ICAMP

Learner Centric Advanced Manufacturing Platform

D3.2 - M24 - Analysis of the Impacts and Evolution of jobs in Advanced Manufacturing

D3.2 - M24 - A Methodological sub-report

LCAMP partners:

TKNIKA – Basque VET Applied Research Centre, CIFP Miguel Altuna LHII, DHBW Heilbronn – Duale Hochschule, Baden-Württemberg, Curt Nicolin High School, AFM – Spanish Association of Machine Tool Industries, EARLALL – European Association of Regional & Local Authorities for Lifelong Learning, FORCAM, CMQE: Association campus des métiers et des qualifications industrie du future, MV: Mecanic Vallée, KIC: Knowledge Innovation Centre, MADE Competence Centre Industria 4.0; AFIL: Associazione Fabbrica Intelligente Lombardia, SIMUMATIK AB; Association HVC Association of Slovene Higher Vocational Colleges; TSCMB:Tehniški šolski center Maribor, KPDoNE: Kocaeli Directorate Of National Education; GEBKİM OIZ and CAMOSUN college.

Document summary

Document type:	Public Report
Title	Analysis of the evolution of jobs in advanced manufacturing
Author	Pascal Pichoutou *Mecanic Vallée*
Co-authors	Hervé Danton *Mecanic Vallée*
Contributors	Camille Leonard CMQEIf,
Reviewers	Unai Ziarsolo TKNIKA
Date	July 2024
Document status	4.0
Document level	Confidential until its publication
Document description	This document describes the main features of the evolution of jobs related to advanced manufacturing in 5 European countries.
Cite this deliverable as:	LCAMP (2024) Analysis of the impacts and evolution of jobs in advanced manufacturing (LCAMP4.0 Deliverable D3.2M24) retrieved from https://lcamp.eu/
Document level	Public

Version Management

Version	Date	Action
0.1	2023-11-29	Draft version
0.2	2023.12-14	Version for revision
0.3	2024-03-23	Reviewed by Unai Ziarsolo
0.4	2024-07-08	Final version reviewed

ACRONYMS

AFDET - French Association for the Development of Technical Education

AFNOR - French association for standardisation

AI - Artificial Intelligence

AR - Augmented Reality

AGV - Automated Guided Vehicles

B2B - Business to Business

B2C - Business to Consumer

CMQEIf - Campus des Métiers et des Qualifications d'Excellence Industrie du futur

CNC - Computer Numerical Control

EQF - European Qualification Framework

ERP - Enterprise Resource Planning

ESCO - European Skills, Competences, Qualifications and Occupations

FDM - Fused Deposition Modelling

FEM - Finite Element Method

HMI - Human Machine Interfaces

HVET - Higher Vocational Education and Training

IoT - Internet of Things

IT - Information Technology

IUT - University Institute of Technology

LCAMP - Learner-Centric Advanced Manufacturing Platform

M2M - Machine to Machine Communications

MV - *Mecanic Vallée*

SME - Small and Medium-sized Enterprises

VR - Virtual Reality

WP - Work Package

CONTENT TABLE

EXECUTIVE SUMMARY

The LCAMP (Learner-Centric Advanced Manufacturing Platform) project under the CoVE initiative aims to enhance regional skill ecosystems in Advanced Manufacturing.

LCAMP plans to establish a European Platform of Vocational Excellence for Advanced Manufacturing, promoting resilience and innovation across regions through collaboration.

This report is a result of the LCAMP Observatory, which is one of the services the LCAMP platform will make available for the final users. The Observatory is led by the French cluster *Mecanic Vallée* and the French VET centre CMQEIf.

During this second year of work, the Observatory Work Package 3 launched an analysis on the impacts of digital and green transitions trends on jobs and skills of the workforce in the advanced manufacturing industry. The analysis focused on a selection of jobs occupied mainly by people qualified by European Qualification Framework (EQF) 3-6 studies.

These analyses are detailed in each regional / national sub-reports written by five countries (the Basque Country, France, Germany, Italy and Turkey) on 28 jobs in the advanced manufacturing industry.

