WHITEPAPER

CRAFTING QUALIFICATIONS FOR THE CHALLENGES OF ADDITIVE MANUFACTURING

EWF

EUROPEAN FEDERATION FOR
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01 Crafting Qualifications for the challenges of Additive Manufacturing

"When you change the way you look at things, the things you look at change" - Max Planck

Europe has been, since the beginning of the Industrial Revolution, a leader on manufacturing. Even as profound transformations swept through the industry to generate periods of big growth, Europe has managed to keep its relevance as new technologies replace older ones. From the steam engine in the middle of the 19th century to the mass-production model at the beginning of the 20th century and the first automation wave in the 1970s, each of these manufacturing revolutions has resulted in a significant productivity improvement.

Yet, the ensuing developments couldn't bring the expected gains in productivity. From manufacturing relocation for lower costs to investments in specialization, no new development has proven to be the silver bullet that generates a growth boost. That was the status of manufacturing, ripe for change, when a few new technologies came of age and became the foundation of what is now commonly called Industry 4.0.

Developments in previously disjointed fields such as artificial intelligence and machine learning, robotics, nanotechnology, 3D printing, genetics and biotechnology are all building on and amplifying one another. It is expected that smart systems—homes, factories, farms, grids or entire cities—will drive the response to problems ranging from supply chain management to climate change. It is more than just a technology initiative. It's the future of manufacturing as we know it.

> We failed at reinventing the manufacturing space, and large technological innovations have played away from it. But what if we could combine those forces? What if the existing manufacturing and large technological innovation came together to create the next big manufacturing reinvention? This is the fourth industrial revolution and it is happening right now.
>
> *Oliver Scalabre, partner Boston Consulting Group Paris, author, "The Next Manufacturing revolution is here"* [1]

The goal is the **"smart factory," with cyber-physical systems capable of autonomously exchanging information, triggering actions, and controlling each other independently.** This facilitates fundamental improvements in the industrial processes involved in manufacturing, engineering, material usage, asset performance and management, as well as supply chain and lifecycle management.

The challenges manufacturers face range from changing customer preferences, cost and capital pressures, shorter product lifecycles, new sources of disruptive competition and a quickening pace of business and demand. They are reinventing their operating and business models to focus on value-added services, and/or entering new geographic markets or adjacent market segments.

As an example of the challenges that lie ahead for companies, **currently, only 8 percent of the tasks developed on factories are automated,** the less complex and more repetitive ones, but this number is expected to grow to 25 percent in a 10-years' timeframe. One example of this change is Amazon, which uses robots extensively to manage its distribution processes, with over 100,000 roaming through their warehouses in close integration with their human counterparts.

BMW already uses 3D printing for custom trim parts.

[1] https://www.ted.com/talks/olivier_scalabre_the_next_manufacturing_revolution_is_here/transcript

Companies need to adapt fast in order to take advantage of this new world. To better assess organizations and leader's readiness to embrace this revolution, Deloitte runs a yearly survey of C-level Executives to understand how leaders are ready to harness the full potential of industry 4.0 to the benefit of their customers, their people, their organization, their community and societies overall. The second report has been issued early in 2019. **Its results show that the number of respondents that believed they were doing all in their power to prepare their workforce for Industry 4.0 fell by nearly half, compared to the 84% of the previous year.**

These results put the spotlight on the fact that many executives are gaining a much deeper understanding of Industry 4.0 and their challenges, by realizing that they have a long path ahead of them and that they need to speed up. **The research also positively highlights that close to twice as many executives refer that they would rather retrain existing workforce than hire new professionals.**

02

Ensuring manufacturing long-term presence as part of Europe's economic fabric

European companies and research institutions continue to play a key role in industries ranging from transportation to energy, from high-tech textiles to aerospace. In order to ensure its continued relevance on the new, thriving industries, a strategic investment has been made in emerging technologies, such as digitization, biotech, nanotechnology and 3D printing, which are part of the transformation sweeping through all industries. As it stands currently, the European Union is the world's biggest exporter of manufactured goods and is a global market leader for high-quality products. In 2017 industrial machinery and transport equipment represented 42% of total exports, other manufactured products 23.9%, chemicals 17.6% and food, drinks and tobacco 7.5%[2].

The importance of manufacturing cannot be overstated as a key pillar of European relevance on global markets. Manufactured goods represent 83% of EU exports, presenting a trade surplus of 233 billion euro in 2017[1] and contributing immensely to the overall trade balance of the European Union (23 billion euro in the same period), compensating for the great imports of necessary primary goods such as energy[3]. And Europe continues to be the largest exporter of manufactured goods, with an export value of €4.67 trillion in 2017 (a 9% increase). Also, its share of world exports of manufactured goods was almost 39%[4].

