



Learner Centric Advanced Manufacturing Platform



PLATFORM ROADMAP 2.0 - UPDATE

WPN° 8 - Platform for Learner Centric Advanced Manufacturing



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0.9		Final version for revision process
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GLOSSARY AND/OR ACRONYMS

AGV - Automated Guided Vehicles
AI - Artificial Intelligence
AM - Advanced Manufacturing
AR - Augmented Reality
Cedefop - European Centre for the Development of Vocational Training
CLF - Collaborative Learning Factory
CoVE - Centres of Vocational Excellence
DFMA - Design Failure Mode & Effect Analysis
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
ERP - Enterprise Resource Planning
ESCO - European Skills, Competences and Occupations
ETF - European Training Foundation
EU - European Union
EXAM4.0 - Excellence Advanced Manufacturing 4.0
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
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

This third version of the LCAMP Platform Roadmap outlines ongoing development of the platform, including infrastructure updates, user journeys, and quality processes. It highlights the launch of the Open Innovation Community and the Learning Factory Toolkit, supporting VET institutions in adopting Industry 4.0. The roadmap ensures coordinated progress and future alignment with EU education initiatives.

This is a working document (3rd version) which is used to prepare the complete roadmap for the LCAMP platform. As such, this document is subject to change and will keep developing until the end of the project.

In its final form, this document will incorporate:

- A high-level development roadmap, including prioritization of features.
- Detailed sprint planning with technical requirements for all user journeys/stories; and
- Instructions for a bug tracking and resolution report system.

It will also include the content management strategy with definitions of:

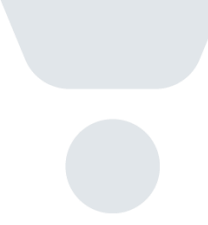
- Types of content to be uploaded to various parts of the platform.
- List of people and teams responsible for generating content, in which format and volumes the content shall be generated and according to which schedules.
- Quality assurance / acceptance criteria for content; and
- Policies for localization and translation of content.

The current version (3.0) of the roadmap includes the updates carried out on the LCAMP website/platform infrastructure, highlighted user journeys, infrastructure components, tool requirements, highlighted use cases, the process timeline, and the internal quality assurance processes.

The platform has successfully achieved milestone MS8 (Open Innovation Community is created inside the Alliance and has a collaboration space in the LCAMP platform) with the creation and launch of the Open Innovation Community, providing a dedicated collaboration space that connects VET institutions, SMEs, and research organizations through active project-based partnerships. This community demonstrates practical innovation collaboration through real-world projects including advanced manufacturing system development and cross-border educational partnerships.

Additionally, the platform has successfully completed deliverable D6.2 through the development and deployment of a comprehensive Learning Factory toolkit that supports VET and HVT institutions in implementing Industry 4.0 technologies for advanced manufacturing education. This web-based toolkit represents a significant technical achievement, incorporating a sophisticated self-assessment questionnaire that evaluates institutional readiness across four critical dimensions: learning methodologies, learning programs, value chain integration, and equipment digitalisation. The toolkit operates in six languages and provides automated maturity assessments, personalized improvement recommendations, and structured implementation





roadmaps that guide institutions through the complex process of upgrading their laboratories to meet advanced manufacturing industry demands. This deliverable demonstrates the platform's evolution from a simple information repository into an intelligent advisory system that actively supports institutional development and capacity building across the European vocational education landscape.

These proven capabilities position the LCAMP platform as a foundation for future integration with emerging European education initiatives, including potential connections to the European Education Area digital infrastructure and alignment with upcoming Industry 5.0 workforce development programs.

A good roadmap leads to a good product development process, which in turn leads to a good LCAMP platform. It contributes to a smooth cooperation of work package partners, ensuring clarity when it comes to the data required and needs met for the LCAMP platform.



1. INTRODUCTION

The LCAMP Platform roadmap outlines and supports both predicted and current user journeys, structuring the platform's development around real-world use cases. It also captures the platform's evolution from basic infrastructure into a sophisticated ecosystem of interconnected tools and services.

The platform's core sections serve distinct but interconnected purposes. The Skills & Jobs Observatory enables employers with workforce development insights. The Learner-Centric Training section connects educators, courses, and career pathways within advanced manufacturing.

Two major achievements demonstrate the platform's maturity beyond basic functionality. The Open Innovation Community operates as an active collaboration environment where VET institutions, SMEs, and research organizations engage in real-world innovation projects, showcasing practical collaboration through ongoing advanced manufacturing initiatives. The Learning Factory Self-Assessment Tool provides comprehensive institutional evaluation across four critical dimensions, delivering automated assessments and improvement recommendations in six languages.

Additional sections including News, Library, and Contact support ongoing community engagement and resource sharing.

Through these interconnected functionalities, the LCAMP platform serves as a comprehensive hub for information exchange, active collaboration, skills development, and institutional capacity building within the advanced manufacturing domain.

Our goal is to create easy to use and intuitive LCAMP tools and a stable and secure infrastructure for the platform. These will allow both the partners who are providing the data and the end users, who will ultimately 'give life' to the LCAMP platform, to populate the platform and ensure its real-world usability.

This document is written in an easy-to-understand language and contains explanations of more complex terminology used.

The IT architecture is divided into two parts: (1) the infrastructure and (2) the application layer, which are segmented into further sub-parts providing more detail.

Keep in mind that this document is a working document, directly connected to the development of the platform, and as such, it is subject to change. In other words, we are developing a large and complex IT platform, and if during this process, which is still in the initial stages, we find that we need to change some things to better serve the platform, we reserve the right to do so in the interest of the LCAMP project.



2. INFRASTRUCTURE

2.1. WEBSITE INFRASTRUCTURE BASICS

The most basic representation of a website infrastructure is split into the infrastructure and the application layer.

The infrastructure layer: The infrastructure layer consists of the physical and virtual components used to host and run a web application using cloud providers (Google Cloud Platform) and hosting services (Kinsta¹).

The application layer: The application layer consists of the programs and components that are used to build a web application. If we break these down further, the layers comprising a website and its entire infrastructure are the following:

- **Web Server:** A web server is a system that stores, processes, and delivers web pages to the users when they request them. Examples of web servers include Nginx, Apache, IIS, and Microsoft Azure.
- **Database:** A database is an organized collection of data needed to run the web application on the platform. Examples of databases used for websites include MySQL, PostgreSQL, MongoDB, and Microsoft SQL Server.
- **Application Server:** An application server is a program that supports the execution of applications on the web page. Separate application servers are used to run different components of the platform.
- **User Interface:** The user interface is the graphical layer of the website that allows users to interact with the web application. User interfaces are created using programming languages like HTML, CSS, JavaScript, and React.
- **Security:** Security measures to protect websites from common threats and malicious attacks. Examples of security measures include firewall protection, user login and authentication, data encryption, and daily backups.

2.1.1.HOW A WEBSITE INFRASTRUCTURE IS STACKED:

Bottom to top:

- **Web Server:** The LCAMP platform is hosted on Kinsta, which is a cloud-based hosting provider. The LCAMP platform is hosted on cloud-based web server infrastructure powered by Nginx and Google Cloud Platform.
- **Database:** The LCAMP platform stores most of its data using MySQL. Some components of the LCAMP platform require a separate database which is setup in PostgreSQL.
- **Application Server:** Some components of the LCAMP platform require separate servers to run its web applications (Zoho Cloud and AWS LightSail).
- **User Interface:** The user interface of the LCAMP platform is created with HTML and CSS using an advanced block builder. Individual components of the LCAMP platform that require a custom user interface are developed in React.