Despite some variations in study methods and presentation of results, this year has established a shared methodological approach and a standardised format for reporting findings, paving the way for further progress.

This report describes the methodology applied by the five countries to perform and validate the impacts' analysis.

1. OUTCOMES

Year 2 study delivery is constituted by the sub-reports below:

Table 1 : List of sub-reports

WRITER	SUB-REPORT REFERENCE	SUB-REPORT SCOPE	CONCAT	OBJECTIVES
FR	D3.2 - M24 - A	Methodological sub-report	D3.2 - M24 - A Methodological sub-report	Describe objectives, outcomes, scope, and the methodology to produce Sub-reports.
BC	D3.2 - M24 - B	Basque Country sub-report	D3.2 - M24 - B Basque Country sub-report	The purpose of each sub-report is to present how jobs selected, tasks and related skills are impacted by Advanced Manufacturing Digital Technologies and the Green Transition.
FR	D3.2 - M24 - F	French sub-report	D3.2 - M24 - F French sub-report	
GE	D3.2 - M24 - G	Germany sub-report	D3.2 - M24 - G Germany sub-report	
IT	D3.2 - M24 - I	Italy sub-report	D3.2 - M24 - I Italy sub-report	
TR	D3.2 - M24 - T	Turkey sub-report	D3.2 - M24 - T Turkey sub-report	
FR	D3.2 - M24 - S	Synthesis of all D3.2 - M24 sub-reports.	D3.2 - M24 – S Synthesis of all D3.2 - M24 sub-reports.	Provides a synthesis of all D3.2 - M24 reports.
FR	D3.2 - M24 - C	Consolidated report	D3.2 - M24 - C - Consolidated report	Gathering of all sub-report

D3.2 outcomes are the inputs of other LCAMP services, mainly:

- Learner Centric Training for Advanced Manufacturing WP5, which manages skills and curricula database.
- LCAMP Platform (LCAMP, n.d.) WP8 and Impact Assessment (WP8 which develops the Platform).

These Sub-reports' list in table 1 was defined following to the first stage of the methodology described here after.

2. INTRODUCTION

The LCAMP Observatory will serve as an easily accessible source of information for VET centres, authorities in charge of curricula, companies, clusters and other associations through a digital platform. Throughout the LCAMP project, the Observatory will issue periodic reports covering technology trends, labour market changes, skill requirements, and occupations in Advanced Manufacturing.

The following publication of yearly reports is expected:

- Report 1: June 2023, D3.2 – M12
- Report 2: June 2024, D3.2 – M24 (this year's focus)
- Report 3: June 2025, D3.2 – M36

These reports are complemented with regional and national sub-reports that will be periodically distributed on the platform and through conventional dissemination channels.

Each of these conclusions is described within all written sub-reports.

In this report, the Observatory work package describes the methodology applied by the five countries to perform and validate analyses of the impact of digital and green transitions on the competencies of the workforce in the advanced manufacturing industry.

3. METHODOLOGY OF THE D3.2-M24 OBSERVATORY REPORT

To build up the database and keep it up to date, the Observatory's operating methodology comprises a five-stage process, which takes place on a regular basis.

- Stage 1: Diagnosis and Priority - Set up Priorities and Fields to Observe.
- Stage 2: Search and Information Gathering
- Stage 3: Information Analysis
- Stage 4: Create value. Development of LCAMP Reports
- Stage 5: Disseminate-Communicate.

In this section, the structure of the LCAMP Observatory is explained, focused for this 2024 year, on trends impacting the description of selected jobs.

