LCAMP

Learner Centric Advanced Manufacturing Platform

TRENDS IN ADVANCED MANUFACTURING AND INSIGHTS FOR VET (A view from the Basque Country)

WPN° 3 Observatory

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GLOSSARY AND/OR ACRONYMS

AI - Artificial Intelligence

AM - Advanced Manufacturing

Cedefop - European Centre for the Development of Vocational Training

CoVE - Centres of Vocational Excellence

EAfA - European Alliance for Apprenticeships

EC - European Commission

ECVET - European Credit System for Vocational Education and Training

EntreComp - The Entrepreneurship Competence Framework

EQAVET - European Quality Assurance in Vocational Education and Training

EQF - European Qualifications Framework

ESCO - European Skills, Competences and Occupations

ETF - European Training Foundation

EU - European Union

HE - Higher Education

HVET - Higher Vocational Education and Training

I4.0 - Industry 4.0

KET - Key Enabling Technology

OECD - Organisation for Economic Cooperation and Development

SME - Small and Medium Enterprises

SWOT - Strengths, Weaknesses, Opportunities, Threats

TVET - Technical and Vocational Education and Training

VET - Vocational Education and Training

WBL - Work Based Learning

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EXECUTIVE SUMMARY

Advanced Manufacturing (AM) and Higher Vocational Education and Training (HVET) need to update training, implement new technologies, and get quick access to data.

The causes behind these needs are technological factors (Industry 4.0), factors conditioned by education systems and education methodologies, social factors and environmental factors (the European Green Deal with its emphasis on the greening industry).

Under the CoVE initiative, the LCAMP project aims to support regional skill ecosystems and various stakeholders in providing new skills and implementing new or updated technologies in VET centres. LCAMP will tackle this by incorporating a permanent European Platform of Vocational Excellence for Advanced Manufacturing.

By collaborating across borders, LCAMP's goal is to support and empower regional Advanced Manufacturing CoVEs to become more resilient, innovative, and better equipped to train, upskill, and reskill young and adult students, to successfully face the digital and green transitions. We will help European regions and countries grow and be more competitive through their VET systems.

Therefore, the LCAMP OBSERVATORY is one of the services in the LCAMP platform. The observatory is led by the French cluster *Mecanic Vallée* and the French VET provider *Campus des Métiers et des Qualifications d'Excellence Industrie du Futur*.

This present document details the first results of the LCAMP Observatory, through the methodology that the LCAMP consortium used to set up and run the Observatory. We had set up a process cycle for the observation consisting of 5 stages:

- Stage 1: Diagnosis and priority
- Stage 2: Search and information gathering
- Stage 3: Information Analysis
- Stage 4: Creating value. Elaboration of LCAMP reports
- Stage 5: Dissemination and communication.

1. INTRODUCTION

The LCAMP observatory is one of the services of the LCAMP platform.

The LCAMP Observatory must be a reliable and easily accessible source of information and data for trainers, VET teachers, and professionals, updated on Digital / Advanced Manufacturing / Smart Industry, delivered through a multimedia and interactive platform -LCAMP platform-, that can be customized according to individual interests (Work in progress in WP8).

This observatory must feed other Work packages (WP), for instance, WP 5 on Learner Centric Training, or Open innovation Community in the WP4.

In a first document about methodology, are set up a process cycle for the observation consisting in 5 stages:

- Stage 1: Diagnosis and priority
- Stage 2: Search and information gathering
- Stage 3: Information Analysis
- Stage 4: Create value. Elaboration of LCAMP reports
- Stage 5: Disseminate-communicate.

Following this process cycle, are detailed the main aspects of the observation methodology:

- Identify reliable sources that we can find in Europe about Advanced Manufacturing.
- Classify and filter data gathered from different sources.
- Present several ways to collect data and to analyse them.
- Define the methods for the creation of annual reports.
- Validate process for those reports.

The observatory will publish periodical reports for VET and HVET target audiences about technology trends, labour market changes, skill needs, and occupations in Advanced Manufacturing. It is expected that SMEs, industry clusters and other associations will also find valuable information in the observatory.

The publication of a yearly report is planned.

- Report 1: June 2023,
- Report 2: June 2024,
- Report 3: June 2025.

This first annual report is gathering sub-reports written by around twenty different writers, from the main partners involved in the LCAMP project. 39 Topics were determined, and 22 TOPICS were analysed and worked on during this first period.