The trends, however, point to some risks that require both scrutiny and decisive action. The factors driving the change in Europe include among other factors, a deindustrialization in the continent, a faster growth in other geographies and the effects of globalization and distributed supply chains.

[2]Eurostat, Statistics Explained, Extra-EU trade in manufactured goods, Data from April 2018. *http://ec.europa.eu/eurostat/statisticsexplained/*

[3]Eurostat, Statistics Explained, International trade in goods, Data from September 2017 and March 2018. *http://ec.europa.eu/eurostat/statisticsexplained/.*

[4]World Trade Organization – World Trade Statistical Review *https://www.wto.org/english/res_e/statis_e/wts2018_e/wts2018chapter04_e.pdf*

Given the diverse development stages in different regions, a more realistic analysis places this evolution in context by comparing it with other developed geographies, such as the United States, which have grown more rapidly. Between 2000 and 2014, the added value generated in Europe increased 20.6%, while the growth in the US was 34%.

The EU program Horizon 2020 recognized the central importance of the industry by creating jobs and growth and by mainstreaming industry-related competitiveness concerns across all policy areas. This was the key message ***"For a European Industrial Renaissance",*** adopted in 2014 with the aim of reaching a 20% target of industry's share in Europe's GDP by 2020.
Horizon Europe, the EU Program for 2021 to 2027 continues to highlight the importance of industrial development by identifying ***"Digital and Industry"*** as one of its five clusters. This cluster will focus on emerging industrial technologies, and the intersection of digital and industrial capabilities. The proposal says that: ***"EU industry provides one out of five jobs and two thirds of private sector R&D investments and generates 80% of EU exports."***

Still, the sector only represents 14.2% of the total European workforce and 26% of the added value of the EU-28 non-financial business economy. As underlined under the renewed EU Industrial Policy, a prosperous Europe needs a successful industry with a strong manufacturing base, which requires modernisation, embracing digitisation and technological change, integrated products and services, development of less polluting and less energy-intensive technologies, reduction of waste and investment in a workforce with the right skills.
To achieve this, means strong investments in Research and Development (R&D), Innovation and Education are needed, with priorities being set on digital transformation and the Key Enabling Technologies (KETs).

The European Union has identified these challenges and has decided to devise a long-term strategy that would ensure its competitiveness and success. ManuFUTURE Vision for 2030 proposes that Europe needs to build on its proven capabilities and invest more to ensure its leadership on:

- Key Enabling Technologies;
- Digital transformation and new business models;
- Mastering complexity of products, processes and systems;
- Resource efficiency and sustainable development;
- Resilient and adaptive manufacturing;
- Innovation ecosystem;

The aforementioned **Key Enabling Technologies** includes micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing technologies. On this paper, we will focus on the role of one of these KETs, **Additve Manufacturing, which is rapidly growing,** and on the need for a broadly accepted harmonized qualification system, specific for this KET, to ensure the future of European industrial competitiveness**.**

03 The rise of production on demand with Additive Manufacturing

Additive Manufacturing (AM) is a comprehensive name for all the technologies that build 3D objects by adding layer-upon-layer, regardless of the type of material. It includes many technologies subsets like 3D Printing, Rapid Prototyping (RP), Direct Digital Manufacturing (DDM), layered manufacturing and additive fabrication. AM application is limitless. But its development has been brewing for a few decades before becoming critical for all industries.

AM technologies first found applications in the 1980s in product development, data visualization, rapid prototyping, and specialized manufacturing. Their expansion into production (job production, mass production, and distributed manufacturing) has been maturing ever since and it is experiencing a dramatic growth. **According to the Wohlers Associates report, a reputable consultancy, the 3D Printing Industry's growth forecast for 2020 is $15.8 billion for all AM products and services worldwide.** The company expects revenue forecast to climb up to $23.9 billion in 2022, and $35.6 billion in 2024. The report highlights notable AM-related activities in many industries, including aerospace. The team collected insights from Airbus, Boeing, Honeywell Aerospace, and United Technologies Corp., to gain perspective on the use of Additive Manufacturing to produce end-use parts. These companies, along with BMW, Deutsche Bahn, Jabil, Oerlikon, UPS, the U.S. Marine Corps, and others shared emerging trends from their perspective.

