
Green skills			
Social skills	Advanced communication and negotiation skills	0	2
	Interpersonal skills and empathy	1	2
	Leadership and managing others	0	0
	Entrepreneurship and initiative taking	0	1
	Adaptability and continuous learning	1	3
	Teaching and training others	2	2
Individual, personal skills	Critical thinking & decision making	2	3
	Personal experience	2	2
	Adapt to change	1	2
	Work autonomously	1	2
	Active listening	1	2
Methodological skills	Basic numeracy and communication	2	3
	Basic data input and processing	2	3
	Advanced literacy	1	2
	Quantitative and statistical skills	1	1
	Complex information processing and interpretation	0	2
	Process analysis	1	2
	Creativity	1	2
	Complex problem solving	1	2
0	Novice		
1	Awareness/Basic Actor		
2	Practitioner		
3	Expert		
4	Master		

PROFILE TITLE	Metal furnace operator		
Summary Statement			
Mission	Metal furnace operators monitor the process of making metal before it is cast into forms. They control metal making furnaces and direct all activities of furnace operation, including the interpretation of computer data, temperature measurement and adjustment, loading vessels, and adding iron, oxygen, and other additives to be melted into the desired metal composition. They control the chemicothermal treatment of the metal in order to reach the standards. In case of observed faults in the metal, they notify the authorised personnel and participate in the removal of the fault.		
TASKS	Current	Future	
Main task/s	measure furnace temperature maintain furnace temperature troubleshoot operate furnace manage emergency procedures ensure public safety and security work in metal manufacture teams admit basic metals to furnace record furnace operations prevent damage in a furnace *malfunctions* *monitor gauge* *record production data for quality control* *process incident reports for prevention* *extract materials from furnace* *ensure health and safety in manufacturing* *load materials into furnace* *measure metal to be heated* *manage time in furnace operations* *perform minor repairs to equipment* *resolve equipment*	(here it should be listed, which tasks are changing/modified in which way, and if new tasks appear)	
SKILLS		Current Level	Future Level
Technical, subject related skills			
Technical	*type of metal manufacturing processes*	3	3
SKILLS		Current Level	Future Level
Transversal skills			
Digital skills	Basic digital skills	1	2
	Advanced data analysis and mathematical skills	1	2
	Cybersecurity	0	1
	Use of complex digital communication tools	0	3
	Advanced IT skills & Programming	0	1
Green skills			
Social skills	Advanced communication and negotiation skills	0	2
	Interpersonal skills and empathy	1	2
	Leadership and managing others	0	0
	Entrepreneurship and initiative taking	0	1
	Adaptability and continuous learning	1	3
	Teaching and training others	2	2
Individual, personal skills	Critical thinking & decision making	3	3
	Personal experience	2	2
	Adapt to change	1	3
	Work autonomously	1	2
	Active listening	1	2
Methodological skills	Basic numeracy and communication	2	3
	Basic data input and processing	2	3
	Advanced literacy	1	2
	Quantitative and statistical skills	1	1
	Complex information processing and interpretation	0	2
	Process analysis	1	2
	Creativity	1	2
	Complex problem solving	1	2
0	Novice		
1	Awareness/Basic Actor		
2	Practitioner		
3	Expert		
4	Master		

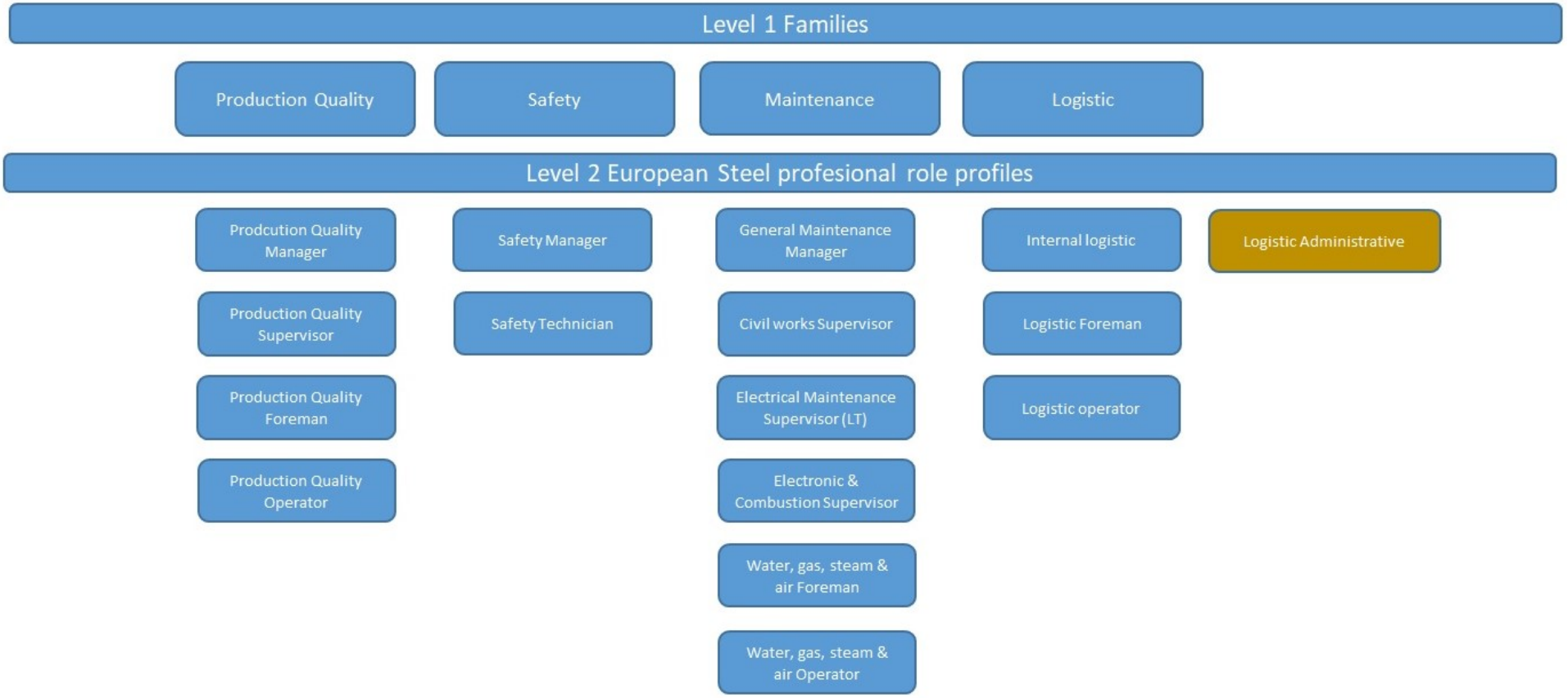
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Rolling Mill and Heat Treatment Family at the downstream of the European STEEL SECTOR Profile Family Tree