2. TOPIC: MANUFACTURING AND INSIGHTS FOR VET (A VIEW FROM THE BASQUE COUNTRY)

The purpose of this chapter is to present some of the development areas related to AM.

These are topics that concern all or some of the stakeholders

- CoVEs and VETs: teachers, trainers and heads of VET schools;
- Learners: students, active workers, job seekers;
- Companies;
- Policy makers and other stakeholders.

2.1 INTRODUCTION

This sub-report aims to provide a comprehensive analysis of the current state of advanced manufacturing in the Basque Country, with a focus on the role of vocational education and training (VET) in developing the skills necessary for this sector. The sub-report identifies the Advanced Manufacturing sector as one key strategic area for the Basque Country's economy and highlights the importance of collaboration between companies, the VET system and governments in fostering innovation and transmitting ideas to the industrial network. Additionally, the sub-report offers reflections for VET teachers, VET students and heads of VET centres.

2.2 CONTEXTUALISATION

The Basque Country has established itself as a key player in the European advanced manufacturing sector, with machine-tool and advanced aeronautical manufacturing being identified as the strategic areas for its economy over the last few decades.

In order to maintain and strengthen its position in this sector, the Basque government has made a strong commitment to vocational education and training (VET), having recognized the crucial role that it plays in developing the skills necessary for this industry.

2.3 OBJECTIVES / RESEARCH QUESTION / PROBLEM STATEMENT

Advanced Manufacturing is a critical sector for the Basque Country's economy, with increasing demand for skilled workers in areas such as robotics, additive manufacturing, and automation. However, the VET system faces challenges in keeping pace with these rapid technological changes and providing students with the skills and competencies needed for successful careers in Advanced Manufacturing.

This report aims to answer the research question, "How can the Basque Country's VET system better prepare students for careers in Advanced Manufacturing?" To achieve this goal, the report has the following objectives:

- Identify the skills and competencies needed for a career in Advanced Manufacturing, based on a review of industry trends and job requirements.
- Assess the current state of VET programs in the Basque Country and their alignment with industry needs, using a combination of surveys, interviews, and case studies.
- Analyze successful models of VET programs in other regions or countries, and identify best practices that can be applied in the Basque Country.
- Provide recommendations for VET teachers, heads of VET centres, and VET students to enhance the quality and relevance of VET programs in the field of Advanced Manufacturing.

The problem statement for this report is that there is a skills gap between the skills taught in VET programs in the Basque Country and the needs of industry in the field of Advanced Manufacturing. Despite the importance of this sector to the Basque Country's economy, students are not being adequately prepared for careers in this field, leading to limited job opportunities and a lack of competitiveness for the region.

The scope of this sub-report is focused on Basque Country's VET system and its alignment with the needs of the Advanced Manufacturing sector. The report draws on a range of sources, including academic literature, industry reports, and other sources from stakeholders in the VET and Advanced Manufacturing sectors. By providing insights and recommendations, this report aims to contribute to the ongoing efforts to improve the quality and relevance of VET programs in the Basque Country and enhance the competitiveness of the Advanced Manufacturing sector.

2.4 FINDINGS

The results are presented starting from the European and national approach down to the level of Basque VET. It shows what is happening in the advanced manufacturing ecosystem in terms of trends, how this may affect Basque VET and how the challenges are being met.

- **European and national approach**
- **Strategic response of the Basque Country**
- **How Basque VET is affected**

European and national approach

The development of new technologies and processes is crucial for the success of the manufacturing industry in Europe[1]. Digitalisation, automation and sustainability are identified as key areas for innovation.

Collaboration is essential to drive progress in the manufacturing industry. It, therefore, underlines the importance of cooperation between stakeholders, including researchers, businesses and policy-makers, to ensure that innovation efforts are coordinated and effective.

The human factor is becoming increasingly important in advanced manufacturing. The need to focus on human-centred manufacturing is highlighted, which involves designing manufacturing systems that are safe, ergonomic, and adaptable to the needs of workers. This includes areas such as human-robot collaboration and the development of skills for the workforce of the future.

Source: Plataforma Tecnológica Española de Fabricación Avanzada: Agenda de prioridades estratégicas de I+D+i (2022)

https://www.manufacturing-ket.com/wp-content/uploads/2022/02/MANU-KET-AGENDA-PRIORIDADES-ESTRATEGICAS-de-IDi.pdf

Advanced manufacturing represents an opportunity for Spain to increase productivity, competitiveness, and innovation, and attract new investment[2].

