



REDEFINING SKILLS FOR A RESILIENT MANUFACTURING SECTOR

EWF

WHITE PAPER

2022

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Preamble

The coronavirus pandemic that unfolded in 2020 and which is still yet to be fully under control, has had dramatic impacts in every aspect of our daily lives, from the way we work to the way we interact socially and to how organizations are structured. Some of its impacts are yet to be fully grasped, as several new studies provide further evidence of significant changes, ranging from its impact on our health to the way we learn and to how companies have been required to redefine their work model.

On the latter, and analysing one specific sector, it also has exposed weak links on manufacturing companies worldwide. The extensive and complex supply chains of many companies have been compromised and even disrupted, with the closure of a small components factory somewhere in the globe having a trickle effect by risking the production cycle of companies, large and small, worldwide.

Overall, these changes can be felt on new work processes being deployed or having to be entirely redefined, on the digitization of many manufacturers, including simple changes such as robotics and artificial intelligence (among other), on the disruption of supply chains and on the redefinition of the skillsets required to achieve this complete overhaul of the manufacturing sector, which we will address on this whitepaper.



1. Redefining the manufacturing ecosystem

The coronavirus pandemic has led to unprecedented changes in every aspect of our daily lives, both as individuals as well as companies, and manufacturing has not been an exception.

For the latter, these changes have been felt on new work processes, on the digitization of many traditional industrial processes associated with new manufacturing technologies, and on the redefinition of the skillsets required to address these changes. But its impact has also been felt on the environment front, where there was a reckoning that, despite a near complete halt of all flights, daily commutes and a reduction of economic activities on a global scale, the impact on emissions of man-made greenhouse gases has not been significant, so the way to tackle this challenge has a lot more to do with a complete overhaul of the economy rather than doing small incremental improvements.

Companies have also faced a shortage of the required materials due to the unique circumstances we are now facing, with supply chain disruptions taking place in almost all industries, forcing companies to adapt and adjust their existing processes to be more flexible and less dependent on distributed supplier's networks. Lastly, there was an impact on the way companies go about their daily business, trying to maintain production and preventing a total shutdown when some of their workers were infected which, although had its origin on the response to a very particular situation with the coronavirus, has put the spotlight on a vulnerability that was not well understood and that needed to be properly addressed by corporations.

These changes have placed an enormous burden on companies' ability to manage this extra layer of complexity when managing their teams, have exposed for many their relatively low levels both on digitization as well as on the use of advanced manufacturing technologies and highlighted the need to train, reskill, and otherwise improve their workforce's digital and advanced manufacturing skills.

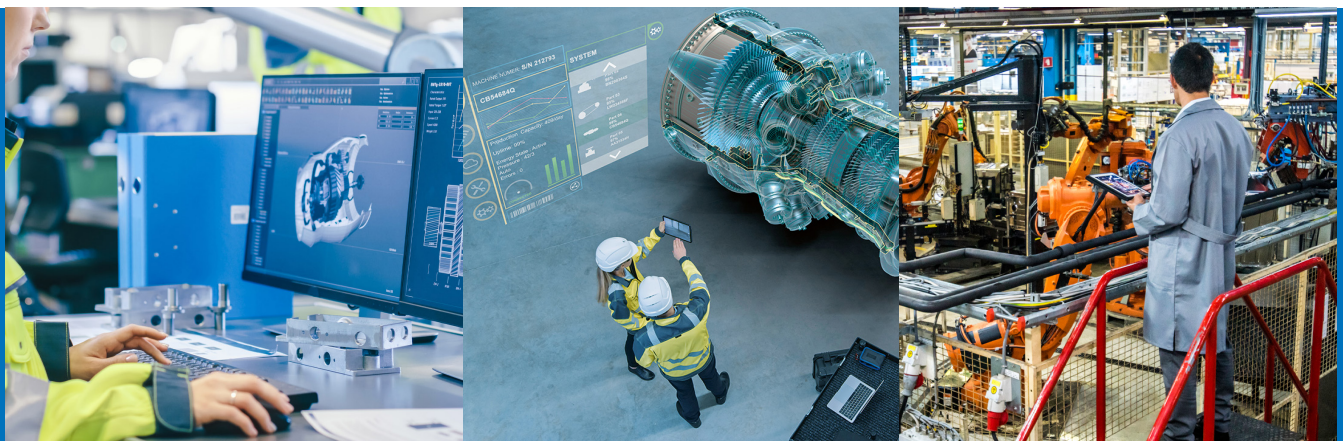
Industrial digitization has faced its biggest test, where companies across different manufacturing sectors were forced into extraordinary measures to protect their people and support operations. While some had to adapt to keep operations running in the face of shortages of workers or raw materials, others struggled to keep up with the sudden spike in demand and other had to adapt, become resilient, and change their normal operation and products to ensure they were addressing the evolving market needs. This was a rude awakening for those that were late entrants on the deployment of Industry 4.0 technologies.