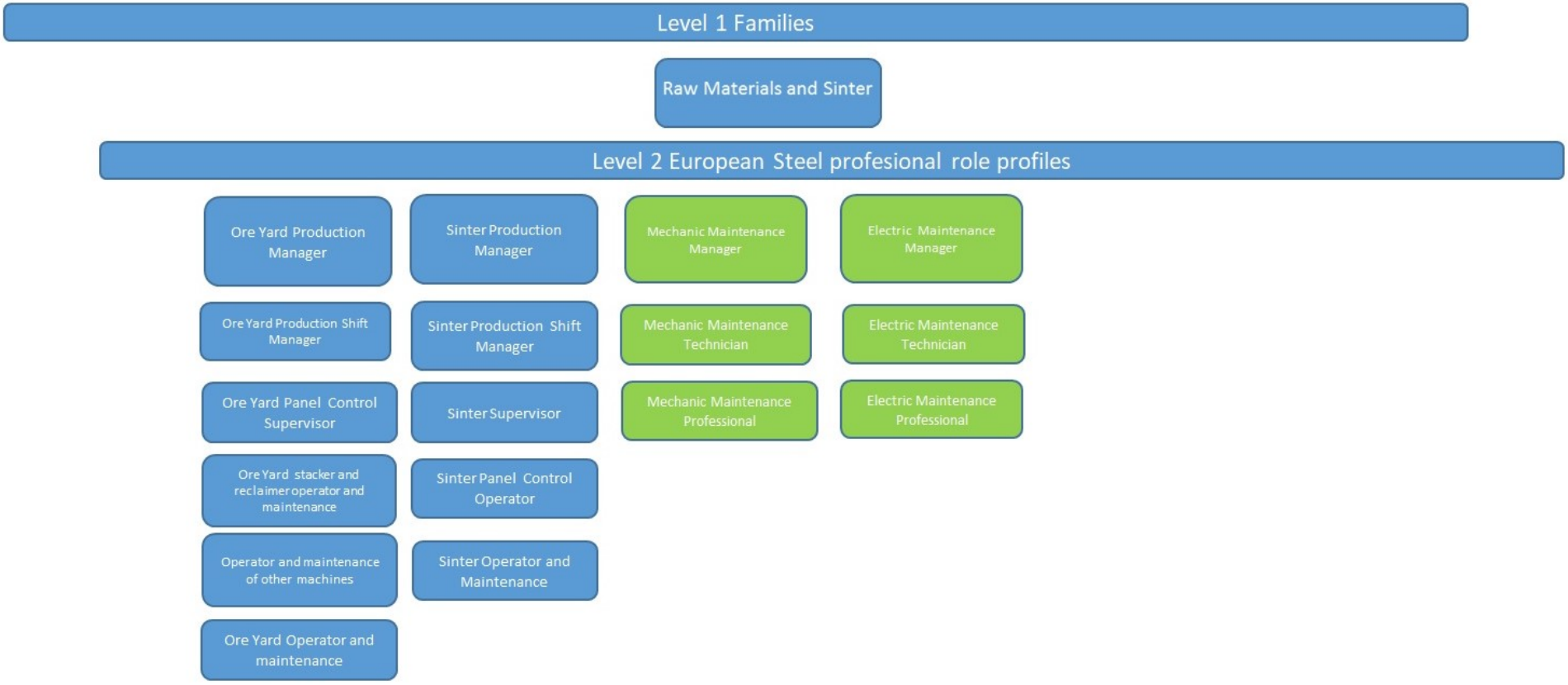
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Finishing Family at the downstream of the European STEEL SECTOR Profile Family Tree



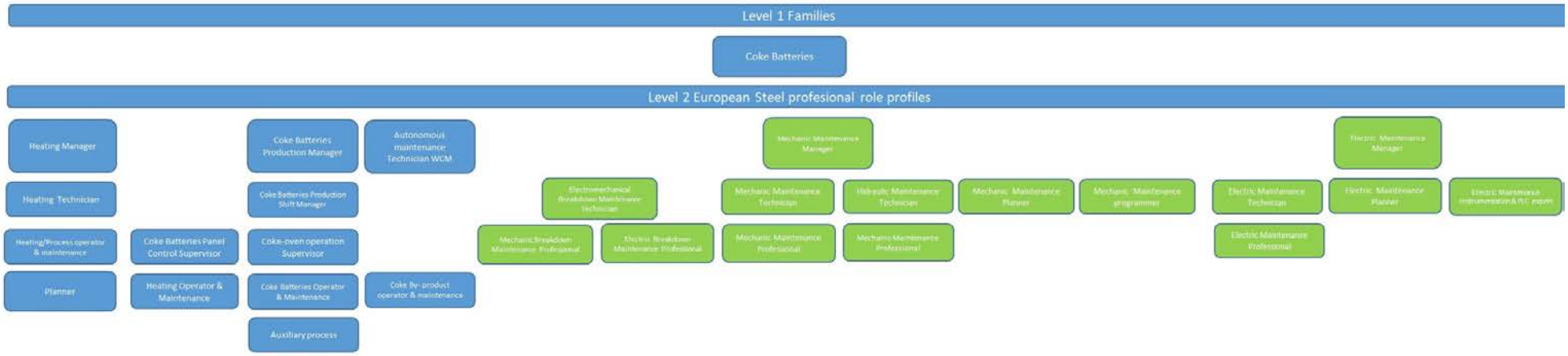
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Production Quality, Safety, Maintenance and Logistic Families at the downstream of the European STEEL SECTOR Profile Family