Spain has a strong industrial base, particularly in the automotive and aerospace sectors, and has the potential to develop new capabilities in areas such as robotics, additive manufacturing, and smart factories.

To realize the full potential of advanced manufacturing, Spain needs to invest in research and development, digital skills, and collaboration between industry, academia, and government, and create an ecosystem that supports innovation and entrepreneurship.

Source: PwC (PricewaterhouseCoopers): Claves e inversiones estratégicas para una España 5.0 (2021)

[1] MANU-KET, « Plataforma Tecnológica Española de Fabricación Avanzada: AGENDA DE PRIORIDADES ESTRATÉGICAS DE I+D+i », *MANU-KET*, 2022, https://www.manufacturing-ket.com/wp-content/uploads/2022/02/MANU-KET-AGENDA-PRIORIDADES-ESTRATEGICAS-de-IDi.pdf.

[2] PwC Spain, « Claves e inversiones estratégicas para una España 5.0 », *PricewaterhouseCoopers*, 2021, https://www.pwc.es/es/publicaciones/economia/assets/claves-e-inversiones-estrategicas-espana-50.pdf.

https://www.pwc.es/es/publicaciones/economia/assets/claves-e-inversiones-estrategicas-espana-50.pdf

The digitalization and automation of the manufacturing process are transforming the labor market, requiring workers to develop new skills and competencies to succeed in the jobs of the future[3].

Vocational education and training (VET) programs play a critical role in preparing workers for the jobs of the future by providing them with the necessary skills and competencies to adapt to the changing technological landscape.

There is a need for collaboration between VET schools and industry stakeholders to ensure that VET programs align with the needs of the labor market, and that students are equipped with the skills and knowledge needed to succeed in Industry 4.0-related fields.

Source: Dualiza (CaixaBank): Observatorio de la Formación Profesional en España - Informe 2021: La FP como clave de desarrollo y sostenibilidad (2021)

https://www.observatoriofp.com/downloads/2021/informe-completo-2021.pdf

The nature of work is changing[4] in the Industry 4.0 era, with an increasing emphasis on digital and technological skills, problem-solving skills, and soft skills such as communication and collaboration.

To prepare VET students for the jobs of the future, VET teachers and heads of VET schools must adapt their teaching methodologies and content to the changing nature of work and incorporate new teaching strategies, such as project-based learning and work-based learning.

To succeed in the Industry 4.0 era, VET students must be proactive in their learning, seek out opportunities for continuous learning and upskilling, gain practical, hands-on experience through internships and other experiential learning opportunities, and be flexible and adaptable in their career paths.

Source: Dualiza (CaixaBank): Cambios en los perfiles profesionales y necesidades de Formación Profesional en España. Perspectiva 2030. (2022)

https://www.caixabankdualiza.es/recursos/doc/portal/2022/06/23/cambios-en-los-perfiles-profesionales97650.pdf

[3] « informe-completo-2021.pdf », 2021, https://www.observatoriofp.com/downloads/2021/informe-completo-2021.pdf.

[4] « cambios-en-los-perfiles-profesionales97650.pdf », 2022, https://www.caixabankdualiza.es/recursos/doc/portal/2022/06/23/cambios-en-los-perfiles-profesionales97650.pdf.

Strategic response of the Basque Country

Advanced manufacturing has been identified as a key area of strategic focus for the Basque Country, with the aim of becoming a world reference in this field by 2030[5].

To achieve this goal, it outlines a series of actions to be carried out, including the promotion of innovation and digitalisation in manufacturing processes, the development of new materials and technologies, and the creation of new business models.

It also highlights the importance of collaboration between companies, research centres and public institutions to boost innovation and competitiveness in advanced manufacturing.

Source: Eusko Jaurlaritza: Plan de Ciencia, Tecnología e Innovación Euskadi 2030. (2021) https://www.innobasque.eus/uploads/attachment_files/pcti-euskadi-2030-604a5a6f761c1.pdf

In the Basque Country, the 6th Basque Vocational Training Plan aims to adapt vocational education and training to the technological and organisational changes brought about by Industry 4.0. This includes promoting the development of digital skills, the use of emerging technologies and the adoption of flexible and innovative training methods.