The core learning is that digital transformation, beyond being a driver of productivity, can bring manufacturing resilience to organizations, aligning industry 4.0 and ESG Goals (Environmental, Social and Governance). To achieve it, organizations must improve their operational efficiency, leverage renewable energy, practice lifecycle thinking, and promote supply chain data transparency. On the first pillar of this strategy, operational efficiency, and according to the *World Energy Outlook 2019 – Analysis - IEA*, “a sharp pick-up in efficiency improvements is the single most important element that brings the world towards the *Sustainable Development Scenario*”.

Another example of a critical change on the way manufacturing companies look at their footprint, is related to the need to have a comprehensive vision of the lifecycle of a product means that the whole process, from extraction of the basic materials to the production process and to the way the products are either recycled or disposed, is analysed to minimize its impact. Again, these major shifts on manufacturing require a more qualified and flexible workforce, capable of handling the increased complexity of their daily routine tasks. On the other hand, companies require digital tools and data to help them expedite their processes and products Qualification and Certification which, in turn, drives them further towards becoming “digital companies”, more flexible and respondent.

The industry is quite aware of this need to adapt and make strong digital investments to address the ongoing challenges of managing through unknown disruptions. Areas of investment can include adding sensors and machine learning to production lines to predict, prevent, and even prescriptively fix problems before they occur. New concepts like Digital twin technologies can help prepare manufacturers for the next disruptive event. According to Deloitte’s annual report 2021 manufacturing industry outlook, a post election poll of manufacturing executives identified that 24% executives who plan to invest in digital technologies believe digital twin technology will be the most important technology in which their company will invest in 2021 (tied for first with augmented workforce efficiencies).

In its simplest form, a digital twin is a representation, or blueprint, of a physical thing. That thing could be a single product or a component. It could also be a production process or even the physical production environment. Using a digital twin, a manufacturer can virtually recreate a product, its production, and even simulate its performance in the real world without having to “bend metal” or take any other physical action. Change is disrupting manufacturing’s traditional strengths, and adaptation and anticipation are a key component of the new corporate lexicon.



2. Redefining skills

“Great companies don’t hire skilled people and motivate them, they hire already motivated people and inspire them”

Simon Sinek, author, “Start with why”

For the European Union, the need to fully embrace digital transformation has been preeminent on all stakeholders’ agenda and has led to the launch of the Digital Decade policy programme . It aims to ensure that the European Union achieves its objectives and targets towards a digital transformation of society and economy in line with the EU’s values, reinforcing its digital leadership and promoting human-centred, inclusive and sustainable digital policies empowering citizens and businesses. The objective is to deliver the EU’s digital transformation in line with this vision by establishing a clear, structured and collaborative process to achieve such result. It is based on a Compass with four cardinal points: digital skills, digital infrastructure, digital business, and digital public services.