¹ The Most Important Things You Should Know About Kinsta



- **Network Infrastructure:** The backend and frontend components of the LCAMP platform are developed on separate development servers hosted in Amazon Lightsail bundle of hardware and software connecting the whole stack
- **Security:** The LCAMP platform is protected with various password-protected levels of access and other default security measures provided by the hosting provider. The website is automatically backed up daily, which enables us to restore the website to a previous state in case of data loss or corruption.

2.1.2.CONTENT MANAGEMENT SYSTEM

A CMS (Content Management System) is a software application designed to create, manage, and publish content for websites and web applications. LCAMP is using WordPress², a popular open-source content management system.

WordPress is one of the most popular CMS solutions due to its ease of use, scalability and large number of plugins and themes (see Figure 1). It has a wide range of features and plugins that make it easy to create and manage websites. Because of its versatility and reliability, it can be serviced by many developers. This significantly lowers the maintenance risk factors due to lack of qualified developers.

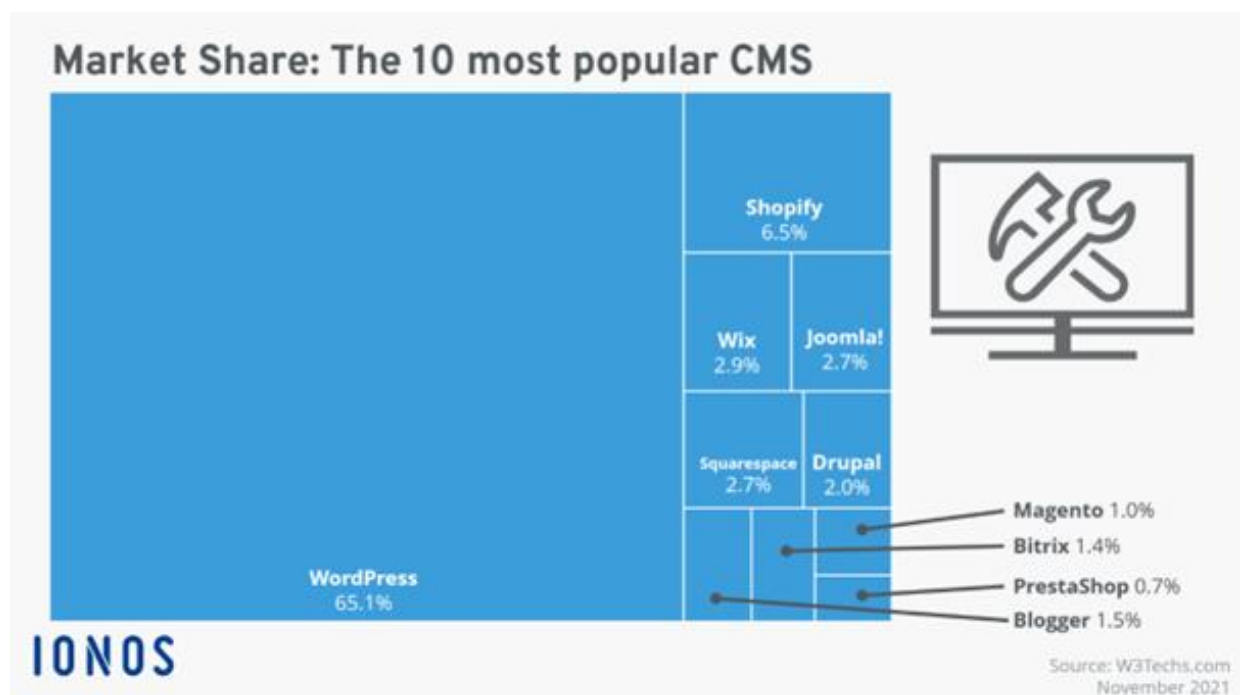


Figure 1: CMS 2021 market share, showing WordPress as the popular choice.

2.1.3.DEVELOPMENT STAGES

Development stages are the stages through which a typical web-based project goes through in the following order:

- **Development:** The development layer is the initial layer where all the content is created and tested prior to being released. This layer is typically used for content creation, testing, and debugging.

² <https://wordpress.org>



- **Staging:** The staging layer is the middle layer in the lifecycle of a website. It is used to prepare content for publication and to ensure that it functions correctly. This layer often includes a copy of the website that is hosted on a production server.
- **Production:** The production layer is the final layer in the lifecycle of a website. This layer is used to host the live version of the website and is typically the version of the website that is publicly available and with which the website users interact.

2.1.4.MANAGEMENT APPLICATIONS AND SOFTWARE

For project management we are using the broader suite of Zoho management applications to streamline our project planning and task management processes. Zoho's user-friendly interface, integrated suite of tools, and cost-effectiveness make it an ideal choice for our needs. With extensive customization options, scalability, and responsive customer support, we are confident in Zoho's ability to meet our requirements while ensuring data security and compliance.

Zoho's suite of tools include but is not limited to:

- **Zoho Projects:** a comprehensive project management tool that facilitates efficient planning, tracking, and collaboration on tasks and projects.
- **Zoho Mail:** a mailing service used in combination with ZeptoMail for optimized delivery of important transactional emails. The LCAMP domain email will be set up with this tool.
- **Zoho Analytics:** used to prepare and analyse data, as well as to create dynamic data visualizations ready to be embedded straight to the LCAMP website pages.
- **Zoho Creator:** a low-code application development platform used to design, develop, and run custom business software, that will be used to create basic components of the LCAMP Platform that don't require custom frontends like the Course Table.

To learn more about the wide array of Zoho apps visit Explore All Products | Zoho (<https://www.zoho.com/all-products.html>).

2.2. LCAMP WEBSITE INFRASTRUCTURE

2.2.1.LCAMP INFRASTRUCTURE LAYER

At infrastructure level, LCAMP platform is using Kinsta hosting service, which offers a scalable cloud instance deployed on the Google Cloud Platform. All management operations are done through the Kinsta Control Panel. More information about the Google Cloud Platform can be found at <https://cloud.google.com/> and information about Kinsta can be found at <https://kinsta.com/>.

We are running an adapted LAMP infrastructure³. LAMP is a good choice for web development because it is reliable, secure, and easy to use. It is also cost-effective, as all the components are freely available. Some of the popular sites built on that type of infrastructure include Wikipedia, Amazon, Facebook, and Google. LAMP stands for Linux, Apache, MySQL, and PHP

³What is LAMP Stack? | What is LAMP Used For? | ServerWatch



– a combination of open-source software technologies that are frequently used in web development:

- **Linux is the operating system.** It is a secure and reliable operating system that can be used to host a variety of applications.
- **Nginx is the web server.** A web server alternative to Apache that can serve static content as well as dynamic content and is performance-optimized for hosting WordPress sites⁴.
- **MySQL is the database.** It is a powerful database that is capable of handling complex queries.
- **PHP** is the scripting language that is used to build dynamic web pages and applications.

The servers are configured to auto-scale based on demand, meaning they will increase or decrease the resources available to the server in response to changes in traffic or usage.

Additionally, we implement the Kinsta content distribution network to enable delivering assets from edge servers around the world using Cloudflare's secure firewall and IP-based protection provided with the Google Cloud Platform firewall⁵.