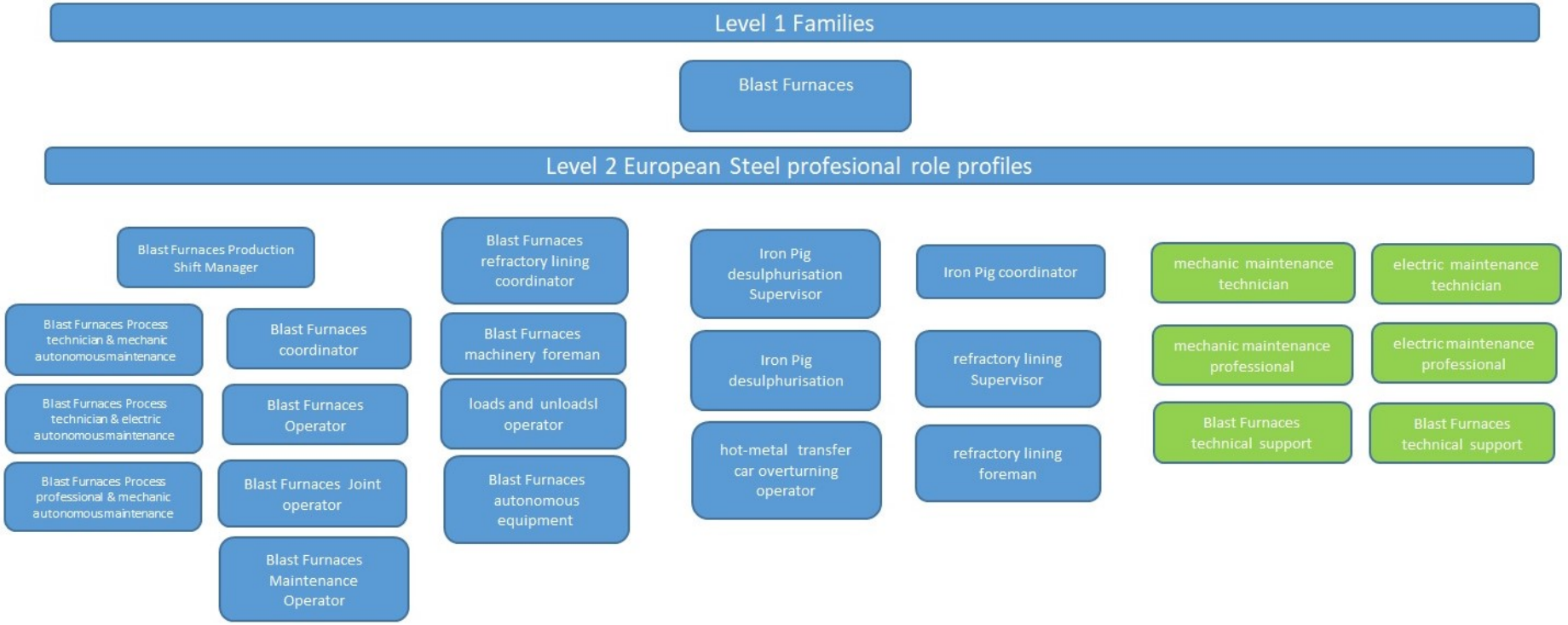
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Raw Materials and Sinter Family at the downstream of the European STEEL SECTOR Profile Family Tree



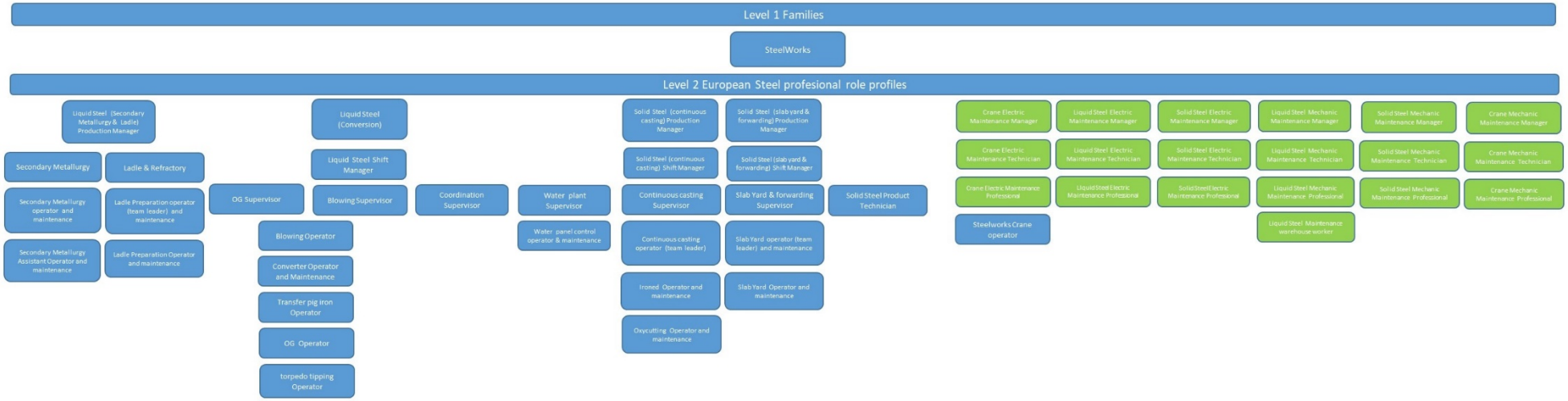
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Coke Batteries Family at the downstream of the European STEEL SECTOR Profile Family Tree