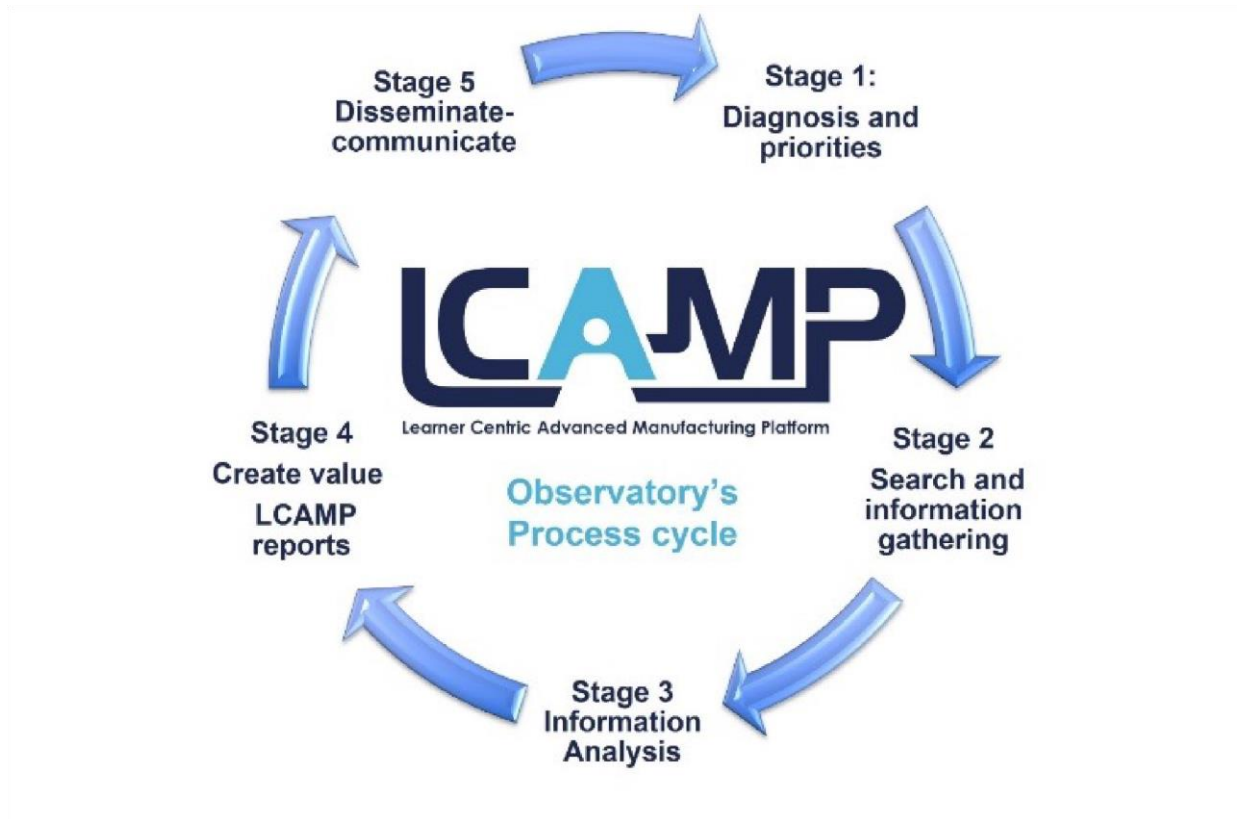That structure follows the process cycle as shown in Figure 1 below:

Figure 1 : Process cycle for the observatory

3.1. STAGE 01 DIAGNOSIS AND PRIORITIES

Before advancing to the analysis of job impacts and objectives for subsequent phases, the diagnostic stage began by addressing key questions. These questions are designed to consistently align with the goals, tasks, and processes necessary for producing the expected deliverables:

1. What is expected from the Observatory D3.2 - M24?
2. What do those outcomes do?
3. What are the outcomes of the Observatory Report 2: June 2024, D3.2 –M24?

Hereafter, are the answers to the above questions:

1. Describe how jobs are impacted by Advanced Manufacturing Digital Technologies and the Green Transition and the related knowledge/skills to be developed.
2. D3.2 outcomes are the inputs of other LCAMP services, mainly:
   o Learner Centric Training for Advanced Manufacturing (WP5)
   o Platform (WP8) and Impact Assessment

3. The Sub-reports are detailed in the above paragraph 2-Outcomes.

3.1.1. FIELDS & AREAS OF OBSERVATION

To define the scope/areas of observation, the following process took place:

- **First statement:** This report describes which digital and green transition trends identified in D3.2 – M12 (Danton *et al.*, 2023), are impacting a selection of jobs, instead of describing how each digital and green transition trend is already impacting jobs.
  Based on this statement and because it was not possible to analyze all the industrial jobs, the analysis focuses on a list of jobs selected by each country.