Among the factors driving this strong growth of Additive Manufacturing worldwide there is a renewed focus on:

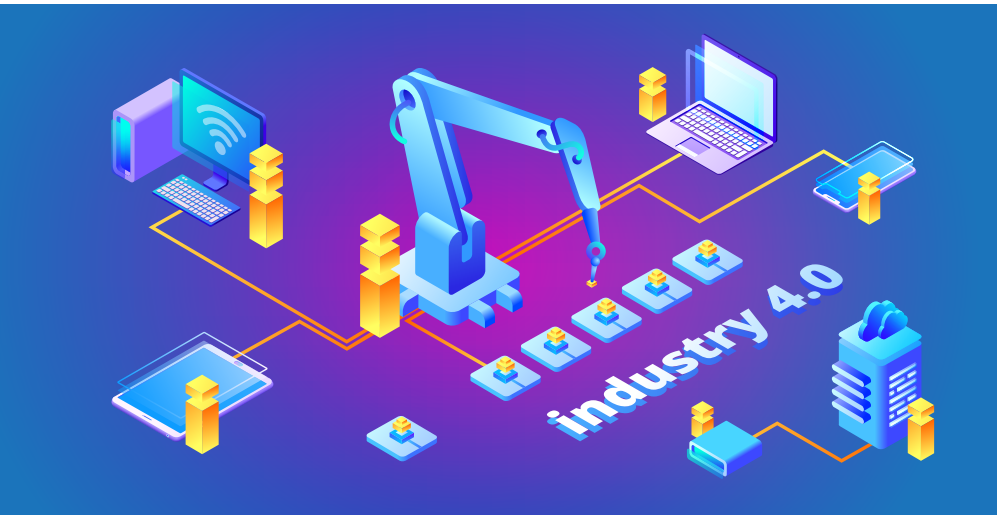
- Design for additive manufacturing (DfAM);
- Education and training;
- Post-processing and post-process automation;
- Materials diversification;
- Custom products and low-volume manufacturing;
- Partnerships and collaborations;
- Start-up companies;
- Viable supply chains;
- Data, security, and interconnectivity;
- Investment in applications;
- Corporate centres of excellence;

Another important reason for its success is the broad number of potential applications for these technologies. They range from AEC (architecture, engineering and construction), industrial design, automotive, aerospace, military, engineering, dental and medical industries, biotech (human tissue replacement), fashion, footwear, jewellery, eyewear, education, geographic information systems, food, and many other fields. So basically, every other industry can benefit from them. And the combination with cloud computing technologies allows for decentralized and geographically independent distributed production, up to a level in which people needing 3D printing can be placed in contact with owners of printers through a network.
In a distributed manufacturing scenario, a company could offer online 3D printing services to both commercial and private customers, working from 3D designs uploaded to the company's website. 3D-printed designs could be either shipped to the customer or picked up from the service provider. **This profound transformation requires a change on all factors involved, and people's qualifications are one of the critical aspects that need renewal,** as digital technologies become a critical part of the manufacturing process.

...people's qualifications are one of the critical aspects that need renewal...

The human resources dilemma

The modernisation effort that the industry is undertaking requires a comprehensive investment in a workforce with the right skills. The required change can be better perceived by the global workforce shifts that are happening in all industries. By 2030, 210 million people around the world are expected to change their occupation. The difference between this and previous industrial transitions is that this one is the broadest in scope. Even where people are still doing very traditional and (apparently) immutable tasks, they now have a mobile phone in their hands which, even if seemingly insignificant, implies a profound change, that creates huge opportunities, amongst others, for financial services.



The fourth industrial revolution, as stated in Professors' Ian Goldin and Chris Cutarna book Age of Discovery, **represents a new renaissance**, with striking similarities but acute differences. Like the first renaissance, **it implies a broad access to knowledge,** which is no longer confined to books, but easily accessible to everyone. It is also faster and it is not narrowed to an industry, but broader in scope. No sector is left unchallenged and manufacturing is no exception, with companies quickly merging into both digital and manufacturing centres, creating new challenges and opportunities. **Existing skills and competences are quickly becoming obsolete,** as this change requires new ones from professionals in all areas. As in any great transformation, there are huge job opportunities to be leveraged for those willing to learn and adapt.

According to Prof. Goldin, the current requirements of deep expertise and broad knowledge will mean an increase in specialisation since the amount of knowledge is growing all the time. The answer to this challenge might be to achieve a T- shape in an individual's knowledge structure – combining very deep learning, with a very broad set of interests and abilities.