As the Commission has stated, and has already been felt in many countries, in the world of tomorrow, digital skills, basic and advanced, will be essential to reinforce our collective resilience as a society: only digitally empowered and capable citizens and a highly skilled digital workforce can ensure that Europe remains a strong and relevant part of the international community in the future. The “Path to the Digital Decade” projects a target of 80% for those aged 16-74 to have at least basic digital skills by 2030. Moreover, digital training and education should support a workforce in which people can acquire specialised digital skills to get quality jobs and rewarding careers.

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We envision a labour market that, in concert with rapidly advancing automation and computation, offers dignity, opportunity, and economic security for workers. How can we make that labour market a reality? Research in multiple fields, from economics and engineering to history and political science, tells us how we got here and offers some glimpses of possible futures. This chapter draws lessons from that work and synthesizes them to point toward ways forward.

MIT The Work of the Future: Building Better Jobs in an Age of Intelligent Machines²

As stated on the MIT paper The Work of the Future: Building better Jobs in an age of Intelligent Machines, **investments in innovation create great business opportunities for growth**, which is crucial to meeting challenges posed by a globalized and fiercely technologically competitive world economy. **These new goods and services generate new industries and occupations that demand new skills and offer new earnings opportunities. From a manufacturing perspective, Digital and manufacturing skills requirements are highly interwoven and it is critical to ensure that the latter, being either traditional or advanced manufacturing, are also addressed. The main difference that has become clear from this new reality is that flexibility and adaptability need to be core in the development and deployment of those skills.**

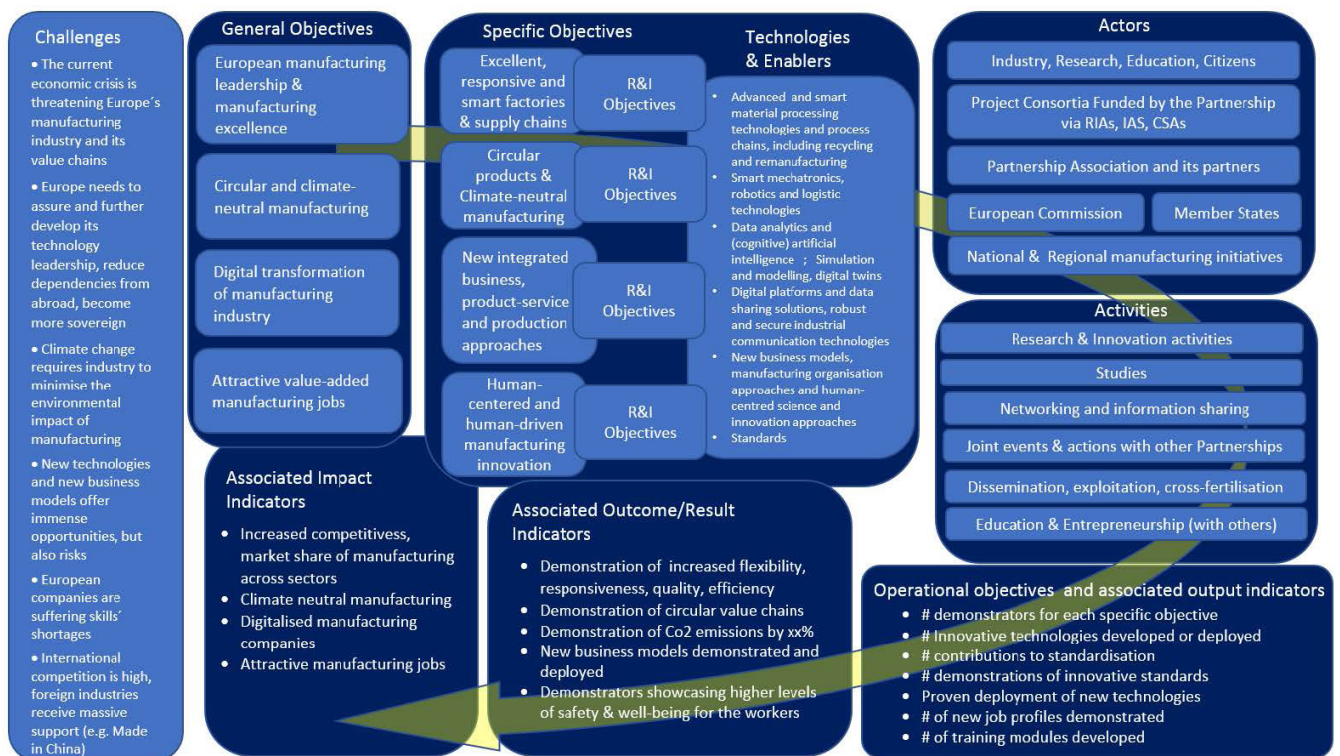
¹Europe’s Digital Decade | Shaping Europe’s digital future (europa.eu)