- **Second statement:** it was decided not to select new jobs, during the "research phase". The job to select already exists in the industry.

  Each country has selected a list of relevant jobs based on the following 5 criteria:

  1. **Industry sectors:** the selected job is to be included in the LCAMP industry sector scope.
  2. **Jobs Impacted:** it has been verified that the jobs related to the digital and green transitions are impacted by the new trends previously identified in–D3.2 – M12;
  3. **Employability:** evaluate the employability/demand within the industry.
  4. **Smart Specialisation Strategy, 2019**: jobs must belong to industrial sectors included in the regional Smart Specialisation Strategies.
  5. **Education level:** it is validating that VET and high VET jobs - I4.0-centred Qualifications are delivered at EQF (European Qualification Frame) (Europass, n.d.) level 3 to 6. To facilitate harmonisation, each job is listed in the following tables with the corresponding ESCO occupation name and code. This enables the identification of jobs that are common across countries and those that are country-specific. These are classified into three groups:
       A – Job selected by 3 countries and more.
       B – Job selected by 2 countries.
       C – Job selected only by one country.
- The initial global list was condensed to shorten the report's length; each country submitted a brief list of jobs for analysis.

From these submissions, selected jobs were approved for further examination in the Sub-reports.

Industry Sectors

With regard to the sectors, the jobs chosen are included in the list below, representing the areas of greatest interest for observation by the LCAMP:

- Machine tools (Mechanical Engineering)
- Automotive
- Aerospace
- Electric and Electronic Industries
- Transport
- Maritime.

The sectors have been defined by the EU Commission (European Commission, n.d.).

Jobs Impacted

The analysis is built by analysing which and how tasks are impacted by the Digital and Green transition trends identified in the previous Report (lcamp.eu/wp-content/uploads/sites/53/2023/07/D3.2-Observatory_reportN1-2.pdf) (Danton & Hudak, 2023). Below is the reviewed list:

Table 2 : list of transition trends

TREND REF	DIGITAL TRANSITION TRENDS
1-1	Internet of Things (IoT) / Smart Sensors / 5G technology
1-2	Artificial Intelligence (AI) / Machine learning / Big Data Analytics
2-1	Virtual and Augmented Reality
2-2	3D scanning
3-1	Cybersecurity
3-2	Edge Computing vs Cloud Computing / Blockchain for Supply Chain / Quantum Computing
4-1	3D Printing/Additive Manufacturing
4-2	Robotics and Automation
4-3	Collaborative Robots (Cobots)
4-4	Digital Twins
4-5	Adaptive Manufacturing Systems
4-6	Predictive Maintenance
TREND REF	GREEN TRANSITION TRENDS / SUSTAINABLE MANUFACTURING
5-1	Renewable Energy Integration
5-2	Circular Economy
5-3	Energy Efficiency
5-4	Waste Reduction
5-5	Green Logistics and Supply Chain

5-6	Sustainable Material Innovation
5-7	Carbon Footprint Management
5-8	Eco-friendly Packaging
5-9	Biomimicry in Design
5-10	Sustainable IT Infrastructure
5-11	Environmental Monitoring and Reporting
5-12	Corporate Social Responsibility (CSR) Initiatives

Employability

Based on common European reports, available regional reports, regional surveys, and other regional methodologies (refer to the following tables), it has been verified that the selected jobs are in high demand and/or experiencing rapidly increasing demand.

Smart Specialisation Strategy

It was necessary to confirm that the selected jobs are relevant to the Smart Specialisation Strategy (European Commission, n.d.) in the respective country.