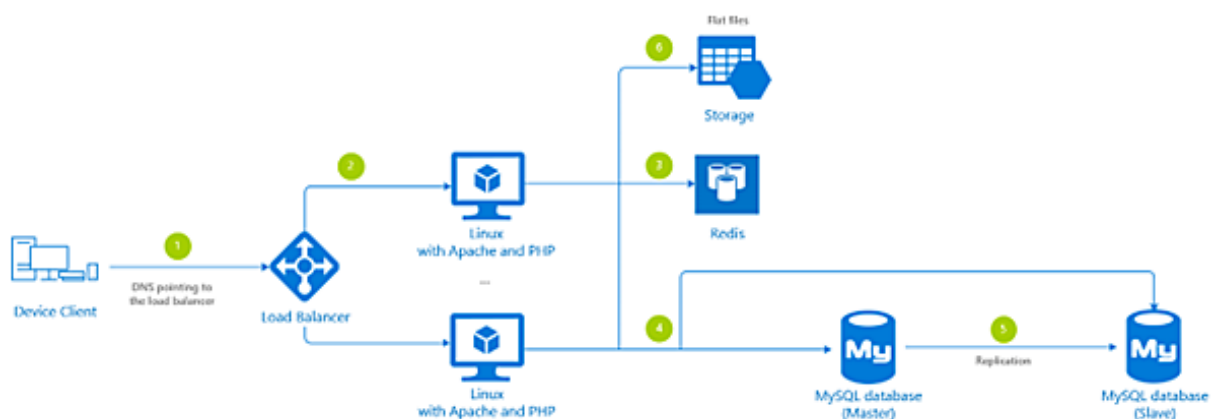


Figure 2: An example of the LCAMP architecture.

2.2.2.SCALABILITY

Scalability means being able to decrease or in most cases increase the scope and size of a project infrastructure or the data layer. For example, being able to add a lot of new users or content etc. In case of LCAMP that could mean adding new advanced manufacturing courses, large number of new skills, adding users (educators, students, job seekers), and so forth.

When talking about scalability of cloud infrastructure, it is one of the main advantages of using cloud computing. With cloud-based solutions, businesses can easily scale up or down to meet their changing needs. This is done by adding or removing resources such as processing power or storage capacity. Cloud infrastructure can be scaled in both vertical and horizontal directions to accommodate increased demand. Vertical scaling involves adding resources such as more servers or storage, while horizontal scaling involves adding more nodes to the cloud system. The scalability of cloud infrastructure also allows businesses to easily adjust their computing

⁴[Nginx vs Apache: Which Web Server Is the Best? \(kinsta.com\)](https://kinsta.com/blog/nginx-vs-apache/)

⁵ 'Kinsta® Cloud Hosting - All Your Projects in One Platform'. Kinsta®, <https://kinsta.com/>. Accessed 29 Feb. 2024.



resources as their needs change, enabling them to quickly respond to market changes or customer demands. Additionally, cloud-based solutions are cost-effective and efficient, offering businesses more flexibility and control over their IT budgets.

2.2.3.LCAMP APPLICATION LAYER

The application layer is set up as a WordPress multisite instance, with the ability to create subsites for each LCAMP sub-application. With the multisite feature, administrators can create a network of sites with shared users, content, and themes. For more information about WordPress multisite, visit <https://wordpress.org/support/article/wordpress-multisite/>.

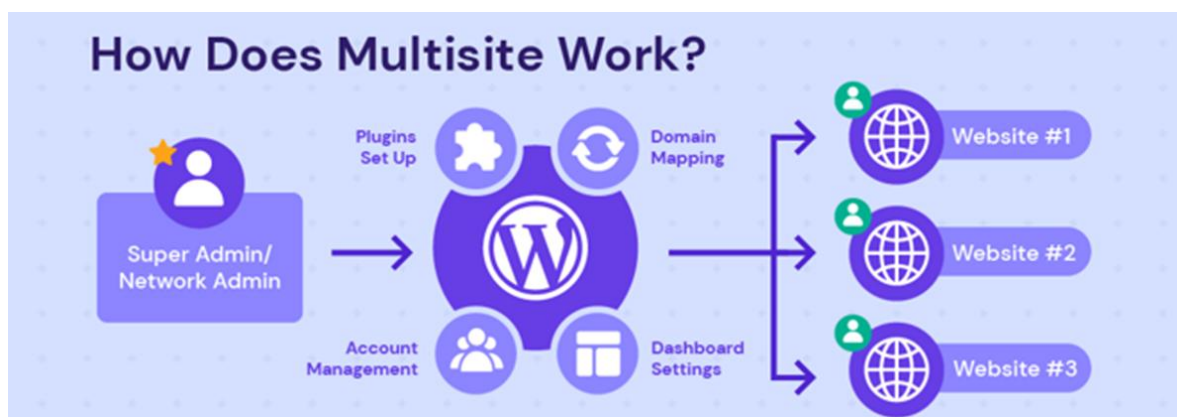


Figure 3: Example of a Multisite architecture.

A note on DAAS, IAAS

DAAS (Desktop as a Service) is a cloud-based service that allows users to access their desktop environment from any device with an Internet connection. It allows users to access their desktop applications, data, and settings from any location.

IAAS (Infrastructure as a Service) is a cloud computing model that allows websites to access and use computing resources such as storage, networks, and servers without having to manage the underlying infrastructure. IAAS allows websites to scale their infrastructure and access resources on demand.

For applications which are deployed in the Cloud in Zoho data centres in Amsterdam, we are implementing a low-code solution via Zoho Creator. Additional information is available in the 'Components' section of this document.

One of the applications created using Zoho Creator aPaaS is the Course Tool. As described in User Journeys and Use cases chapters, it will allow Course organizers to add lists of courses or each course manually, in accordance with the EC standards.



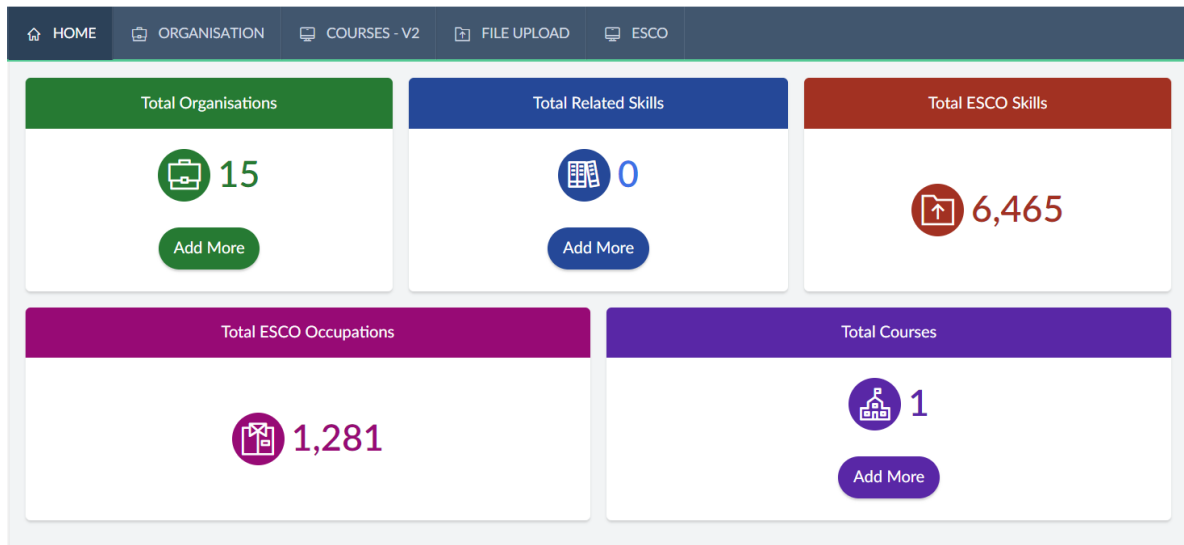


Figure 4: PrtScr from our Creator-based Courses app.