²The Work of the Future: Building Better Jobs in an Age of Intelligent Machines - MIT Work of the Future

3. Strengthening the manufacturing sector in Europe

European companies and research institutions continue to play a key role in industries ranging from transportation to energy, from high-tech textiles to aerospace. The importance of the manufacturing sector in Europe can't be overstated. Between 2002 and 2019, exports of manufactured goods increased from EUR 865 billion to EUR 1 764 billion. Imports of manufactured goods increased from EUR 662 billion in 2002 to EUR 1 347 in 2019. In this period, the trade balance increased from EUR 204 billion in 2002 to EUR 340 billion in 2020. And in 2020, manufactured goods made up 83 % of all EU exports and 74 % of EU imports³.

To sustain this unique positioning of Europe, a comprehensive strategy, including investments on critical new technologies is a key requirement. And, to ensure its continued relevance on the new, thriving industries, the **Made in Europe program (2021 - 2027) aims to secure Europe's position as a relevant competitive force moving forward.** In order to achieve that, European manufacturing needs to address both the ecological and digital transitions, while maintaining technological leadership to stay competitive. The size and the complexity of the associated challenges - such as the integration of Artificial Intelligence, the use of industrial data, the transformation into a circular economy and the need for agility and responsiveness - requires pooling of resources and a novel approach of cooperation.



³Extra-EU trade in manufactured goods - Statistics Explained (europa.eu)



The **Made in Europe Partnership**⁴ will bring together the leading actors from manufacturing and relevant European industrial ecosystems, coming from academia, industry, non-governmental organisations, and the public sector.

The Partnership will serve as a platform for national and regional manufacturing technology initiatives and the required disciplines and technologies, creating economies of scale, common understanding and alignment of objectives and priorities.

To achieve these goals, a strategic cooperation with key actors at a national, regional, and local levels is required, to ensure that the results will be best leveraged. The **Made in Europe partnership** will create a sound base for the transformation of European manufacturing ecosystems towards circular industries and increased flexibility, by leading on the associated technologies. These changes will, in turn, contribute to a competitive, green, digital, resilient, and human-centric manufacturing industry in Europe. To ensure this effective and swift transition, addressing head-on skills for manufacturing is of paramount importance, and EWF is one of the key drivers in that specific objective.

⁴ec_rtd_he-partnership-made-in-europe.pdf (europa.eu)

4. A flexible, evolving system

The fourth industrial revolution has no boundaries, which means no sector is left unchallenged. For companies in manufacturing, change means becoming both digital and manufacturing centres. For professionals, change means having to expand their existing skillsets to address new manufacturing technologies, while also developing new skills and competences matching business and technological requirements that are quickly evolving which, in turn, puts a strain on traditional education systems. The answer to this qualification challenge, which is global in scope, is strongly dependent on the ability of traditional Education and Vocational Education and Training (VET) systems to bring forth curriculums and methodologies that are widely accepted and get the workforce up-to-speed with new business requirements and modern technologies being deployed.

This need for profound change has also been highlighted on the Work of the Future study and on the path for the Digital Decade that the European Commission launched, both mentioned before. And the **European Federation for Welding, Joining and Cutting (EFW)** has always been looking ahead to ensure its qualification system keeps itself aligned with the most recent technological changes that emerge, as its history clearly demonstrates.