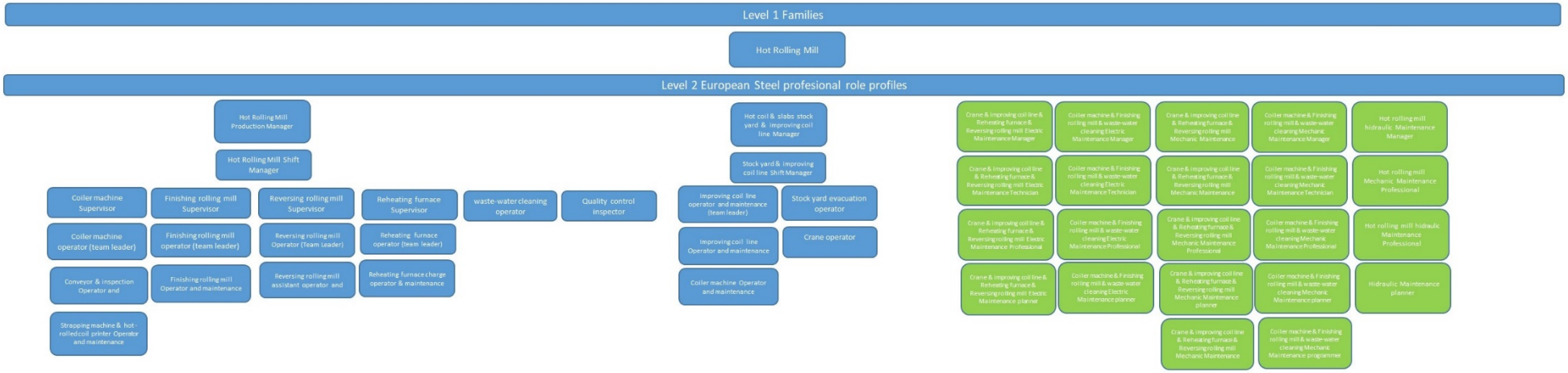
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Blast Furnaces Family at the downstream of the European STEEL SECTOR Profile Family Tree



European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Steelworks Family at the downstream of the European STEEL SECTOR Profile Family Tree

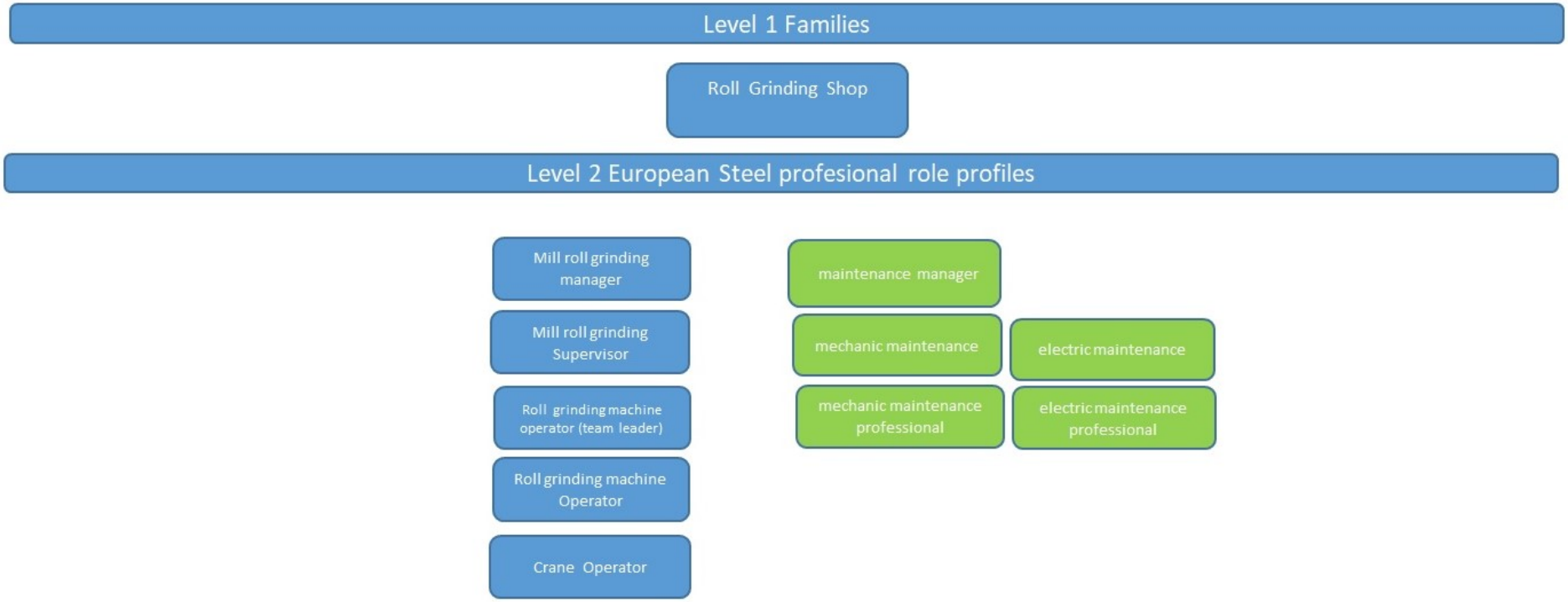


European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Hot Rolling Mill Family at the downstream of the European STEEL SECTOR Profile Family Tree