Statistics

For statistics we are implementing a Matomo Analytics server, also running as an application on the analytics.knowledgeinnovation.eu domain. Matomo is an open-source analytics platform that provides website owners with detailed reports on visitor interactions. More information about Matomo Analytics can be found at <https://matomo.org/>.

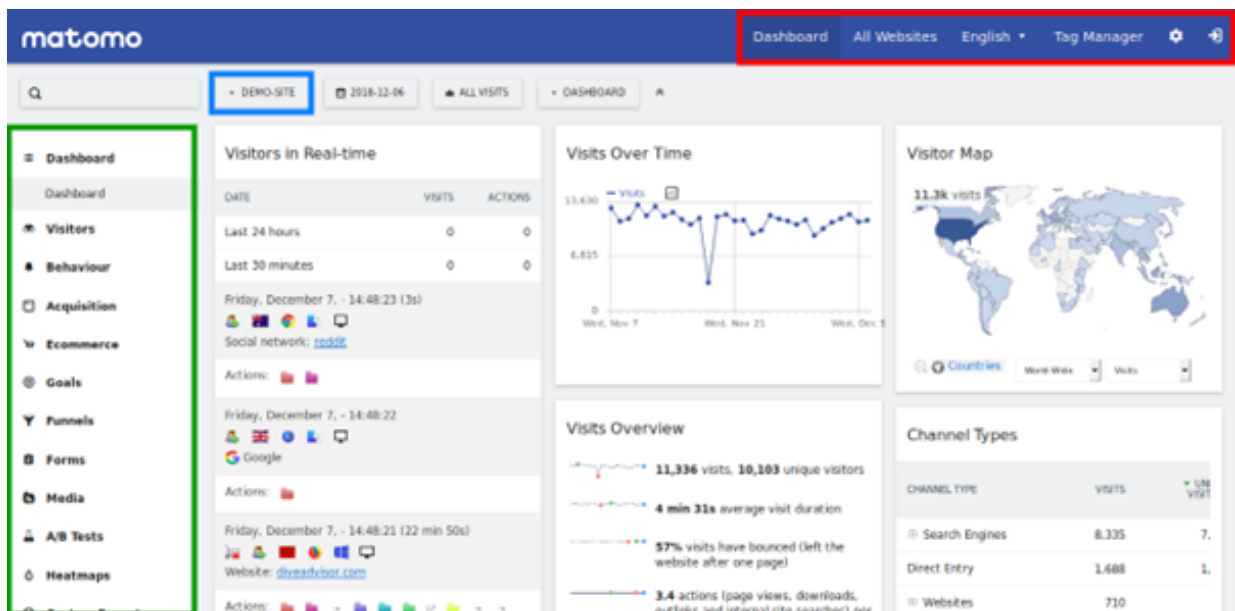


Figure 5: example of a Matomo dashboard.

2.2.4.LCAMP DEVELOPMENT

The LCAMP platform is currently in the development stage. In view of the large amount and variety of data we will have to handle and localize, we are also working on parts of staging in



parallel. The development stage for LCAMP consists of setting up the entire infrastructure layer for further development as well as setting up ways of gathering the standardized data about courses and skills from the partners.

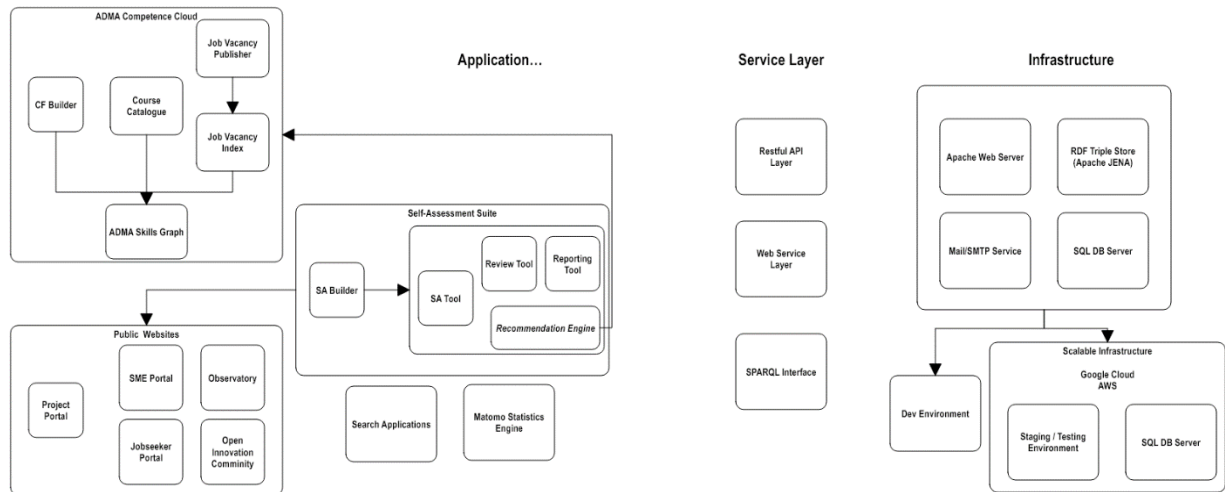


Figure 6: LCAMP complete architecture overview.



3. USER JOURNEYS

User journeys are a structured description and visual representation of a user's experience with an application.

They are used to help designers understand and plan out a user's experience from the moment they first open the application to the moment they complete the task they are trying to accomplish.

With LCAMP we identified five distinct user journeys that we are currently focusing on:

1. Employers publishing job openings
2. Educators providing courses.
3. Job seekers creating their skill profile.
4. Learning Factories assessing their competence.
5. Open Innovation Community

3.1. EMPLOYERS PUBLISHING JOB PROFILES

The tool for publishing job profiles within the LCAMP platform is aimed at employers who wish to define and share role requirements in the field of advanced manufacturing. By selecting the skills required for each job profile, the platform helps target suitable candidates. In all steps described below, the user is the employer.

3.1.1.EMPLOYER DESCRIBES THE JOB PROFILE

The user provides a title, or a description of a job opening, and is presented with a template library of similar job profiles. The templates provide an alternative title and/or basic description of the job profile based on input. User can parse the presented options by reading a basic description of the job profile, as well as a list of related skills broken up into two categories: **(1) required** and **(2) additional** skills.

The employer then has the option to:

- a) Select an existing job profile.
- b) Create a new job profile.

Employer selects an existing job profile.

The user can choose one of the proposed templates and confirm their choice. The user can then edit the description of the job profile.

Employer creates a new job profile.

If the user doesn't like any of the options the user may create a new job profile by providing a description of the job profile, filling in all the information manually.



3.1.2.EMPLOYER EDITS SKILLS LIST

The employer can **move** the skills from the Required skills list to the Additional skills list within the job description and vice-versa, is able to **add** new skills and to **delete** skills from the list. A job profile must have at least one associated (1) required and (1) additional skill.

After confirming the selection, if the job profile is different from the initial template, the job profile is stored in the template database to be reused for future job openings excluding all identifying information about who created the job profile.

3.2. OPEN INNOVATION COMMUNITY

To foster collaboration between Centres of Vocational Excellence (CoVEs) and Small and Medium Enterprises (SMEs) and enhance the role of VET/HVET institutions in applied research and development (R&D) activities, LCAMP has established a dynamic *Open Innovation Community* (OIC) under Work Package 4. This initiative directly supports Specific Objectives SO9 and SO10, aiming to both stimulate impactful innovation partnerships and clarify the contribution of VET/HVET to Advanced Manufacturing (AM) and Regional Smart Specialisation Strategies.