The plan aims to strengthen collaboration between the vocational education and training system and the industrial sector to ensure that the skills and competencies acquired by learners respond to the needs of the labour market. This includes promoting the involvement of enterprises in the design and delivery of training programmes and establishing partnerships between vocational education and training institutions and enterprises.

The plan recognises the importance of advanced manufacturing as a key sector for the economic and social development of the Basque Country. In this sense, the plan aims to support the development of advanced manufacturing through vocational training, promoting the acquisition of the necessary skills and competencies for the digitalisation and automation of industrial processes, and supporting companies in their transition towards Industry 4.0.

Source: Eusko Jaurlaritza: 6º Plan de Formación Profesional. (2022)

https://www.innobasque.eus/uploads/attachment_files/pcti-euskadi-2030-604a5a6f761c1.pdf

How Basque VET is affected

[5] « pcti-euskadi-2030-604a5a6f761c1.pdf », 2021, https://www.innobasque.eus/uploads/attachment_files/pcti-euskadi-2030-604a5a6f761c1.pdf.

Advanced manufacturing technologies, such as additive manufacturing, robotics, and nanotechnology, are transforming the manufacturing sector and creating new opportunities for vocational training[6].

Vocational training programs must be updated to include training on advanced manufacturing technologies in order to prepare workers for the jobs of the future.

There is a growing trend towards the use of digital technologies in manufacturing, such as 3D printing, robotics, and automation. These technologies are enabling manufacturers to produce more complex and customized products, while also improving efficiency and reducing costs.

Source: Orkestra - Instituto Vasco de Competitivad (Fundación Deusto): El rol de la formación profesional en los servicios avanzados. (2020)

https://api.observatoriofp.com:8443/documents/20123/51081/48_El-rol-de-la-formaci%C3%B3n-profesional-en-los-servicios-avanzados.pdf

Industry 4.0 is a new industrial revolution[7] that involves the integration of advanced technologies such as cyber-physical systems, the Internet of Things, big data, and automation into the manufacturing process. This requires a workforce that is familiar with these concepts and technologies and has the skills and competencies needed to work with them.

Advanced manufacturing techniques such as additive manufacturing (3D printing) and robotics are becoming more widespread in Industry 4.0, leading to increased efficiency and productivity. VET programs need to adapt their curricula to provide students with hands-on experience with these techniques to better prepare them for the changing demands of the industry.

Educational institutions and industry partners need to collaborate to develop training programs and apprenticeships that align with the needs of the local workforce. VET students can benefit from internships and apprenticeships that provide them with real-world experience and help them develop industry-specific skills.

Source: Revista Tecnológica nº 14. Enero - Diciembre 2021: Formación Profesional y el impacto de la Industria 4.0. (2021

http://www.redicces.org.sv/jspui/bitstream/10972/4419/1/RevistaTecnologica2021_Art11.pdf

[6] Mikel Albizu Echevarria et Miren Estensoro Garcia, « EL ROL DE LA FORMACIÓN PROFESIONAL EN LOS SERVICIOS AVANZADOS », *Orkestra*, 2020, https://api.observatoriofp.com:8443/documents/20123/51081/48_El-rol-de-la-formaci%C3%B3n-profesional-en-los-servicios-avanzados.pdf.

[7] « RevistaTecnologica2021_Art11.pdf », 2021, http://www.redicces.org.sv/jspui/bitstream/10972/4419/1/RevistaTecnologica2021_Art11.pdf.

3. CONCLUSION

General conclusions

From a general perspective, there is a need for collaboration, investment and education to advance the industry and prepare the workforce for future jobs.

The manufacturing industry faces challenges such as competition in a global market, changing technologies, and the need for human-centered manufacturing. To address these challenges, stakeholders must work together, develop new technologies and processes, and prioritize vocational education and training programs to prepare workers for the changing landscape of Industry 4.0.

In Spain, investment in research and development, digital skills, and collaboration between industry, academia, and government is needed to enhance competitiveness, productivity, and innovation in areas such as robotics, additive manufacturing, and smart factories.

Vocational education and training programs must adapt their teaching methodologies and content to the changing nature of work, provide practical, hands-on experience, and encourage flexibility and adaptability in career paths. By investing in collaboration and education, the manufacturing industry can thrive and workers can stay competitive in the rapidly evolving job market.

In the Basque Country, in order to improve competitiveness, productivity and innovation, it is necessary to invest in research and development, digital skills and collaboration between industry, academia and the administration.