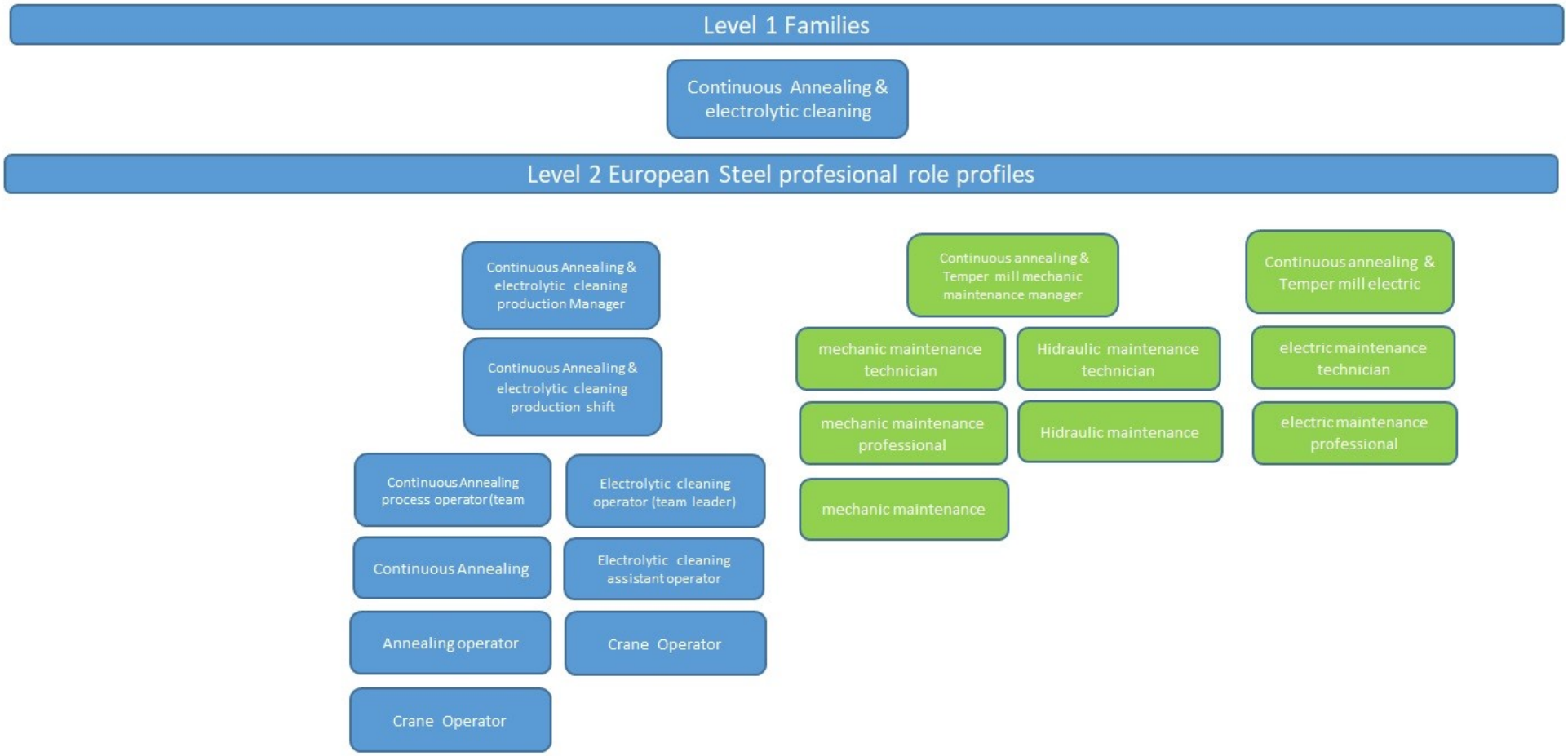
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Pickling Line Family at the downstream of the European STEEL SECTOR Profile Family Tree

European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Roll Grinding Shop Family at the downstream of the European STEEL SECTOR Profile Family Tree

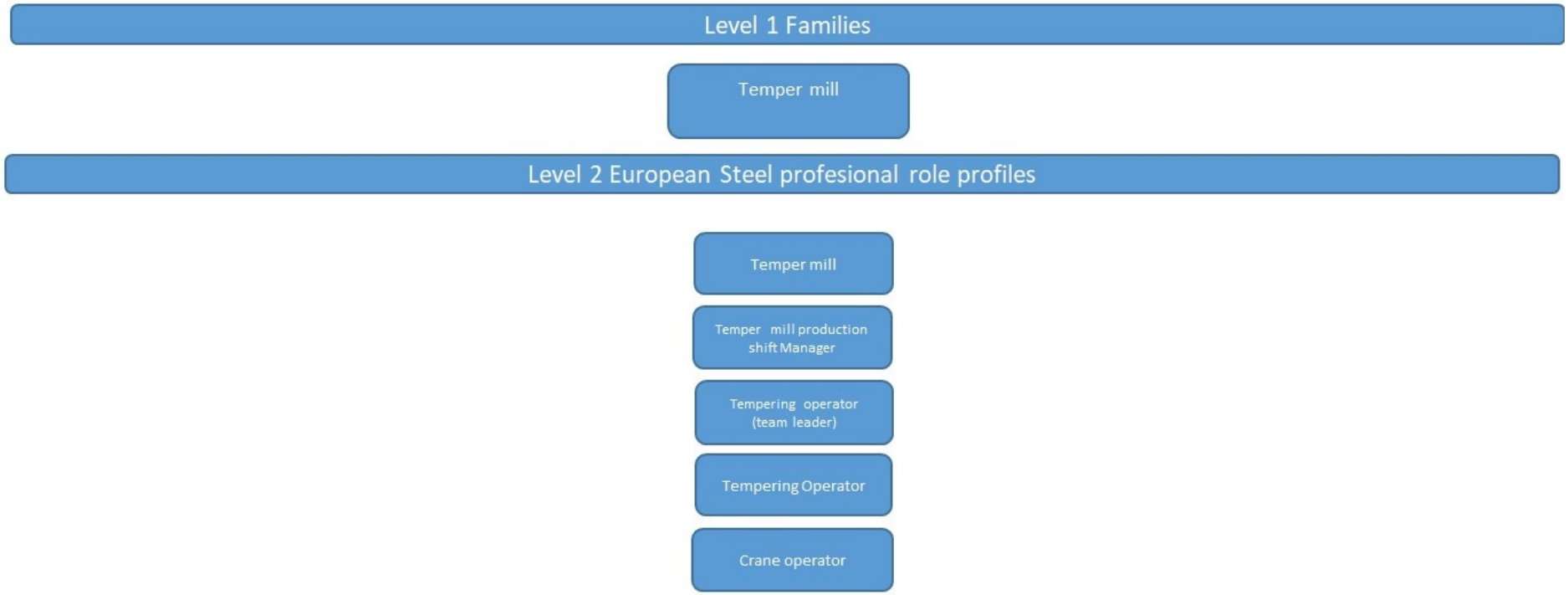


European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Tandem Mills Family at the downstream of the European STEEL SECTOR Profile Family Tree

European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Continuous Annealing and electrolytic Cleaning Family at the downstream of the European STEEL SECTOR Profile Family Tree