Hosted on the LCAMP platform, the OIC serves as a collaborative digital hub where stakeholders can connect and exchange knowledge around applied R&D. The platform is accessible via this link: <https://lcamp.eu/activity/an-open-innovation-community/>. It is actively managed by the WP4 OIC leaders in partnership with LCAMP consortium members.

This community showcases real-world, value-adding projects that reflect the synergies between education and industry, with a particular focus on the integration of Industry 4.0 technologies into VET and HVET environments. Projects are continuously updated and curated to demonstrate ongoing engagement and tangible results aligned with the LCAMP vision.

The OIC's development and operation correspond to two major milestones:

- **MS8 – Open Innovation Community Created:** The establishment of the OIC within the LCAMP Alliance and its dedicated space on the platform.
- **MS9 – Open Innovation Community Running:** The active operation of the OIC, evaluated through metrics such as the number of projects initiated, user satisfaction, and the submission of EU-funded proposals (e.g. Erasmus+, Horizon).

To further demonstrate the community's impact, Deliverable D4.2 documents several pilot initiatives involving SMEs, VET/HVET centres, and EU project submissions. The content uploaded on the LCAMP platform provides concrete evidence of these collaborative efforts and highlights the OIC's role in driving innovation, technology transfer, and regional development as follows:



1. General project

▶ PROJECT TITLE

IMPLEMENTATION COLLABORATIVE LEARNING FACTORIES

COURSE START

17/03/25

ESTIMATED DURATION (COURSES):

6

▶ THE PROJECT IS BASED ON SOME OF ADMA'S 7 TASKS ☒ YES ☐ NO

▶ IF YES, PLEASE SPECIFY WHICH ONE(S)

- ☐ T1: Advanced Manufacturing Technologies.
 ☐ T4: End-to-End Customer Focused Engineering
 ☐ T7: Value Chain Oriented Open Factory
☒ T2: Digital Factory.
 ☐ T5: Human Centred Organisation
☐ T3: ECO Factory.
 ☐ T6: Smart Manufacturing

▶ PROJECT DEVELOPED BETWEEN CENTRES: ☐ YES ☒ NO

▶ CENTRE LEADING THE PROJECT

Centre code	Name of the VET centre	Type of organisation	Region/Country
	MIC ŠC Škofja Loka	EDU	SI

▶ LIST OF ALL PARTICIPATING VET CENTRES

Centre code	Name of the VET centre	Type of organisation	Region/Country
	MIC ŠC Škofja Loka	EDU	SI

+Add



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► PROJECT SUMMARY (IN TWO SPEECHES)

Implementation of Collaborative learning factories

2. Project Resources

► HUMAN RESOURCES:

PARTICIPANTS		VET CENTER			
ID card	Name and surname	Centre code	Name of the VET centre	Competence Profile	Dedication Time
	Igor Hanc		MIC ŠC Škofja Loka	Head of	

+ Add

► PROJECT SUPPORT

Name of the company	Company representative	Supplier (yes/no)	Commitment to collaboration
		NO	
		NO	
		NO	



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3. Project Objectives

► GENERAL OBJECTIVES OF THE PROJECT

Why the project, the final objectives, contributions to VET, the project's objectives.

The Collaborative Learning Factories project aims to integrate advanced manufacturing technologies into vocational education

Final Objectives: Enhance skills and technology adoption in VET. Foster international collaboration among VET centers. Improve

Contributions to VET: Provides realistic, hands-on training environments. Bridges the skills gap with modern manufacturing technologies

Project Objectives: Support regional skill ecosystems. Implement digitized collaborative scenarios. Develop scalable and sustainable

+ Add



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3.2.1.MS8 COMPLETION AND TECHNICAL IMPLEMENTATION

The Open Innovation Community achieved its key milestone MS8, successfully establishing a dedicated collaboration space within the LCAMP platform. This milestone represents the culmination of extensive research and development work outlined in Task T4.1, which involved comprehensive desk research across multiple areas of innovation in vocational education and training.

The research foundation for the OIC encompassed several critical areas that shaped its final implementation. Understanding how VET systems engage in research and development activities provided insights into the unique challenges and opportunities that vocational education institutions face when participating in innovation ecosystems. The investigation into innovation approaches within small and medium enterprises revealed the specific needs and constraints that SMEs encounter when seeking to collaborate with educational institutions. Perhaps most importantly, the exploration of the relationship between innovation and entrepreneurship highlighted how collaborative platforms can serve as catalysts for both technological advancement and business development within the advanced manufacturing sector.

The community platform demonstrates practical application of innovation community principles through its project-based structure. Rather than operating as a simple networking tool, the OIC functions as an active collaboration environment where real projects connect educational institutions, industry partners, and research organizations. This approach reflects the findings from the extensive research into innovation communities, emphasising that successful collaborative platforms must provide concrete opportunities for meaningful engagement rather than merely facilitating introductions between potential partners.

3.2.2.PLATFORM INTEGRATION AND USER EXPERIENCE

The technical implementation of the Open Innovation Community showcases sophisticated integration with the broader LCAMP platform infrastructure. The community operates as a dedicated workspace within the multisite WordPress architecture, providing seamless access for registered users while maintaining appropriate security and privacy controls for sensitive project information.

Project showcases within the community demonstrate the practical outcomes of collaborative innovation efforts. Each project entry provides comprehensive information including project descriptions, methodological approaches, requirements from educational institutions, industry partner needs, and anticipated outcomes. This structured approach ensures that community members can quickly understand project scope, identify collaboration opportunities, and assess alignment with their institutional capabilities and strategic objectives.

The community's design reflects understanding that effective innovation partnerships require clear communication channels, well-defined project parameters, and transparent expectation management. By providing standardised project templates and structured information presentation, the platform reduces barriers to collaboration while ensuring that all stakeholders have access to the information necessary for informed decision-making about potential partnerships.





Figure 7: Open Innovation Community Project Overview Interface



Figure 8: Community Project Categories and Navigation





Figure 9: Detailed Project Showcase Example - Automatic Bottling System Development

The operational success of the Open Innovation Community creates opportunities for expansion into other sector-specific innovation networks and potential integration with European research funding program matching systems, positioning the platform as a replicable model for innovation-education collaboration across different industries and regions.

3.3. EDUCATORS/COMPANIES PUBLISHING COURSES

The tool for publishing learning opportunities (courses) is meant for educators or companies that wish to publish information about their courses on the LCAMP platform.

The user is the educator who is uploading the data about the learning opportunity. They first log into the tool using their username and password provided by the admins.

They are then presented with 2 options:

- (1) to upload a course to the database according to required structure OR
- (2) to enter each course manually, which is necessary for new advanced manufacturing courses.

3.3.1. EDUCATOR/COMPANY PUBLISHES A COURSE FROM SCRATCH

The user needs the simplest way possible for adding a new course, while filling in all the mandatory fields to map the courses according to parameters in the project requirements.

Educator provides course information

When a user clicks on "+ Courses" they are presented with a form to fill out with course information. The user must fill in all the mandatory fields (*). All users should publish courses in



a common style, so that a learner is always presented with the same type of information and can easily compare courses with each other. Within the LCAMP partnership we have decided to follow the European Learning Model⁶.