The Basque Government has launched several initiatives such as the Basque Digital Innovation Hub and the Advanced Manufacturing Training Center to develop new skills in areas such as robotics, additive manufacturing and smart factories.

These initiatives are designed to provide practical experience for vocational education and training students and to align VET programmes with the needs of the labour market.

The Basque Government also encourages collaboration between industry and VET schools to develop new technologies and processes and ensure that VET students are prepared for the changing landscape of Industry 4.0.

Overall, the initiatives implemented in the Basque Country serve as a model for the advancement of the manufacturing industry and the preparation of the workforce for the jobs of the future.

Conclusions for the VET Community

For VET Teachers

As Industry 4.0 advances, the manufacturing industry is changing rapidly, requiring workers to develop new skills and competencies to keep up with the technological advancements. As a

VET teacher, it's important to understand the changing nature of work and the skills required for the jobs of the future.

One of the key findings related to advanced manufacturing is the importance of collaboration between stakeholders in the industry, including VET schools, industry partners, and government. VET teachers can play a critical role in preparing students for careers in advanced manufacturing by adapting their curricula to align with the needs of the labor market and collaborating with industry partners to provide students with practical, hands-on experience.

Another important finding is the need for workers to be flexible and adaptable in their career paths, continuously learning and upskilling to stay relevant in the rapidly evolving job market. As a VET teacher, it's important to encourage students to be proactive in their learning, seek out opportunities for continuous learning and upskilling, and gain practical experience.

Finally, it is important to highlight the importance of vocational programmes in preparing workers for the changing landscape of Advanced Manufacturing and ensuring employability. As VET teachers, it is important to adapt teaching methods and content to the changing nature of work and to incorporate new teaching strategies to prepare students for the jobs of the future.

In summary, as a VET teacher, it's crucial to stay up-to-date with the latest trends and advancements in advanced manufacturing and collaborate with industry partners to provide students with the necessary skills and competencies.

For VET Students

Industry 4.0 is changing the nature of work and requiring a new set of skills and competencies from workers, including those who receive vocational education and training (VET). This means that as students, they need to be proactive in their learning, seeking out opportunities for continuous learning and upskilling, gaining practical, hands-on experience, and being flexible and adaptable in their career path.

Collaboration between VET schools and industry stakeholders is crucial in ensuring that VET programs align with the needs of the labor market. This means that students should be aware of the trends and needs of the industry, and try to gain exposure to real-world projects or internships whenever possible.

Finally, preparing for the jobs of the future requires a combination of technical skills and soft skills, such as communication, problem-solving, and teamwork. Student must focus on developing both sets of skills, through formal training and practical experience, to ensure their employability in Industry 4.0-related fields.

Overall, the key message for VET students interested in advanced manufacturing is to be proactive, collaborative, and focused on developing a well-rounded set of skills to succeed in the rapidly evolving job market. This includes seeking out opportunities for continuous learning and upskilling, gaining practical, hands-on experience, and being flexible and adaptable in their career paths. Additionally, it's essential for VET students to develop competencies beyond technical skills, such as problem-solving, critical thinking, communication, and teamwork, which are highly valued in the industry. By taking an active approach to their learning and development, VET students can position themselves for success in the competitive and dynamic field of advanced manufacturing.

For Heads of VET Centres

The advanced manufacturing industry is rapidly evolving, and it is crucial for VET centres to keep up with these changes in order to effectively prepare their students for the workforce. To do so, it is important for heads of VET centres to stay informed about the latest trends and advancements in the field and to collaborate with industry partners to ensure that their programs align with industry needs.

One of the key challenges facing VET centres is the need to strike a balance between traditional manufacturing skills and new, emerging technologies. This requires a willingness to adapt and change curricula to incorporate new techniques and tools while also maintaining a strong foundation in the fundamentals.

In addition, it is important for VET centres to focus on developing a well-rounded set of skills in their students, including soft skills like communication, problem-solving, and critical thinking, as well as technical skills. This will help ensure that graduates are prepared for the demands of the advanced manufacturing workplace and are able to adapt to new challenges as they arise.

Overall, heads of VET centres play a critical role in preparing the next generation of workers for the advanced manufacturing industry. By staying informed, collaborating with industry partners, and focusing on a well-rounded education, they can help ensure that their students are well-prepared to succeed in this rapidly evolving field.

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