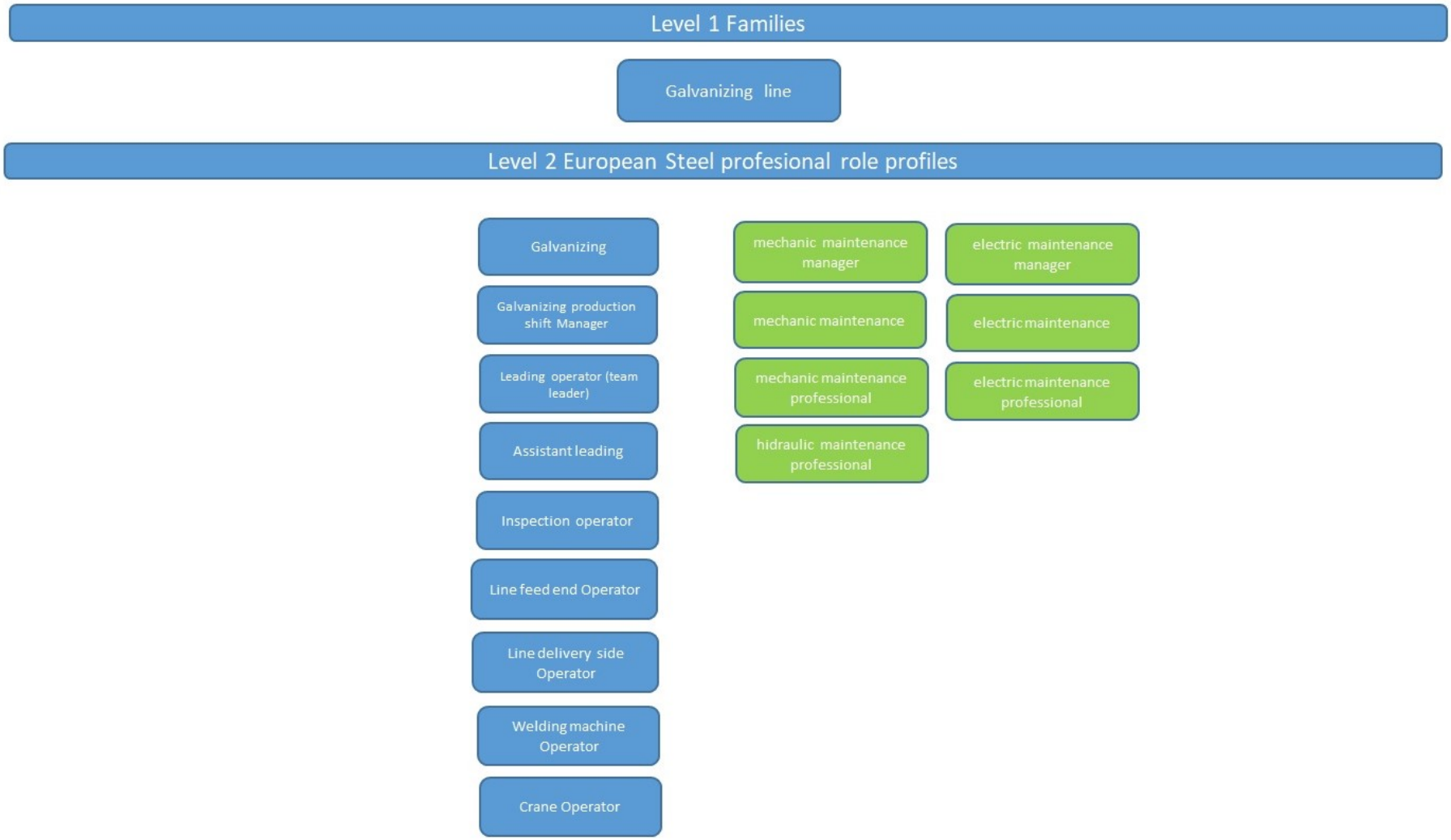


European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Temper Mill Family at the downstream of the European STEEL SECTOR Profile Family Tree