Identifiers

- **Awarding body***: entity related to the awarding activity i.e., the organisation that issues the qualification (Free text).
- **Issuer ID**

Basic Course Information

- **Title***: The title of the learning opportunity (Free text)
- **Thematic Area***: Thematic Area according to the ISCED-F 2013 classification (Drop-down)
- **EQF Level***: The qualification level as specified by a European Qualification Framework (Drop-down)

Additional Course Information

- **Credit System***: The framework used to assign the credit points to the learning specification: ECTS, EHEA, EQF, ECVET (Drop-down).
- **Credit Points***: The credit points assigned to the learning specification., following an educational credit system. (Number)
- **Course Description**: A free text description of the learning opportunity (Free text).
- **Duration Type***: How we are measuring the duration of the learning opportunity (By week/by semester).
- **Maximum Duration***: The maximum duration (in duration type) that a person may use to complete the learning opportunity for which this qualification is designed (Number).
- **Default Language***: The base language of the learning opportunity (Drop-down).
- **Entry Requirement***: Specific entry requirements of prerequisite of individuals for which this learning achievement specification is designed to start this learning opportunity (Free text).
- **Admissions Procedure**: Specific information on how to apply for the course (Free text).
- **Volume of Learning***: The estimated number of hours the learner is expected to spend engaged in learning to earn the award. This would include the notional number of hours in group work, practical sessions, as well as hours engaged in self-motivated study (Numbers).
- **Location***: The location of the learning opportunity (Drop-down).

⁶ [SHACL constraints for European Digital Credentials application profile \(htmlpreview.github.io\)](https://htmlpreview.github.io/?https://github.com/SHACL/SHACL-constraints-for-European-Digital-Credentials-application-profile/blob/master/SHACL-constraints-for-European-Digital-Credentials-application-profile.ttl)



Learning Entitlement, Outcomes & Potential Occupations

- **Learning Entitlement:** The title of the learning entitlement (i.e. What title does someone receive by completing this course) (Free text).
- **Related ESCO Skills:** A link to an ESCO skill, provided using the ESCO skills-controlled vocabulary (the learning outcomes of this learning opportunity) (Drop-down).
- **Custom Skills:** Applicable skills not found in the ESCO database (Drop-down).
- **Related ESCO occupation(s):** The ESCO occupation which the individual may access through the entitlement. It should be provided using the ESCO occupations (Drop-down).

Other information

- **Homepage*:** The homepage of the learning opportunity (Text tool for URL).
- **Mode of Learning*:** Refers to the way in which educational content is delivered, such as online or in-person lectures, group projects, or self-study materials (Drop-down).
- International Exchange Programmes (Yes/No).
- Internship opportunities (Yes/No).
- Learning Opportunity Type*

Educator links the course to the LCAMP competence framework

The user links the course to the competence framework by selecting from a list of skills the learner will gain at the end of the course. (IN DEVELOPMENT).

Option: Educator submits the Course data

By clicking the Submit button, the user saves chosen and entered data into the Courses Table as a new course. If any of the mandatory fields are missing, instead a pop-up informing the user that the data entries are invalid appears, prompting the user to fill in the missing details before trying to submit the data again.

Option: Educator resets all fields

By clicking the Reset button, the user erases all entered data, no data is saved into the Courses Table

3.3.2. EDUCATOR UPLOADS THEIR COURSE(S) TO THEIR COURSES TABLE

Educator uploads their course(s) as .xls

Users with existing course databases can import their data as .xls. Upon signing into the tool, user can select the option of adding a course by clicking the File Upload tab in the tool.

Educator links the courses to the competence framework

The user links the course to the competence framework by selecting from a list of skills the learner will gain at the end of the course.



3.4. JOB SEEKERS

This feature is currently under development. Due to its complexity and dependence on the successful deployment of the skills and course databases, the job search tool will be introduced in later stages of the LCAMP platform rollout.

The tool is designed to support users seeking paid opportunities published on the platform. It will accommodate multiple user journeys based on the status of the job seeker's CV, including:

1. Users who already have a Europass-formatted CV
2. Users with a CV hosted on another SaaS platform
3. Users without a CV
4. Users wishing to upgrade or rebuild their CV within the LCAMP platform

Following one of these initial pathways, users will be guided to complete their **skill profile**, which will be linked to the LCAMP competence framework (currently in development). This connection will enable the platform to recommend suitable job opportunities and targeted learning pathways based on identified skill gaps.

3.4.1. JOB SEEKER ALREADY HAS A EUROPASS-STRUCTURED CV

User logs in the tool or creates a user account. The user then uploads their CV using a '+' icon. Before confirming upload, user is reminded that the CV needs to be structured following Europass.

3.4.2. JOB SEEKER HAS A CV WITHIN ANOTHER SAAS PLATFORM

After creating a user account, the user is presented with an option of uploading OR importing their CV from other platforms. Before confirming upload, user is reminded that the CV needs to be structured following Europass.

3.4.3. JOB SEEKER HAS NO CV

Upon creating a user account, the user is presented with an option to create a CV from scratch. They are then presented with a form following Europass standards and structure, where they can manually enter their details. Once they are ready, they can save their entries, and a CV following Europass is saved to their profile.

3.4.4. UPGRADING EXISTING CV

After a CV is uploaded or created, user has an option to edit details within the CV.

3.4.5. JOB SEEKER IMPROVES THEIR SKILL PROFILE

The job seeker can improve their skill profile by providing evidence of course completion. Upon completing a course from the Course Table, the user is awarded with skills the educators related to the course. The new skills are saved in the user's skills profile unless the user already has the skill on the same level or better in the skill profile.



3.4.6. JOB SEEKER LOOKS THROUGH THE JOB OPENINGS

The user can find available job positions by browsing the published job opportunities uploaded by employers, adjusting for filters such as location, suitability to their skill profile, etc.

Alternatively, the user may find available job positions via a recommendation engine, which informs the user of any new job opening made on the platform that matches their skill profile (the user must have a ticked checkbox “Inform me of open job positions” in their profile).

Option: LCAMP skill gap analysis

Once the user clicks on a published job opportunity, and IF they have performed a skill profile, the skill gaps between the user’s skill profile and the jobs required and additional skills are shown.

Option: LCAMP proposes appropriate courses based on skill gap

Once the skill gap between the users’ current skills and the required skills for the selected job opportunity are presented, learning courses which, if taken, would offer the learning outcomes needed to gain the skills the user is lacking for a specific job opportunity.

3.5. VET INSTITUTIONS USING LEARNING FACTORY SELF-ASSESSMENT TOOL (D6.2)

As part of Work Package 6 - **Industry 4.0 Technology Absorption through the Collaborative Learning Factory (CLF)** - the Knowledge Innovation Centre (KIC) has developed a Self-Assessment Tool (SAT) hosted on the LCAMP platform. This digital tool directly addresses deliverable D6.2 by supporting the implementation of Industry 4.0 technologies in vocational education and training (VET) laboratories, with a focus on Collaborative Learning Factories.

The SAT forms a central component of the CLF assistance framework and contributes towards the achievement of Specific Objectives SO16, SO17, and SO18⁷. It enables VET and Higher VET (HVET) centres to evaluate their current integration of Industry 4.0 technologies, helping them understand their level of maturity and identify priority areas for development. Upon completion, users receive an automated self-assessment report, including tailored recommendations and proposed improvement actions.

Designed to be accessible and widely usable across regions, the SAT is available in six languages (English, Spanish, French, Italian, Turkish, and Slovenian). It is embedded within a web-based toolkit that also includes a maturity model, a training catalogue aligned with different levels of technological maturity, and other resources to guide VET institutions in upgrading their laboratories to meet the demands of advanced manufacturing.

This work contributes to milestone MS15 - the creation of the LCAMP CLF assistance framework - and supports key project indicators such as tool availability (I46), user engagement (I47), and

⁷ Specific Objectives:

SO16: Develop morphology of a Collaborative Learning Factory (CLF) and the needed elements for its implementation

SO17: Implement Industry4.0 related technologies in VET centre’s labs

SO18: Develop an assistance framework to help VET/HVET centres in implementing industry 4.0 technologies in their labs.



user satisfaction (I48), as coordinated by the Department of Education of the Basque Government.