Education Levels

LCAMP is focused on advanced manufacturing for the European VET and HVET Education systems. According to the European Qualifications Framework (EQF) (Europass, n.d.), education levels from EQF3 to EQF6 are covered by VET and Higher VET Education systems.

Then it is validated that selected jobs can be performed at EQF 3 to 6 level.

3.2. STAGE 02 AND 03 SEARCH & INFORMATION GATHERING AND ANALYSIS

Consortium partners employ various methodologies within the Technology Surveillance and Competitive Intelligence systems. The information-gathering strategy outlined in the Observatory incorporates the best practices from these methods. It adapts their use according to the observation targets, as detailed in the D3-1 Observatory Methodology document. (Danton-b, 2023).

In this section, the methodologies and tools to be used by partners are described. There are also some software and IT applications that could be used by the project if tailored to LCAMP requirements: The section classifies as follows:

- Different methodologies, and how they are used.
- Software or other tools used in each methodology (if any).
- When each methodology or combination of those is used.

During this second year of the project, and specifically its analysis phase, the Observatory is based mainly on secondary research activities, to do desk research activities, which have a predominant role in the Observatory.

1. Web Scraping, "Real-time" information.
2. Publications, Professional magazines, clusters' reports, etc.
3. EU project's results review.

Desk research activities were conducted at the national level in the LCAMP partner countries of France, Germany, Italy, Slovenia, Spain, and Turkey. Based on these regional and national

desk research efforts, national reports were produced. This forms part of Stage 04: Extracting Value & Report Creation.

3.2.1. EXTRACT VALUE & REPORT CREATION

It proceeds in two steps:

- **Step 1:** Sum up all jobs' impacts within the following document:

Table 3 : Tasks and skills impacted related to occupation.

OCCUPATION REFERENCE	OCCUPATION TITLE	TASK	IMPACTING DIGITAL TECHNOLOGY AND/OR GREEN TRANSITION	IMPACT DESCRIPTION	RELATED NEEDED SKILLS/ KNOWLEDGE IMPACTED	EXPECTED TENDENCY FOR SKILL EVOLUTION	SKILL TYPE	MATURITY LEVEL TO REACH	SKILL ESCO URL	SKILL DESCRIPTION
Code of the occupation in ESCO	Specify the Occupation title (Preferred Term)	Name of task	Reference s from « D3.2 M12 » reviewed (see table provided below)	Main impacts identified on this task	If Skill available in ESCO data base: ESCO Skill name.	Code of the skill in ESCO	Skill/ knowledge	L4 (Expert) Bloom descriptors: (create, evaluate, analyse, apply, understand, remember) L3 (Intermediate+) Bloom descriptors: evaluate, analyse, apply, understand, remember) L2 (Intermediate) Bloom descriptors: (analyse, apply, understand, remember) L1 (Basic/Beginner) Bloom descriptors: (apply, understand, remember)	If Skill availa ble in ESC O data base: http:// dxxx	If Skill available in ESCO data base: ESCO Skill description. If not indicate skill description.

- **Step 2:** Write the relevant sub-report with all the detailed information.

CoVEs for Advanced Manufacturing | #LCAMP_EU

3.2.2.VALIDATION PROCESS

The validation process assures the quality of the reports generated within the Observatory.

The process of validation of the results of the analyses carried out by the Observatory must be very exhaustive. The credibility of the results published is based on three pillars.

1. The contrasted quality of the sources used.
2. The transparency of the process of analysis of information.
3. The validation of the conclusions by authorities with expertise in the relevant fields.

Considering the high relevance of the validation process, it is carried out on 3 levels:

1. Internal validation at a thematic team level and/or at regional level.
2. Validation at consortium level.
3. External validation carried out by panels of experts.

Internal Validation

The Observatory's steering group approves the reports. The final internal evaluation is led by the Observatory leader and co-leader, that are *Mecanic Vallée* (MV).

The internal validation is a prerequisite to call the panel of experts and continue with the external validation steps.

Panel of Experts

An international panel of experts was created during the first year of the project. This panel has to approve the conclusion and finding to be included in the reports elaborated in the LCAMP Observatory.