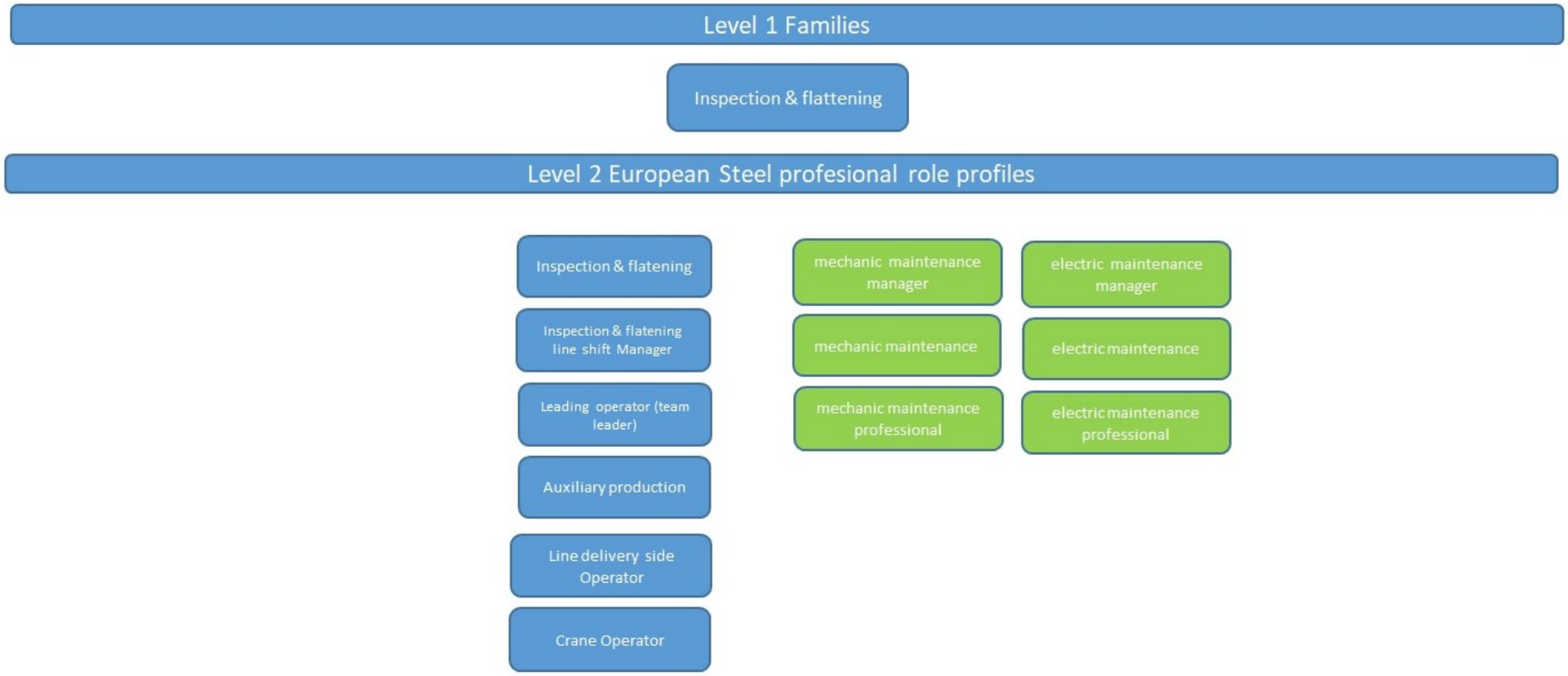


European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Tin Plate Line Family at the downstream of the European STEEL SECTOR Profile Family Tree

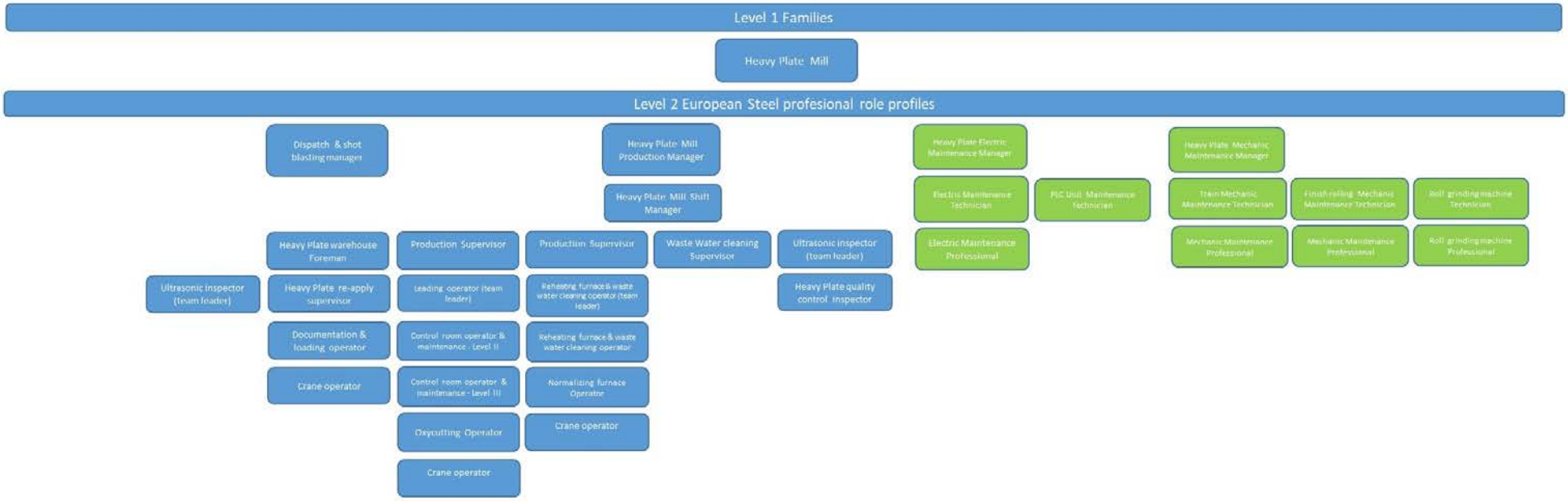
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Galvanizing Line Family at the downstream of the European STEEL SECTOR Profile Family Tree



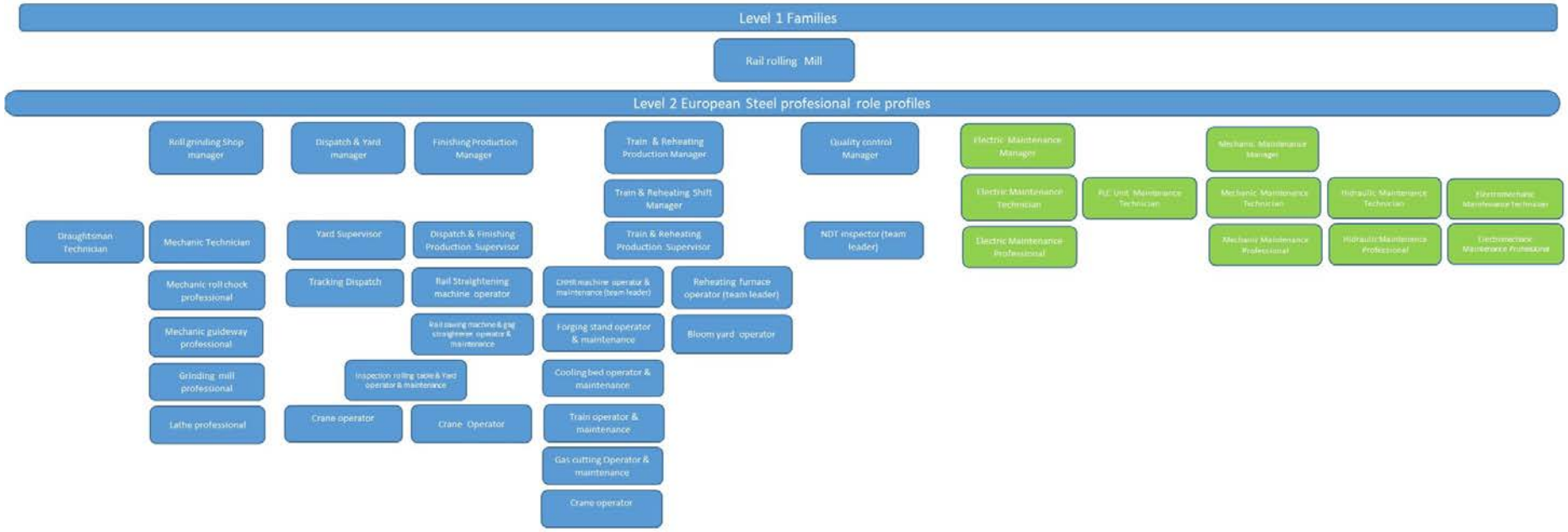
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Inspection and Flattening Family at the downstream of the European STEEL SECTOR Profile Family Tree