The toolkit is accessible at [<https://lcamp.eu/activity/collaborative-learning-factories/>] and includes the following components:

Self-Assessment Tool Features: The Learning Factory Self-Assessment Tool evaluates four key dimensions:

Learning Methodologies:

- Assessment of current pedagogical approaches;
- Integration of Industry 4.0 concepts in curriculum;
- Evaluation of hands-on learning practices.

Learning Programs:

- Analysis of existing training modules;
- Alignment with industry requirements;
- Assessment of program flexibility and adaptability.

Value Chain:

- Evaluation of learning factory processes;
- Integration of real-world manufacturing scenarios;
- Assessment of industry partnerships.

Equipment and Digitalisation:

- Current state of technological infrastructure;
- Digital tool integration capabilities;
- Assessment of hardware and software readiness.

Technical Implementation: The SAT is built using a custom assessment builder PHP plugin which allows us to create custom reports. It's integrated into the main LCAMP platform infrastructure via a Wordpress plugin. Users can access the tool through a secure login system and receive personalized reports upon completion.

The following images show the SAT interface:



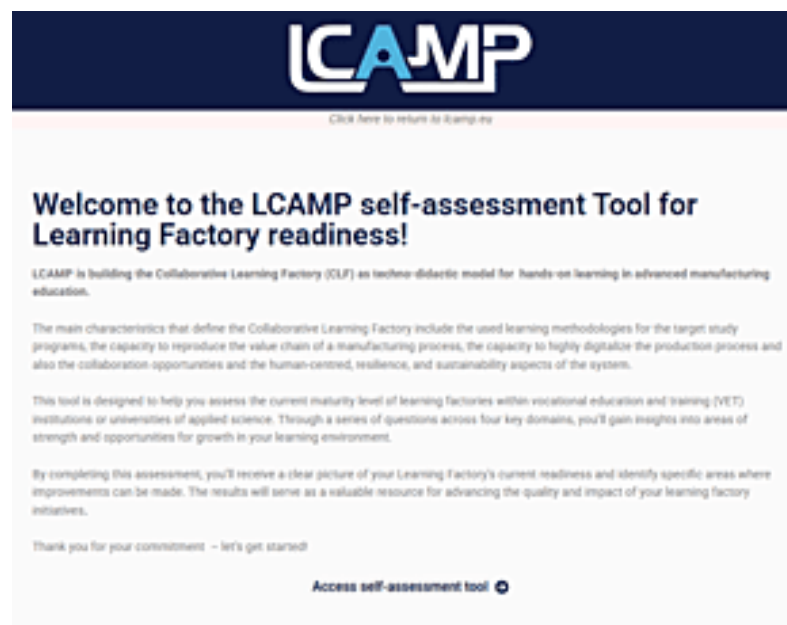


Figure 10: Learning Factory Self-Assessment Tool Welcome Screen

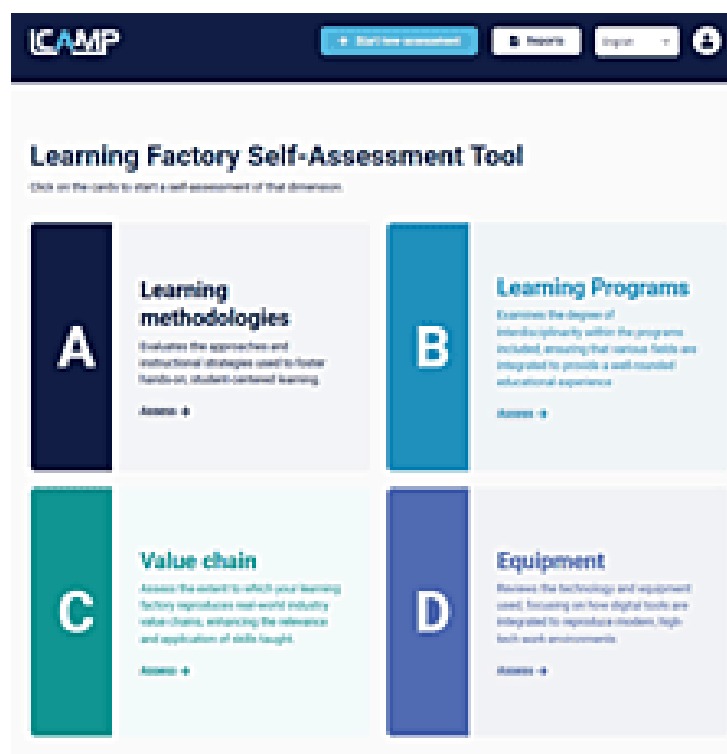


Figure 11: Assessment Categories Overview



Learning methodologies – English

Progress: 100%

General overview

Do the study programs consist exclusively of theoretical subjects?
☐ Yes
☒ No

Do you use PBL/CBL/gamification or similar active methodologies?
☒ Yes
☐ No

Do you carry out inter-disciplinary PBL challenges/projects?
☒ Yes
☐ No

Are concrete Key Performance Indicators (KPIs) developed to evaluate the effectiveness of the training and of the Learning Factory?
☒ Yes
☐ No

Buttons: Back, Save, Next

Figure 12: Learning Methodologies Assessment Interface

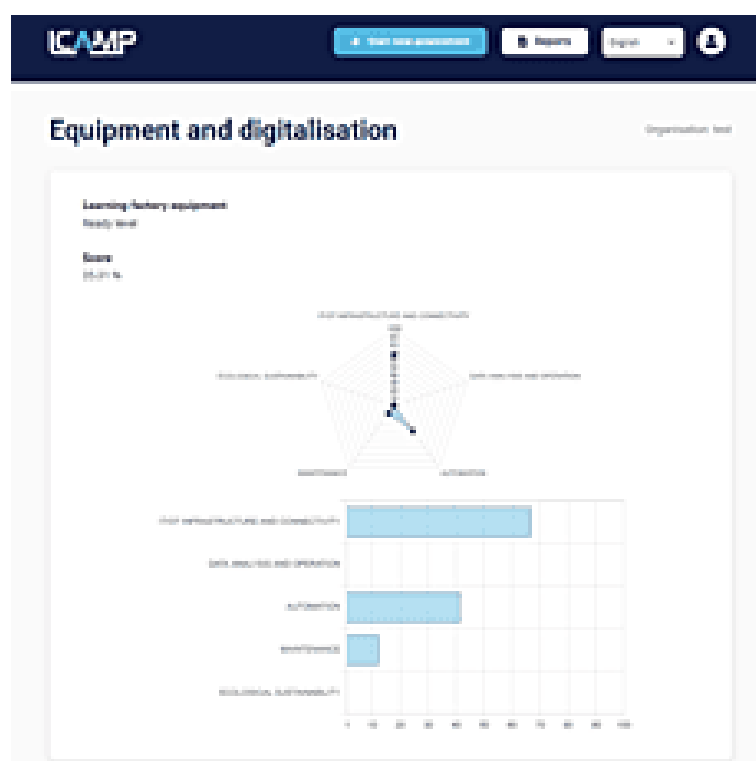


Figure 13: Equipment and Digitalisation Assessment Results

The comprehensive assessment framework developed for advanced manufacturing applications demonstrates scalability potential for other industry sectors and compatibility with emerging European digital credential systems, creating opportunities for broader institutional readiness evaluation across multiple vocational education domains.