The **World Economic Forum report on the Future of Jobs** highlights the importance of 3D printing, resource-efficient sustainable production and robotics, which are all seen as strong drivers of employment, in light of a continued and fast-growing need for skilled technicians and specialists to create and manage advanced and automated production systems. The result of this change is a transformation of manufacturing into a highly sophisticated sector where high-skilled professionals are in strong demand.

The effects of Industry 4.0 on the workforce can be felt on the following areas[5]:

Big-Data-Driven Quality Control

Algorihtms based on historical data identify quality issues and reduce product failures.

Predictive Maintenance

Remote monitoring of equipment permits repair prior to breakdown.

Robot-Assisted Production

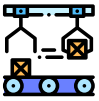
Flexible, humanoid robots perform other operations such as assembly and packaging.

Machines As a Service

Manufacturers sell a service, including maintenance, rather than a machine.

Self-Driven Logistics Vehicles

Fully automated transportation systems navigate intelligently within the factory.



Self-Organizing Production

Automatically coordinated machines optimize their utilization and output.

Production Line Simulation

Novel software enables assembly line simulation and optimization.

Additive Manufacturing of Complex Parts

3-D printers create complex parts in one step, making assembly redundant.

Smart Supply Network

Monitoring of an entire supply network allows for better supply decisions.

Augmented Work, Maintenance and Service

Fourth dimension facilitates operating guidance, remote assistance and documentation.

[5] https://www.bcg.com/industries/engineered-products-infrastructure/man-machine-industry-4.0.aspx

Where does Europe stand currently in terms of digital skills?

The European Union Digital Transformation Scoreboard findings demonstrate that integrating digital solutions has mostly enabled technology adopters to either keep their employee numbers stable or increase them. Overall, the job creation rate rose from 10% last year to 21%, while the rate of employee numbers remaining stable or increasing rose from 54% to 66%. This should lessen the fear of jobs being lost because of digital transformation. Essentially, the shift in existing job definitions and the emergence of new skill sets require continuous up/reskilling to meet the needs of the evolving digital economy.

According to the DTS findings, 57% of the companies surveyed believe that they have the necessary skills to adopt new digital technologies, while the remaining 43% are either unaware or lacking the necessary skill set for digital transformation.

Individuals must engage in life-long learning not only to remain employable but also to achieve fulfilling and rewarding careers. Likewise, **employers should** not solely rely on new workers with the right ready-made skills but **invest on workforce up/reskilling as a beneficial investment even in the absence of skills shortages**. For policy makers, fostering continuous reskilling and lifelong learning across the economy is quite critical in order to maintain a labour force equipped with the right skills needed to boost a sustainable, smart and inclusive economic growth.

In order to respond to these changes, traditional Education and Vocational Education as well as Training systems must cope with the demand for new curriculums and methodologies to address the need to get the workforce up-to-speed with new business requirements and technologies being deployed, including the ability to cope and adapt to change. The broadest possible recognition of the assimilated knowledge is a critical component of this reality. **Qualifications also need to be harmonized** so that they can be broadly accepted, regardless of the location where the training is held, reducing overhead for companies who want to find the best professionals to meet their needs as quickly as possible.

04

EWF Harmonized Qualification System | A Qualification System to build upon

As economies become increasingly open and companies operate complex value chains of vast geographic scope, they pose new challenges for knowledge acquisition, forcing traditional learning methods to adapt and evolve. To make knowledge acquisition and recognition more effective, a connection between its two existing pillars is needed. These systems, which are the traditional education system learned at Universities and the technical training given for specific jobs, are currently not connected, implying that a qualified technician will not have its qualifications recognised in the traditional education system, hindering the industry's growth by slowing the adoption of newer technologies and creating unnecessary barriers to the improvement of the workforce's qualification.

Also, learning profiles are quickly evolving, and the issues faced by professionals and companies alike range from the need to quickly adapt, streamline retraining and reskilling, and, lastly, to integrate modularity on existing qualification systems. To respond to these challenges through the development of national qualification systems is highly time-consuming, meaning that the industry struggles to access the right professionals and the right time. Providing international harmonized qualifications is another key enabler to ensure that organizations can work consistently in any location and can leverage the best resources for optimal results, regardless of their current location.

This is felt across several, not to say all, manufacturing technologies. As an example, in Welding Technologies this need has been felt by the industry. **Not only are welding technologies more sophisticated and advanced but also welding processes frequently require professionals with the ability to assemble products coming from diverse locations (that must abide by the same standards of production quality). Additionally, workers are required to be highly knowledgeable about materials and their characteristics, as well as on how to operate complex tools and machinery, where digital is tightly interwoven into the processes.**

With new technologies like Adhesive Bonding and Metal Additive Manufacturing gaining relevance in Manufacturing, it is also possible to see that there will be more requirements on the Professionals that use and implement these technologies.