Composition, duties, frequency and timing of the panels of experts was already described in the D3-1-Observatory Methodology" document (Danton *et al.*, 2023).

Once the research teams of the LCAMP Observatory established the main conclusions and findings to be included in the reports of the observatory, and after the validation of those reports by the Observatory's steering group, the regional panel of experts met and approved the findings.

Each panel decided the format of their meetings and the methodology.

The reports by the LCAMP partners documented the findings and conclusions from the panel discussions. The respective partner prepared the final regional report to be submitted to the observatories' steering committee. To enhance communication, stimulate collaboration, and collect feedback for final validation, each country was encouraged to adopt a review process using shared tools that facilitate the examination of documents and statements.

3.3. STAGE 05 COMMUNICATION

All sub-reports are shared with Work Packages 5 and 8 (WP5 and WP8). They are designed to be practical and structured for use by WP5 and WP8. The subsequent tables titled "Tasks and Skills Impacted Related to Occupation" (e.g., Table 12), which summarize the impacts on all jobs, serve as a database for both WP5 and WP8.

3.4. LOCAL SPECIFICITIES

Due to the unique context of each country, the general methodology was clarified and/or adjusted as needed. These modifications are detailed in the respective sub-reports. Below is a summary of these adjustments.

In the Basque Country the research methodology combines a) an analysis of regional reports; b) a selection of jobs for the analysis; c) interviews with companies.

In Italy and France, a combination of these specificities / clarification was applied.

In Germany, the analysis follows a mixed academic approach that aims to combine different methods. AI was used to identify a trend and provide supporting data. Business surveys were conducted to confirm the results and gain further insights. This comprehensive approach allows a broad understanding of the issue to be developed and sound conclusions to be drawn.

In Turkey, the development of the report follows a methodology that is in line with other partners' approach. In terms of selecting the jobs, the Smart Specialisation Strategy for Turkey was considered as the main source while the outline of the jobs inspected in this report were decided after discussions and distribution among other project partners from different countries.

Analysis of the impacts were carried out by the Turkish project partners from different backgrounds and occupations, trying to cover as much variety as possible and consider each and every aspect.

The emerging report was validated by experts from the advanced manufacturing sector by sharing the draft version and gathering feedback / using a Survey Tool where individual statements from the report are converted into a survey to make the validation process easier for the experts.

4. REFERENCES

Danton, H., Ayani, M., Burgoa, L., Burman, R., Arslan, F., Gale, R., Handman, M., Ipek, E., de Lamo Blas, I., Le Bras, A., Milosevic, V., Minto, G., Molinero, J. C., Otaño, A., Rupp, K.-D., Solaberrieta, L., & Venet, N. (2023, June). *Observatory Report N1 (LCAMP Deliverable 3.2)*. LCAMP Partnership. https://lcamp.eu/wp-content/uploads/sites/53/2023/07/D3.2-Observatory_reportN1-2.pdf

Danton, H., & Hudak, R. (2023, March). *Observatory Methodology (LCAMP Deliverable 3.1)*. LCAMP Partnership. https://lcamp.eu/wp-content/uploads/sites/53/2023/07/D3-1-Observatory-Methodolgy-Final-version-1.pdf

Description of the eight EQF levels | Europass. (n.d.). Retrieved 4 September 2024, from https://europass.europa.eu/en/description-eight-eqf-levels

Home. (n.d.). LCAMP. Retrieved 4 September 2024, from https://lcamp.eu/

Sectors—European Commission. (n.d.). Retrieved 4 September 2024, from https://single-market-economy.ec.europa.eu/sectors_en

Smart Specialisation Platform. (2019, September 26). Smart Specialisation Platform; European Commission. https://s3platform.jrc.ec.europa.eu

5. INDEX OF ILLUSTRATIONS

CoVEs for Advanced Manufacturing | #LCAMP_EU

6. INDEX OF TABLES

LCAMP

Learner Centric Advanced Manufacturing Platform

**Co-funded by
the European Union**