EFW started out with the **International System for Training, Qualification and Certification** in the fields of **Joining Technologies, in Quality, Environment, Health and Safety**. While Joining Technologies remain at the core of the system and are broadly used by its members and industry, the system has since evolved to meet industry's changing requirements and technological breakthroughs. It started evolving to include **Additive Manufacturing**, and by leveraging EFW's expertise in the development of advanced harmonized qualifications that are broadly used and recognized.

These qualifications, as with all others developed by **EFW**, are a result of the cooperative work between the federation 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. The success of this approach can be seen through the number of **member countries that are already part of the federation, now totalling 29 member countries and 1 Observer Member from outside Europe**. Also worthy of note, the Federation has licensed its Qualification System to IIW in 2000 and, since then, **a combined EFW/IIW System has been offered in more than 40 countries worldwide**.

But **EFW** is not standing still on its achievement and, by actively searching and identifying new needs for the industry as a whole, along with its network of partners, has developed the **first International Additive Manufacturing Qualification System** to support the fast adoption of this new market. **EFW** currently offers **Qualifications in Metal AM**, three at the Operator level and three at Engineering level. And they have been gaining additional momentum, with the International harmonised qualifications for professionals in additive manufacturing already recognized in 33 European countries. The first countries offering these qualifications are **Italy, Germany, France, UK and Spain**, and the first course for Laser Powder Bed Fusion (LPBF) operator started this year in Italy, with the first diplomas already awarded.

A flexible, evolving system

EWF and its partners are also actively pursuing the creation of support bodies. First, an **AM Observatory**, to map and monitor AM's industry technological trends, skills shortages and mismatches, policies and figures for the AM Qualification System. Additionally, two Councils (Industry and Qualification Education) were created, whose mission is to identify and validate skills needs and implement AM training courses and approve training guidelines of the **AM Qualification System**.

The Federation's aim is to continue being at the forefront of innovation in qualifications and to be seen as a critical partner on the manufacturing ecosystem, providing the most sought-after qualifications, in accordance with the industry's newest trends. New technologies cannot be effectively deployed if the workforce is not properly qualified, and EWF and its members are uniquely positioned to provide professionals with the most required qualifications.

Disrupting the status Quo – how the pandemic has upended the traditional skills acquisition model and how the qualification system has risen to the challenge

At the beginning of the lockdown, when training sessions were not possible to be carried out physically, qualifications were being taught entirely in a digital manner. The transition to this methodology was smooth and continuous, as EWF had previously identified all content that could be applied, both in person or digitally. Over time, it became clear, together with ATB's (Authorized Training Bodies), that the balance between knowledge and skill should be approached in a different way. All qualifications have separate learning modules, some with a greater focus on knowledge, others on skill. Practice is an essential element in all qualification modules, although some can be complemented with simulations, or extended with virtual reality devices, the practice of handling certain equipment can rarely be replicated in its entirety.

Leveraging this long-term experience in dealing with the most advanced manufacturing technologies, the federation has looked at how to best support companies in addressing the challenges posed by the pandemic, since its harmonised Qualification System is based on a continuous search for **innovative methods to improve Traditional welding and Additive Manufacturing personnel training and qualification and on the continuous update of EWF's qualification system to respond to evolving manufacturing industry trends**. The training methodology has evolved to cope with the new learning possibilities made possible by the forced adoption of distant learning. In itself, this change has also led to the need to ensure **the consistency on training quality as well as the overall integrity of the system**, covering both the way training is performed as well as managed.

Responding to market requirements, and in line with the most recent trends in knowledge acquisition, the system is evolving both in terms of the horizontal qualifications that are relevant to any industry, as well as in the development of uniquely tailored qualifications targeting specific industries.

This approach can be seen in the recent participation of **EFW** in several conferences around the definition of the **Future Skills for Europe's Aerospace and Defence Industry**, discussing what would be the skills required and how they can be best addressed. The Federation is also actively involved in the early development of a skills in manufacturing qualification system.