To address these challenges, **Welding organizations from different EU countries came together and created the European Federation for Welding, Joining and Cutting, widely know as European Welding Federation - EWF. A**

process that started in 1992 with the harmonisation of content on education and the implementation in terms of the courses' syllabus and hours of training allocated to each module, and it is still being implemented to ensure the needs of the industry are addressed.
From the start, one key issue was the need for recognition, ensuring that all involved stakeholders were engaged in its development and embraced the new qualifications. The other issue that needed to be addressed was the harmonisatrion of the implementation of the Training and Qualification System. To meet this requirement, EWF has developed a quality system compliant with ISO/IEC 17024, ensuring that the resulting qualifications have the same uncompromised quality, regardless of the country where the course was taken.

The uniqueness of EWF's system relies on its ability to leverage a single syllabus for each level of Qualifications, an harmonised system for examinations and a Quality Assurance System, **resulting in the same qualification being awarded by any of the 683 Authorised Training Bodies (ATBs) in 46 countries where the system is currently in use.**

The cornerstones underlying the long-term vision and strategy of EWF are the following:

- To ensure that the training and qualification System is updated to comply with technical innovation and industrial demand;
- To develop new qualifications in line with technological and industrial advances;
- To provide a pathway for continuous professional development for professionals in manufacturing;
- To ensure the quality of EWF's diplomas, by running a rigorous quality assurance system worldwide.

EWF's work has not only focused on creating new Qualifications but also in ensuring that the Qualifications developed answer the needs of the industry. One example is the use of **modular training to give companies and professionals more flexibility when choosing their own qualification path.** The modular approach addresses **workforce mobility, life-long learning requirements and flexible pathways for continuous professional development,** all of which are basic requirements for today's and future professionals. It allows professionals to pick and choose the most appropriate qualifications to achieve the required certification, thus enabling further flexibility of the workforce in response to the industry's changing requirements.

A modular curriculum offers students more flexibility and variety than traditional forms of curricular organisation, empowering them to manage their training needs as they progress. It also allows students to choose the path and modules that fit their professional needs and ambitions.

As part of this push to bring training and learning methodologies up to the current standards for digital natives, EWF and its members are looking at the development of innovative ICT training solutions potentially including Welding Simulators, Game Based Learning, and Serious Gaming. These are new and innovative teaching methods that allow learners to playfully explore different parts of a scenario.

In summary, the uniqueness of EWF's harmonized qualification and quality systems create a swift pathway for the recognition of qualifications in countries that are already engaged with the system. Currently, this ecosystem comprises 46 countries, 44 ANBs (Authorized Nominated Bodies) and 683 ATBs (Authorised Training Bodies). The network also includes 55,000 companies worldwide. The Authorised Training Bodies are approved and supervised by the ANBs to deploy and teach the EWF Qualification courses, combining both supporting knowledge and application experience, in a close relation with industry and their needs.

05 Additive Manufacturing Qualifications by EWF | Designed in Europe with a global focus

The exponential growth in additive manufacturing and the evolving nature of these technologies mean that the need for professionals capable of dealing with them is increasing. This puts pressure on all relevant stakeholders to provide a qualification system for the industry that is capable of developing professionals with the required skillset. **EWF has effectively built upon its expertise in the development of advanced harmonized qualifications to launch an International Qualification System in Additive Manufacturing,** which puts it in a leading position to reduce the hurdle of skills recognition and to provide the reliability of the awarded diploma at an International level.

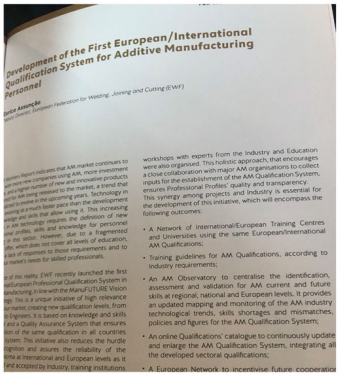
These qualifications are a result of the cooperative work between EWF and experts representing both industry and education (e.g. training centres, universities, and research organisations), that agreed on the technical and pedagogical structure of the qualifications needed for current and future professionals in metal additive manufacturing. The collaboration of EWF with different organisations, supported by several European projects, has been crucial to enhance the rapid implementation of the first International Qualification System for Additive Manufacturing personnel.

