



Learner Centric Advanced Manufacturing Platform



SIMULATION OF MANUFACTURING PROCESSES IN VOCATIONAL TRAINING

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



CONTENT TABLE

- CONTENT TABLE 5
- EXECUTIVE SUMMARY 6
- 1. INTRODUCTION..... 7
- 2. TOPICS: SIMULATION OF MANUFACTURING PROCESSES IN VOCATIONAL TRAINING 8
 - 2.1 Simulation of Manufacturing Processes 8
 - 2.1.1 Basics of Simulation 8
 - 2.1.2 Applications and Benefits 8
 - 2.1.3 Challenges and Limitations..... 9
- 3. CONCLUSION 10
 - 3.1 Connection with Vocational Education 10
 - 3.2 Recommendations and next steps..... 10
- 4. REFERENCES..... 12



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. TOPICS: SIMULATION OF MANUFACTURING PROCESSES IN VOCATIONAL TRAINING

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 SIMULATION OF MANUFACTURING PROCESSES

Simulation of manufacturing processes is the use of computer-aided tools to imitate real-world manufacturing processes in a virtual environment. This technique has become increasingly popular in the manufacturing industry as it provides an efficient way to design, optimize, and analyse manufacturing processes. The purpose of this report is to provide an overview of simulation in manufacturing processes, its applications, benefits, challenges, and limitations, and its connection with vocational education.

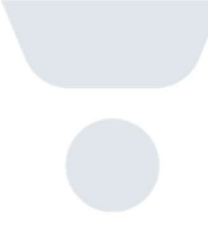
2.1.1 BASICS OF SIMULATION

Simulation is the process of modelling a real-world system or process to predict its behaviour under different conditions. In manufacturing processes, simulation is used to create a virtual representation of a manufacturing system, which can be used to identify and optimize process parameters, reduce production time, and improve product quality. There are different types of simulation used in manufacturing processes, including discrete event simulation, continuous simulation, and agent-based simulation. Each type of simulation has its advantages and limitations, depending on the application.

2.1.2 APPLICATIONS AND BENEFITS

Simulation can be used in various applications in manufacturing processes, including virtual prototyping and product design, process optimization and performance analysis, training and education of personnel, and quality control and inspection. Virtual prototyping and product design allow engineers to test and validate the design of a product in a virtual environment before producing it. Process optimization and performance analysis help to identify bottlenecks, reduce cycle time, and improve process efficiency. Training and education of personnel can be





enhanced through simulations that provide realistic scenarios that trainees can interact with. Quality control and inspection can be improved by simulating the inspection process, reducing the need for physical inspection and improving the accuracy of inspection.

Simulation provides numerous benefits to manufacturing processes, including cost savings and time efficiency, reduction of errors and waste, and increased product quality and innovation. Simulation can reduce the need for physical prototypes and testing, reducing material and labor costs. Simulation can also help reduce the time needed to develop and optimize a manufacturing process, reducing time-to-market. By reducing errors and waste, simulation can improve product quality and reduce the number of defective products produced. Finally, simulation can help drive innovation by allowing engineers to explore new designs and concepts quickly and cost-effectively.

2.1.3 CHALLENGES AND LIMITATIONS

While simulation has numerous benefits, there are also challenges and limitations that need to be addressed. Some of the challenges include data acquisition and management, integration with existing systems and processes, and costs and expertise. Data acquisition and management are essential to ensure the accuracy of the simulation. Integration with existing systems and processes can be a challenge, especially if there are complex legacy systems in place. Finally, costs and expertise can be a barrier to adopting simulation, as it requires specialized software and personnel.



3. CONCLUSION

Simulation technology is a powerful tool that can help manufacturers optimize their production processes, reduce costs, and improve efficiency. While there are challenges to implementing simulation technology, the benefits are numerous, and the future prospects are promising. Additionally, simulation technology is becoming an increasingly important part of vocational education, providing students with the skills necessary for a successful career in manufacturing. To fully leverage the capabilities of simulation technology, it is important for manufacturers and vocational schools to invest in simulation software and ensure that their students have the skills necessary to succeed in the manufacturing industry.

3.1 CONNECTION WITH VOCATIONAL EDUCATION

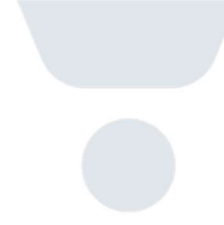
Simulation has a vital role to play in vocational education, providing students with a practical and realistic learning experience that is difficult to achieve through traditional methods. By incorporating simulation into vocational education, students can gain practical experience and skills, which can be transferred to real-world manufacturing processes. Simulation can be used to train students in different manufacturing processes, from assembly line production to CNC machining. Simulation can also be used to teach safety protocols and practices, which are essential in the manufacturing industry.

3.2 RECOMMENDATIONS AND NEXT STEPS

To fully leverage the capabilities of simulation in vocational education, several recommendations and next steps should be considered.

- Develop and implement simulation-based training programs: Vocational education institutions can design and implement simulation-based training programs that enable students to gain hands-on experience in manufacturing processes without the risk of damaging equipment or harming themselves. Such programs can be customized to the needs of the students and the industry they will be working in.
- Collaborate with industry partners: Vocational education institutions should collaborate with industry partners to design and develop simulation models that reflect real-world manufacturing processes. Such collaboration can also help ensure that the training programs are aligned with the latest industry trends and practices.
- Encourage lifelong learning: Vocational education institutions should encourage students to engage in lifelong learning by providing access to additional training programs and resources that allow them to stay up-to-date with the latest technological advancements in manufacturing processes.
- Invest in technology: Vocational education institutions should invest in the latest simulation technology to create realistic and immersive learning environments that





replicate actual manufacturing processes. This can help students to develop the skills needed to operate and maintain the latest manufacturing equipment and technology.

- Evaluate and improve the effectiveness of simulation-based training programs: Vocational education institutions should evaluate the effectiveness of their simulation-based training programs regularly to identify areas for improvement. This can help ensure that the training programs are effective in preparing students for the demands of the industry.



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