In short, today's international qualification in manufacturing require:

- **Flexibility** – The old model of a traditional training where the worker has to stay away from his post for the duration of the course, is being replaced by a more flexible approach, which can include components of online learning;
- **Modularity** – Another key trend pertains to one simple reality of manufacturing companies nowadays. To perform a specific function, a professional may only need a unique expertise from EWF's qualification system and, by creating a modular approach to the qualifications, that can be easily picked upon by each company, EWF provides an easy answer to these questions;
- **Upskilling and reskilling** – Providing opportunities to professionals in welding and AM requires that companies can support them in acquiring additional qualifications within their existing training path or outside, to muster other technologies. EWF system also provides a unique and effective way for professionals to achieve it;
- **Hybrid training** – Although the entirely in-person training is something that is not entirely required, online only training also does not meet the requirements for peer analysis and learn with training. Therefore, EWF has already integrated within the system the possibility for hybrid training as an effective way to acquire the required qualifications. Adding to this the use of virtual/augmented reality tools also increased the hybrid potential of some of the qualifications.

These **four requirements are critical to the success of manufacturing companies worldwide**, not losing sight of the importance of an effective high-quality training, while at the same time being perceived as a benchmark to which qualification systems can be matched to. What has already been learned from the experience of the pandemic, and the changes enforced, can be summarized with the need to have a hybrid learning solution, as digital-only solutions are not effective to achieve the level of proficiency and ability to perform the required tasks of the system's qualifications, and that ensuring its effective harmonization using digital methodologies, is a key requirement. **EFW** has played an important role here by working with industry, research and training centres and all of its partners in developing qualifications that take into consideration the requirements of industry in terms of flexibility, modularity, upskilling and reskilling and hybrid training.

Most companies and individuals looking for EWF qualifications expect a level of consistency and quality that is only possible given its highly sophisticated quality system, that is constantly improved to ensure it lives up to the expectations of the digital age. Other recent trends include life-long learning and continuous update of qualifications, as well as the ability to quickly shift to other posts that may require a simple additional module from the system. Also here, EWF has been engaged in integrating modularity into the system, as well as shorter trainings, to meet the evolving requirements from the industry.

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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, supporting a faster and broader adoption of this new qualification system for Additive Manufacturing. Currently, this ecosystem comprises 43 countries, 44 ANBs (Authorized Nominated Bodies) and more than 600 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/IIW Qualification courses, combining both supporting knowledge and application experience, in a close relation with industry and their needs.

5. Industry 4.0 technologies disrupting manufacturing and EWF's system

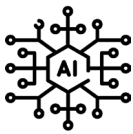
Industry 4.0 is the future of manufacturing, where an intelligent network of machines and processes, with the help of information and communication technologies, takes manufacturing to a whole new level, in which **Cyber-physical systems lie at the core**. This new reality implies the integration of modern control systems, with highly sophisticated communications, which are some of the key enabling technologies of Industry 4.0. The opportunities created by the possibility of having products and means of production networked and able to communicate are vast and, for many companies, still starting to be leveraged. The technologies that comprise Industry 4.0, coupled with the redefinition of what are the workforce profiles to leverage them, are critical to ensure resilience and flexibility in manufacturing companies, and 2020 was the year that forced companies to rethink the direction of their operational strategies, changing/adapting to a new way of running their businesses but also at the same time accelerate the integration of industry 4.0 technologies on their operations in order to achieve their goals.

Doing so requires a qualified workforce, and EWF has always envisaged the leading-edge qualification of more and better professionals in manufacturing. That is why the federation has been actively looking at new opportunities to develop its system to keep it in sync with the most advanced industry requirements.

Given the unique challenge posed by COVID-19, Industry 4.0 technologies such as Internet of things (IoT), Artificial Intelligence (AI), analytics and automation have taken on a whole new degree of significance. The pandemic has hugely accelerated the drive of organizations to digitally transform and to qualify the workforce in order to meet these new requirements. Advances such as the integration of Information Technology (IT) and Operations technology (OT) are bringing together data that can drive efficiency and innovation. New technologies are beginning to deliver the benefits of highly automated, digital workflows. The following examples highlight some of those technologies, which are also being leveraged from a skills training perspective by EWF to address manufacturing qualification requirements.