To ensure that the developed AM Qualifications are aligned with the industry's needs and requirements, a systematic approach involving several stakeholders has been put in place to collect inputs from different sources, as demonstrated through the next figure.

EWF has conducted market researches to collect information on the market's needs and possible solutions for future workers and professionals already involved in the AM sector. It has carried out validation workshops with experts from the industry and the educational system, and developed Qualification pathways for the levels of Operators and Engineers. This approach ensures the quality and transparency of the Professional Profiles in AM.

The **EWF AM Qualification System follows a modular structure**, which enables a more flexible and tailormade training (Modular and Cumulative System), as well as an easier integration of International Qualifications in National Qualifications Curriculum.

The World Manufacturing Forum has selected the EWF Qualification System in Additive Manufacturing as a case study to include in the Report, **"Skills for the Future of Manufacturing"**

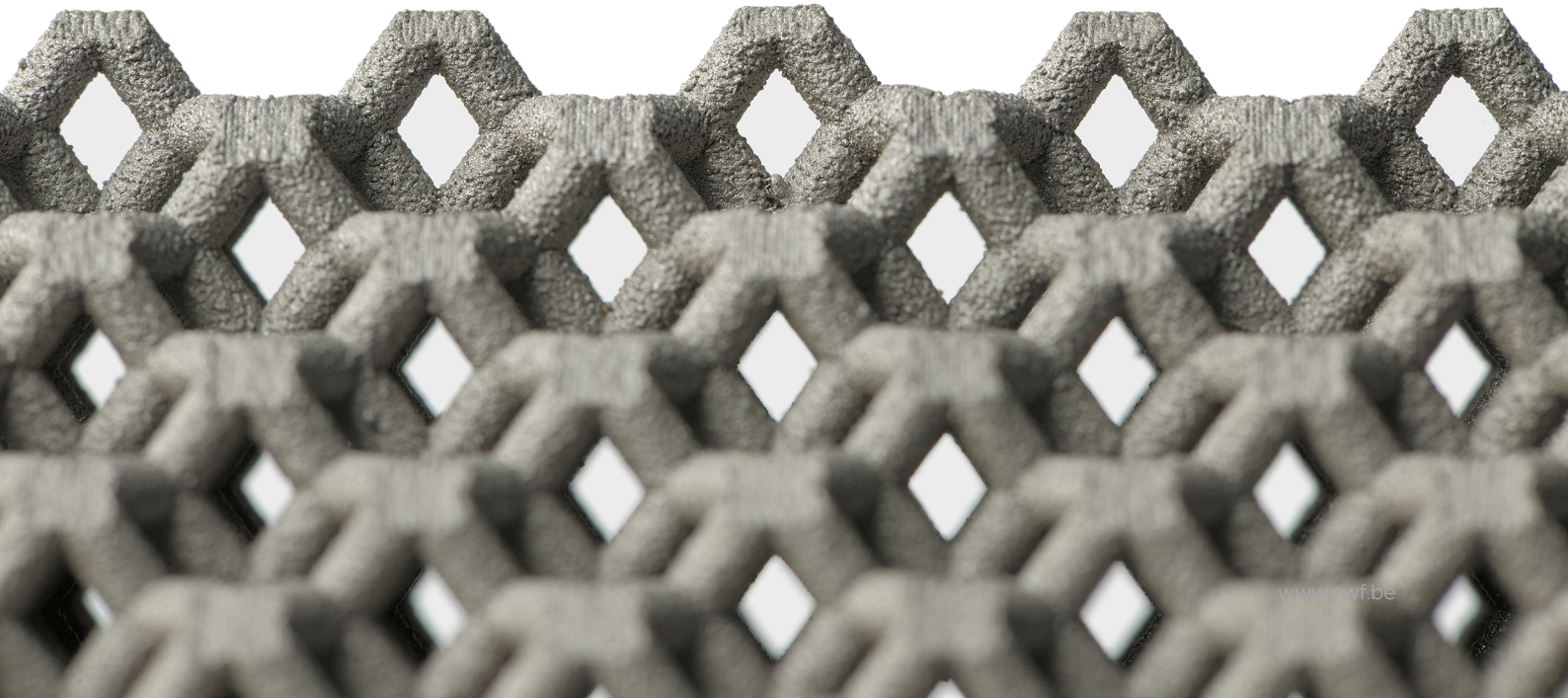


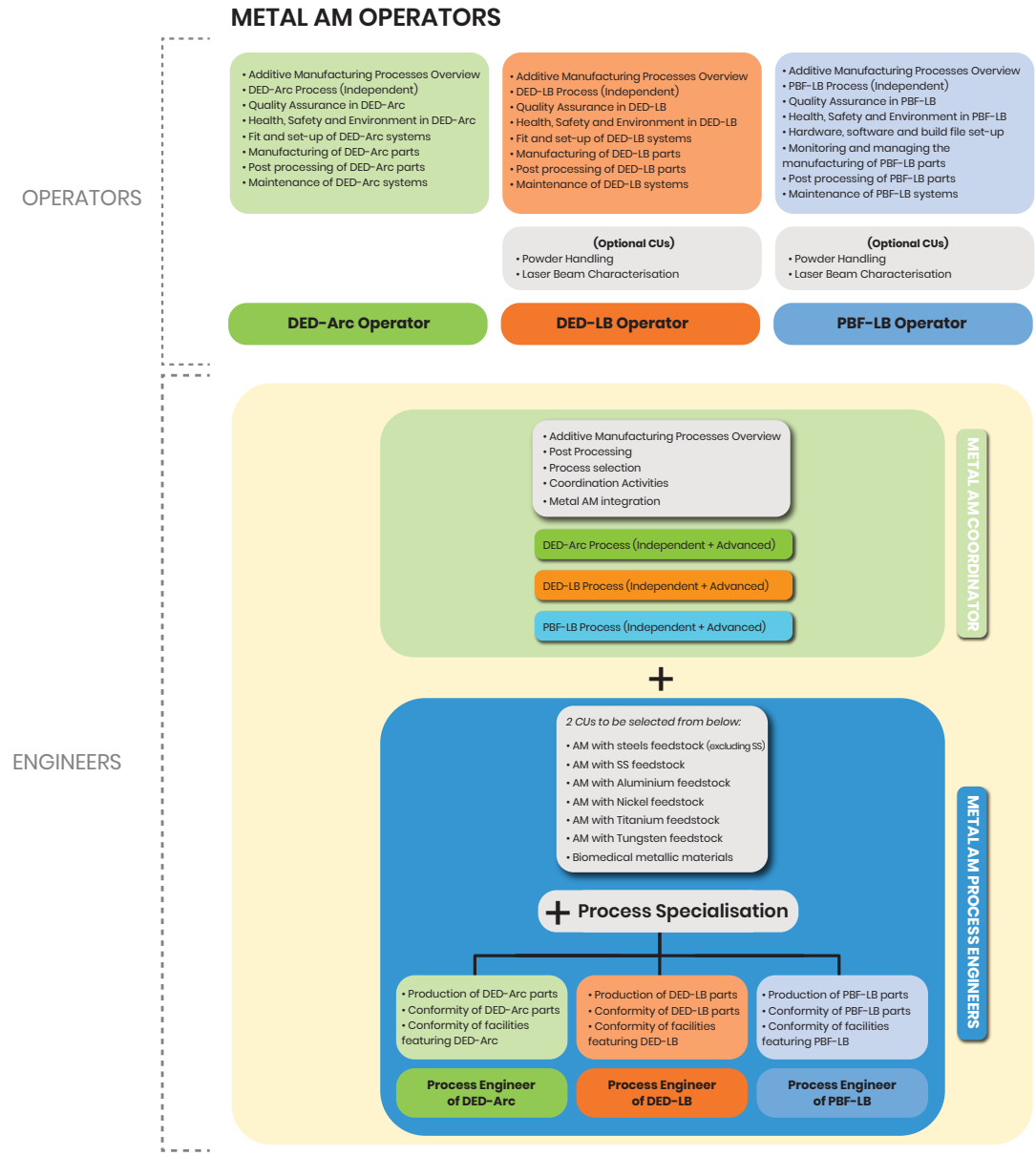
EWF currently offers 6 Qualifications in Metal AM: 3 at the Operator level and 3 at Engineering level.
The first countries offering these qualifications are Italy, Germany, France, UK, Portugal and Spain, and the first course for Laser Powder Bed Fusion (LPBF) operator took place in **Italy in May 2019**.

The 2019 **EWF AM Qualification System** includes 4 processes related to Professional Profiles in either **Operator** or **Engineer levels**.

Moreover, the **EWF Qualifications framework** also includes a process for an independent Engineer, called the Metal AM Coordinator. The key differences between the Metal AM Coordinator and Metal AM Process Engineer lays in the additional Materials and Process specific Competence Units (CUs) the latter must fulfil.

The framework depicted on the next page shows a comprehensive summary of the Metal AM Qualifications, as well as the respective Competence Units/Modules.





