



Learner Centric Advanced Manufacturing Platform



ROBOTICS

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. MOBILE ROBOTICS IN ADVANCED MANUFACTURING FACTORIES

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

In recent years, great technological advances have been made in areas such as the Internet of Things, Big Data and artificial intelligence. These advances have a direct impact on robotics and make the level of autonomy that a robot can have increased considerably. This autonomy includes the possibility of learning or mapping spaces and having the ability to move through them, without the need for human intervention; that is, go from one point to another point, being able to avoid the different obstacles that may be on the way¹.

In the manufacturing industry, where good intralogistics is necessary, mobile robots can play a very important role. Although today the use of mobile robots in the industrial sector in the Basque Country is low, it is probable that mobile robotics will gain more and more prominence as new technologies are incorporated to improve production processes.

For this reason, it is essential that knowledge about autonomous and mobile robotics be worked on in vocational training in the Basque Country.

The following sections will be discussed below:

- The current state and problems of intralogistics in the industry.
- Solutions and advantages offered by mobile robotics for intralogistics.
- The current state of the Euskadi Vocational Training regarding autonomous and mobile robotics.

2.1.1 PROBLEM STATEMENT

Intralogistics in the industry has been and continues to be in most cases, a task carried out by people; people who carry the weight of work tools or material directly on their body or using carts, tugs and forklifts. This way of operating has several disadvantages:

¹ Robotnik, « Robots móviles y Industria 4.0: automatización y flexibilidad », *Robotnik* (blog), 12 janvier 2021, <https://robotnik.eu/es/robots-moviles-en-la-industria-4-0-automatizacion-y-flexibilidad/>.



- Highly qualified workers spend time on intralogistics tasks that do not have added value. Many human errors are made, depositing materials in the wrong places and using methods that can put the safety of personnel at risk.
- It is very difficult to track the material: know its location, quantities, how long it has been on that site, etc.
- Transportation is not flexible, since it is very difficult to handle a variety of products.

These inefficiencies directly affect the production process of the company, causing possible losses, both economic and human.

2.1.2 MOBILE ROBOTICS SOLUTIONS FOR ADVANCED MANUFACTURING

The use of mobile robotics in industrial intralogistics solves many of the problems discussed in the previous section. Here are some of the benefits it offers:

- Skilled workers will dedicate themselves to those tasks that add value.
- Human errors are eliminated, optimizing space and protecting the physical integrity of workers, preventing them from moving heavy weights or harmful materials.
- The traceability of the material will be inherent to intralogistics.
- Has the ability to easily adapt to changing production needs.

Clearly, AMR fleet-based intralogistics solutions are a trend and are already sufficiently consolidated from a technological point of view. Therefore, there are already many manufacturers and providers of this type of solution on the market.

Mobile robots designed for industrial intralogistics are called AMR² (Autonomous Mobile Robot). These robots are equipped with multiple sensors: cameras, lidar, ultrasound, etc. Through these sensors, they learn the map of the place and in this way they are able to move through space autonomously, choosing the optimal route for each trip. The routes are flexible, so that if an obstacle gets in the way, the robot is able to detect the obstacle, avoid it and recalculate an alternative route to reach its destination.

² RdR, « ¿En qué destaca el nuevo controlador de robots AMR de Omron? », *REVISTA DE ROBOTS* (blog), 2 mars 2022, <https://revistaderobots.com/robots-y-robotica/en-que-destaca-el-nuevo-controlador-de-robots-amr-de-omron/>.





Figure 1 : Autonomous Mobile Robot

The key for a company's intralogistics to be as efficient as possible is to have a fleet of AMR robots and that the individual behaviour of each robot contributes so that the joint behaviour of the fleet is optimal. That is to say, that the robots work collaboratively, not only with the rest of the robots, but also sharing space and interacting with the company's personnel. For this, mobile robot systems have fleet management software, which can be accessed from any location and using any type of device. From the fleet manager it is possible to carry out the following actions:

- Monitor the status of all robots and collect relevant metrics or data and display them on a dashboard. Identifying bottlenecks or critical points on which action must be taken to optimize intralogistics.
- Plan missions and routes, to minimize transport times and improve route efficiency. Said orchestration may be graph-based.
- Optimize the use of time, maximizing the autonomy times of the robots, avoiding downtime or production stops.

Although in its infancy, there are also a small number of vendors developing and offering mobile robots that incorporate a collaborative robotic arm. In this way, the robot is made more versatile and can carry out more complex tasks: picking up and depositing material at different heights, loading and unloading the AMR, pressing buttons to open doorways or elevators that get in the way of planned route, etc.





Figure 2 : Collaborative robotic arm

2.1.3 EUSKADI VOCATIONAL TRAINING REGARDING AUTONOMOUS AND MOBILE ROBOTICS

Although industrial robotics is a deeply rooted subject and is dealt with in various cycles and specialization courses in the Euskadi FP, work is carried out exclusively with collaborative robotic arms, since in the environment industry it is the most abundant. Therefore, students do not acquire skills related to autonomous and mobile robotics for industrial environments.

However, the Council of Ministers, at the proposal of the Ministry of Education and Vocational Training, on 10/25/2022, approved the Royal Decree establishing the Higher-Level Vocational Training Specialization Course in Collaborative Robotics³ ⁴. One of the professional modules that make up this course is dedicated to mobile and autonomous robots. Among the different learning outcomes of this professional module, mention is made of the acquisition of skills related to environment mapping, autonomous navigation, creation and establishment of missions, the implementation of the fleet manager, etc.

³ « El Gobierno crea un nuevo curso de especialización en robótica colaborativa », 25 octubre 2022, <https://www.educacionyfp.gob.es/prensa/actualidad/2022/10/20221025-cursorobotica.html>.

⁴ « BOLETÍN OFICIAL DEL ESTADO N 273 » (BOLETÍN OFICIAL DEL ESTADO, 14 novembre 2022), https://ivac-eei.eus//upload/sp/documentos/291/ele_ce3_rob_col_rd.pdf.



Along with this specialization course, a new framework of possibilities opens up to be able to work on skills related to mobile autonomous robotics for industrial environments and achieve students aligned with industrial digital transformation and advanced manufacturing.

2.1.4 STATEMENTS

After carrying out this analysis on the current problems of intralogistics, the technological trend in mobile robotics for industrial environments and the current state of skills related to mobile robotics in Euskadi FP, it is possible to conclude some of the following conclusions:

- Intralogistics is one of the key points of a company. The more efficient intralogistics is, the better the company's production process will be and economic losses and exposure of operators to accidents will be avoided.
- Mobile robotics is a technology that can perform intralogistics tasks efficiently; the transfer of material is achieved safely, with traceability, without waiting times, etc.
- Knowledge and skills on industrial mobile robotics are a field to be addressed in Euskadi FP. And the new specialization course offers the opportune opportunity for this.



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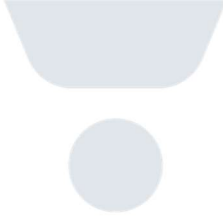


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