Industry 4.0 technologies are redefining the way products are manufactured and even how traditional supply chains operate

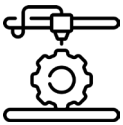


Artificial intelligence

Artificial intelligence, for one, has been extensively used by a large group of industries such as gaming, banking, retail, commercial, and government, among other, but has taken longer to gain traction in manufacturing. AI-driven machines are laying an easier path to the future by yielding a number of benefits – offering new opportunities, enhancing production efficiencies, and bringing machine interaction closer to human interaction. The Fourth Industrial Revolution is knowledge-based work, supported by automation. By creating new ways to automate tasks, we can rebuild the way people and machines live, interact & collaborate, to make a superior, stronger digital economy.

Regarding manufacturing, it is necessary to find technology solutions that can help the “human arm” achieve tasks with even greater intelligence. Artificial intelligence (AI) and robots/cobots (Collaborative Robots) will continue enhancing manufacturing technologies far beyond what was initially conceived. Machine learning algorithms and advanced data availability will continue to drive improvements at a pace never seen before. All these changes are helping the manufacturing industry move forward, where welding and additive manufacturing are just some examples of manufacturing processes that will gain with the introduction of AI in a manufacturing environment.

However, the impact of AI and robotization will have both positive and negative effects on the international manufacturing industry in general. While AI will bring significant benefits to the manufacturing industry it is important to ensure that current and future workforce is capable of “interact” and implement it in a manufacturing environment and that it is seen as an enabler and a tool that assists the manufacturing industry and workforce and not be perceived as a tool that “competes” with the manufacturing workforce. For this to happen, training and qualification of the manufacturing personnel is critical.



Additive Manufacturing

EFW's acknowledged the trend and made a significant investment on qualifying and on the development of new technologies in order to support the manufacturing sector. Additive Manufacturing has emerged as a potential flexible solution for locally supplying various types of these items, demonstrating the potential of AM for a local and flexible production of strategic items, reducing supply chain dependency. The digital versatility and accelerate prototyping process of 3D printing empowers a swift mobilization of the technology and hence a rapid response to emergencies but also to new products and new ideas.

One of the main reasons that made AM an important tool during the pandemic is the fact that it is a manufacturing process with a high level of flexibility and adaptation to new products. This also increased the visibility of Additive Manufacturing and industry became more aware of how a new technology like AM can support them in becoming more resilient, more industry 4.0-ready and, even more important, more flexible and capable of quickly adapting to new scenarios and new products. And, ensuring a broader adoption of Additive Manufacturing on the long run, during the last decade, the decrease in the cost of processors and the expiration of patents made desktop 3D printers available as entry level-machines.





Advanced and Bio-based Materials

Manufacturing at the nanoscale is known as nanomanufacturing. Nanomanufacturing involves scaled-up, reliable, and cost-effective manufacturing of nanoscale materials, structures, devices, and systems. It also includes research, development, and integration of top-down processes and increasingly complex bottom-up or self-assembly processes.

In more simple terms, nanomanufacturing leads to the production of improved materials and new products. As mentioned above, there are two basic approaches to nanomanufacturing, either top-down or bottom-up. Top-down fabrication reduces large pieces of materials all the way down to the nanoscale, like someone carving a model airplane out of a block of wood. This approach requires larger amounts of materials and can lead to waste if excess material is discarded. The bottom-up approach to nanomanufacturing creates products by building them up from atomic- and molecular-scale components, which can be time-consuming. Scientists are exploring the concept of placing certain molecular-scale components together that will spontaneously “self-assemble,” from the bottom up into ordered structures.