- European / International Powder Bed Fusion – Laser Beam Personnel Qualifications:
  European / International Operator - E/IO PBF-LB
  European / International Process Engineer - E/IPE PBF-LB
- European / International Powder Bed Fusion – Electron Beam Personnel Qualifications:
  European / International Operator - E/IO PBF-EB
  European / International Process Engineer - E/IPE PBF-EB
- European / International Directed Energy Deposition – Arc Personnel Qualifications:
  European / International Operator - E/IO DED-Arc
  European / International Process Engineer - E/IPE DED-Arc
- European / International Directed Energy Deposition – Laser Beam Personnel Qualifications:
  European / International Operator - E/IO DED-LB
  European / International Process Engineer - E/IPE DED-LB
- European / International Process Independent Personnel Qualifications:
  European / International Metal AM Coordinator- E/I MAMC

06

The brave new world of the Additive Manufacturing qualification system

EWF and its partners are not resting on their laurels and are actively developing novel qualification profiles that meet existing and future industry requirements. In addition to the aforementioned profiles, EWF is currently working towards the development of the **professional profiles for Metal AM Designer, AM Inspector and Operators on other technologies.** And more will follow in the near future, to ensure that all Qualifications required by the AM industry are available.

That is why the harmonised AM Qualification System is based on a **continuous search for innovative methods to improve AM personnel training and qualification** and the continuous update of the EWF qualification system, intercepting the needs, contents and paths for the new professional figures required by the international industrial world.

The main European Funded Projects supportive and involved in this activity are:

SAM - Sector Skills Strategy in Additive Manufacturing

The aim of this project is to address the critical issue of workforce development for Additive Manufacturing (AM) by developing a shared skills vision and collaborative learning solutions for the sector at European levelFor more information regarding the project please visit:
www.skills4am.eu

CLLAIM - Creating Knowledge and Skills in Additive Manufacturing

CLLAIM project addresses the current qualifications shortcomings for Additive Manufacturing implementation in industry and proposes actions to overcome these. For more information regarding the project please visit:
www.cllaimprojectam.eu

ADMIRE - Knowledge Alliance for Additive Manufacturing between Industry and Universities

Admire intends to respond to the industrial need for qualification of the Additive Manufacturing workforce. Together, universities, companies and students will design a Metal AM Master's degree according to level 7 of the European Qualification Framework.For more information regarding the project please visit: www.admireproject.eu

In collaboration with several project partners, industry and other organizations, **EWF is collecting different inputs that will contribute to create and implement the International AM Qualification System.**
EWF aims to reach the following milestones:

- Create a Network of International Training Centres and Universities using the same AM Qualifications;
- Ensure alignment between industrial needs, including standards, and the developed AM Qualifications
- Develop and implement Training guidelines of the AM Qualification System, according to the requirements of the industry.
- Assure the International implementation is supported by EWF's Quality Assurance System rules and operating procedures, critical in ensuring harmonization and quality in the delivery of the AM Qualifications;
- Create an AM Observatory, a centralised unit for the identification, assessment and validation of AM's current and future skills at regional, national and European levels. This Observatory in Additive Manufacturing will provide an updated mapping and monitoring of the AM's industry technological trends, skills shortages and mismatches, policies and figures for the AM Qualification System;
- Develop an online Qualification's catalogue to continuously update and enlarge the European AM Qualification System, integrating all the developed (and to be developed) sectoral qualifications;
- Implement the guidance from the European Qualifications Framework (EQF) levels, boosting the recognition and transfer of credits by applying European Credit System for Vocational Education and Training (ECVET) methodology and tools;
- Enhance skills and competences of trainers in the field of AM by promoting exchange of successful pedagogical methods and practices between teachers and trainers from VET and High Education;
- Develop a European Network to encourage future cooperation and mobility in the field of education and work;

07 Conclusion

Additive Manufacturing is entering fast into the mainstream, as its usage scenarios have expanded and grown in scope and sophistication. It is already redefining many industries, and it has the potential to disrupt traditional business models and value chains, creating new opportunities for companies willing to invest in this brave new world of customized, on-demand, manufacturing. To ensure that it meets its growth potential, it is crucial to have professionals capable of dealing and operating in Additive Manufacturing. That is why international harmonized qualifications developed with the industry and all relevant stakeholders by a reputable organization are fundamental to its broad utilization and, as a result, for the fast development of this new market. EWF is doing just that through its network of partners, providing access to a diploma that is broadly accepted by the industry and that complies with the relevant standards, all working together to **fulfill the vision of a renewed and competitive manufacturing sector at the heart of Europe.**

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