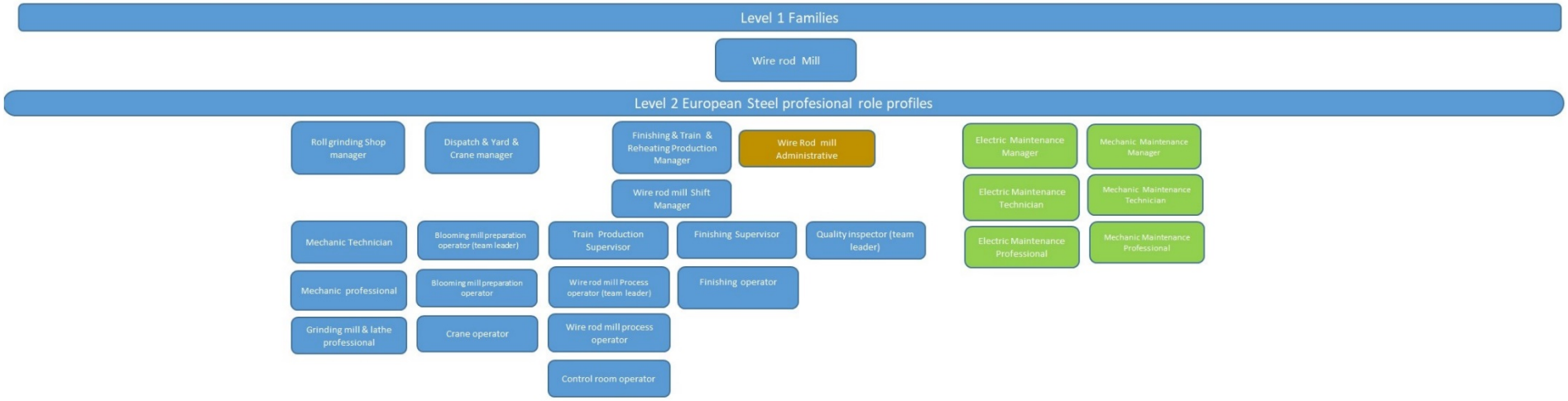
European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Heavy Plate Mill Family at the downstream of the European STEEL SECTOR Profile Family Tree



European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Rail Rolling Mill Family at the downstream of the European STEEL SECTOR Profile Family Tree

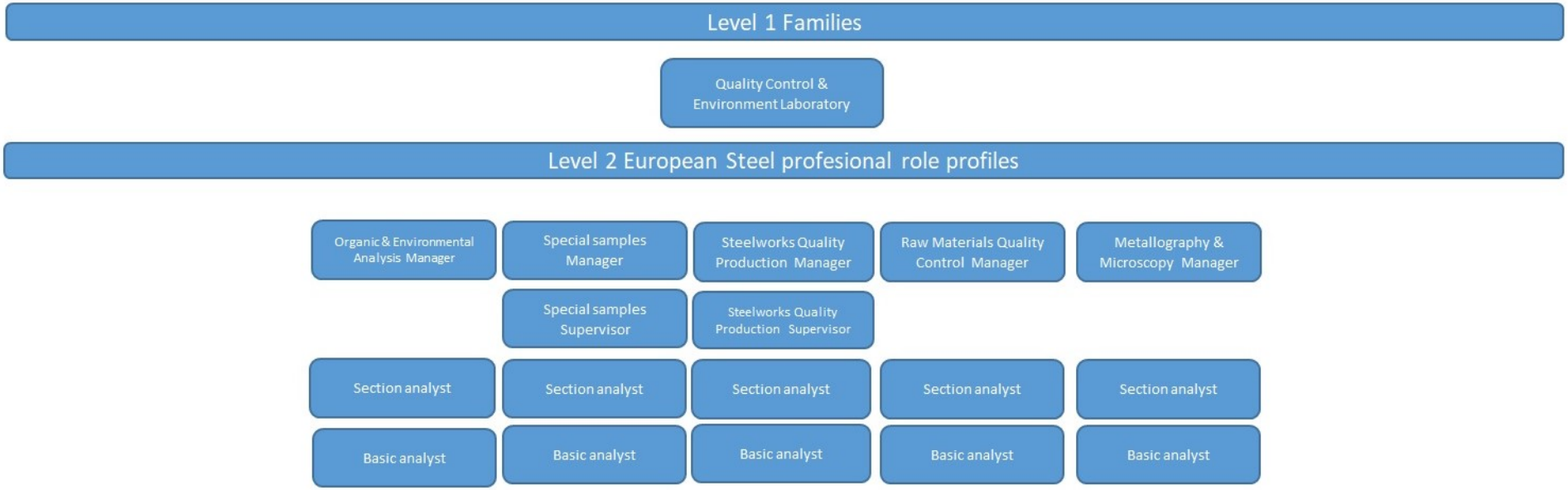


European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Wire Rod Mill Family at the downstream of the European STEEL SECTOR Profile Family Tree



European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Central Maintenance, Warehouse and Internal Transport Family at the downstream of the European STEEL SECTOR Profile

European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Quality Control and Environment Laboratory Family at the downstream of the European STEEL SECTOR Profile Family Tree



European STEEL SECTOR Professional Role Profiles: profiles (level 2) of Electric Energy and Energetic Fluids Internal Control Family at the downstream of the European STEEL SECTOR Profile Family