Another frontier technology being explored is bio-based products. These are products with components wholly or partially derived plants or renewable marine, agricultural or forest materials. These new products allow manufacturing products live up to their promise of a more circular economy, and provide new opportunities for companies to create innovative products that meet customers' expectations.

Also on this ground-breaking new area, EWF is participating, with both the LightMe and MULTI-FUN projects. The LightMe project aspires to be a reference for boosting innovation in the field of lightweight metal matrix nanocomposites. MULTI-FUN, on the other hand, aims to focus on market-creating innovation, developing advanced materials and equipment for the additive manufacturing of multi-material parts, including the application of nanotechnologies. But always with the goal to identify and develop the necessary training and personnel qualifications to support the manufacturing sector in the implementation and usage of advanced and bio-based materials

6. Manufacturing redefined: Human-centred and flexible

Flexible manufacturing is all about adaptability. The ability to adapt to changes in product requirements without compromising its quality. A flexible manufacturing system is the production method that helps make this happen, and that can cut down both on production times and the amount of resource required. The system is designed to adapt to changes like slight variations to a product, production volumes, or the addition of entirely new products. It does this with the help of computers and machines that can automate key manufacturing processes including machining and assembly, loading and unloading, and data processing.

And these machines include industrial robots, which have been in manufacturing plants since the late 1970s, also referred to as manufacturing robots, which have automated repetitive tasks, prevented or reduced human error to negligible rate, and shifted human workers focus to more productive areas of the operation.

The scope of use of robots in plants vary. Applications include assembly, welding, painting, product inspection, picking and placing, die casting, drilling, glass making, and grinding. But digital technology, as well as manufacturing breakthroughs, have led to the creation of ever-more complex robots, to perform tasks that are increasingly closer to what a human operator will do. With the addition of artificial intelligence, an industrial robot can monitor its own accuracy and performance and train itself to get better. Cobots are another robotics application that uses machine vision to work safely alongside human workers to complete a task that cannot be fully automated. **This is blurring the lines between traditional shopfloor operations and the new hybrid world, where robots will increasingly be seen as working with human operations, side by side, in fact creating the world of human-centered manufacturing.**



Manufacturing redefined: Human-centred and flexible

When the going gets tough, EWF gets going

Since its inception, EWF has always strived to be at the leading edge of technology and innovation, side by side with the industry as it looks for new and innovative ways to produce new goods. As technologies evolved, EWF would provide the qualifications that are most required by professionals to perform at their utmost best. That unique approach has led the federation to look out for cooperation with other sectors beyond welding over the years, such as the implementation on new technologies in Manufacturing, training/qualifying personnel in a wide range of manufacturing processes and areas (e.g. AM, Adhesives, Laser Processing, Plastics, etc) and creation of products and services, meaning that the federation has increasingly become an unsurmountable part of the manufacturing industry's ecosystem. New endeavours, such as the aforementioned initiatives in sectors such as the Aerospace and Defence as well as in advanced and new processes and technologies, have demonstrated its versatility and success.

This is also very clear on the challenge being posed by the pandemic. The system has evolved, its training methodologies have been able to withstand and respond to the new hybrid learning model as well as to the need to create modules that more easily allow professionals to move between qualifications in different work environments as, for instance, change from welding coordinator to Additive Manufacturing coordinator, but also to move between countries and continents. While also looking into new challenges, such as artificial intelligence, circular economy, flexible manufacturing and more new concepts that have recently become mainstream.

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*Above all, always looking ahead to what's next has been the unique **DNA** of **EFW** and will remain so for the foreseeable future, as a key partner at the leading edge of industry and to ensure that the manufacturing sector can have access to high quality manufacturing qualifications regardless of where they are.*

This is the route EWF is taking, from being recognised as the organization for International Welding Qualifications to a strong partner of the manufacturing sector by developing and implementing an International Manufacturing Qualification System, where welding, joining and additive manufacturing were the foundational steps to evolve from.



EWF

Av. Dr. Mário Soares 35, 2740-119 Porto Salvo
P: +351 215815200 | **E:** ewf@ewf.be