3.6. DETAILED SPRINT PLANNING AND TECHNICAL OPERATIONS

The sprint planning process for the LCAMP platform is designed to ensure collaborative and transparent development of features aligned with partner needs and user requirements. Each sprint cycle focuses on refining specific user journeys and tools, based on the technical roadmap and evolving feedback from the consortium.

3.6.1. APPROACH

Sprint planning follows a structured, partner-inclusive process:

1. **Identification of Priorities:** Each sprint begins by identifying the key features or components to be developed or improved. These are prioritised based on milestone timelines, partner feedback, and technical readiness.
2. **User Journey Mapping:** We break down each user story (e.g. educator uploading a course, employer creating a job profile, job seeker improving their skill profile) into a series of functional steps, ensuring that platform interactions are intuitive and aligned with real-world needs.
3. **Technical Specification Development:** For each user journey, we define technical requirements, including:
 - Front-end design and UX considerations
 - Back-end logic and database structures
 - Required integrations (e.g. ESCO skills framework, course databases)
 - Language and localisation support
 - Accessibility and security measures
4. **Partner Demonstration Sessions:** During each sprint meeting, the development team walks partners through newly developed features via **live screen sharing**. This allows for immediate clarification, usability checks, and feedback collection.
5. **Documentation and Video Guidance:** To facilitate asynchronous collaboration, we produce **short demonstration videos** and walkthroughs for each new feature. These videos are shared with partners post-sprint and serve as both onboarding resources and long-term reference materials.
6. **Feedback and Iteration:** Partner feedback is captured during sprint meetings and through follow-up communication. Iterations are planned into subsequent sprints based on feasibility and impact.

3.6.2. TOOLS USED

- **Zoho Projects** for sprint tracking, bug logging, and task assignment
- **YouTube (unlisted links)** for sharing demo recordings
- **WordPress + Zoho Creator** for implementing front-end and back-end features
- **Matomo** for user engagement tracking and continuous UX improvement



3.6.3. USER JOURNEYS COVERED

The sprint planning process supports continuous enhancement across all LCAMP user journeys:

- **Employers** publishing job profiles
- **Educators and training providers** uploading courses
- **Job seekers** creating or updating skill profiles
- **VET institutions** conducting self-assessments using the Learning Factory Toolkit
- **Stakeholders** engaging through the Open Innovation Community

Through this agile, user-centred approach, we ensure that platform development remains responsive, inclusive, and aligned with real usage scenarios across the LCAMP ecosystem.

3.6.4. BUG TRACKING AND RESOLUTION REPORT SYSTEM

To maintain the stability, functionality, and user experience of the LCAMP platform, we operate a structured bug tracking and resolution process managed through **Zoho Projects**.

How to Report a Bug

Project partners who encounter technical issues on the platform are encouraged to report them by email:

✉ **Diana Miceli** – diana@knowledgeinnovation.eu

Subject: **Bug Report – [Brief Description]**

Please include:

- A clear description of the issue
- Steps to reproduce the problem (if applicable)
- Screenshots, screen recordings, or log files (if available)
- URL or section where the issue occurred
- Device and browser information (optional)

This process ensures all relevant details are captured from the outset, helping the development team quickly understand and address the issue.

Internal Bug Logging and Prioritisation

Once a bug is reported, it is logged into our internal tracking system within **Zoho Projects**. Each issue entry includes:

- A description and reproduction steps
- Severity level
- Priority status
- Any related attachments or supporting material

Bugs are prioritised as follows:

- **Critical** – Affects core functionality or prevents essential user actions
- **High** – Impacts usability or data integrity significantly
- **Medium** – Causes inconvenience but does not block functionality



- **Low** – Cosmetic or minor, non-urgent issues

Each bug is assigned to the appropriate development team member for resolution.

Resolution and Verification

Once resolved, the fix undergoes a **verification process**. This includes internal testing to ensure the issue has been successfully addressed and the affected functionality is working as expected. Where necessary, we may follow up with the reporting partner for confirmation.

Supporting Transparency and Responsiveness

This process enables timely and transparent issue resolution. Demonstration videos, release notes, or FAQ updates may be produced to clarify common fixes or new features. Periodic updates on resolved issues can be provided on request.

By combining structured tracking with open partner communication, we ensure that all bugs are addressed systematically and in alignment with the overall development roadmap.



4. COMPONENTS

4.1. THE PROPOSED LCAMP INFRASTRUCTURE LAYER

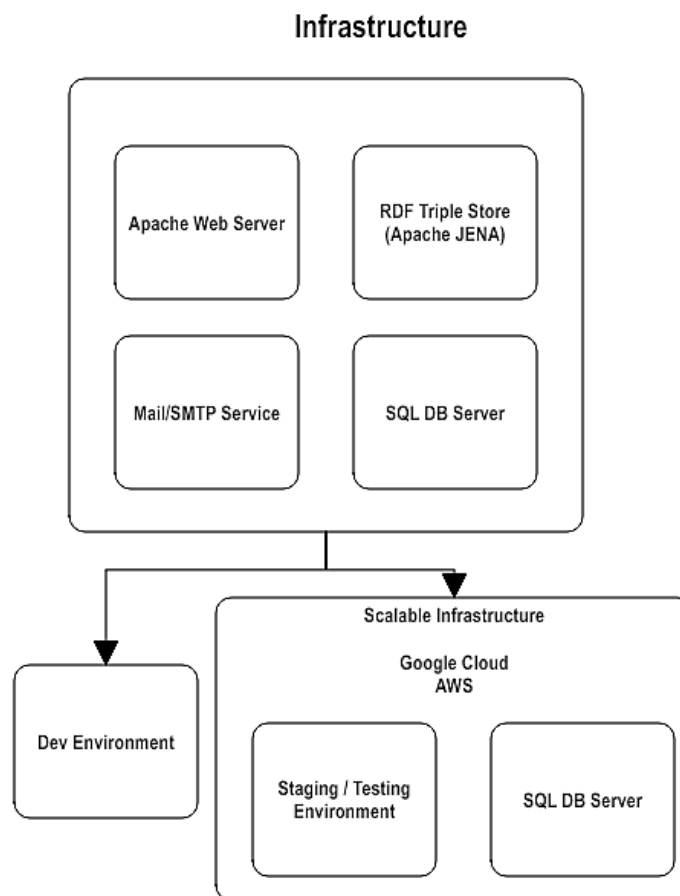


Figure 14: Overview LCAMP infrastructure layer.

LCAMP Infrastructure overview Legend:

1. **Apache:** Apache is a web server that enables web applications to be hosted on the web using a variety of technologies.
2. **RDF Triple Store (Apache Jena):** Apache Jena is an open-source Java based RDF triple store that provides a scalable and reliable platform for storing, manipulating, and querying large amounts of RDF data.
3. **Mail/SMTP Service:** Mail/SMTP Service is a type of service that provides email hosting and delivery services.
2. **SQL DB Server:** SQL DB Server is a type of database server that provides a platform for storing, manipulating, and querying structured data.



3. **Google Cloud:** Google Cloud is a cloud computing platform that provides a range of services for computing, storage, networking, and analytics.
4. **AWS:** AWS is a cloud computing platform that provides a range of services for computing, storage, networking, and analytics.

4.2. THE APPLICATION LAYER

The application layer of a website is the layer of the website that interacts with the user. This layer includes all the logic, code, and interactions that the user experiences when visiting the website. This layer is responsible for handling user input, processing requests, generating visual elements, and providing an interface for the user to interact with the website. This layer is also responsible for providing a secure connection between the user and the website, as well as providing authentication and authorization services. Additionally, this layer is responsible for handling any errors or exceptions that occur during the user's interaction with the website.

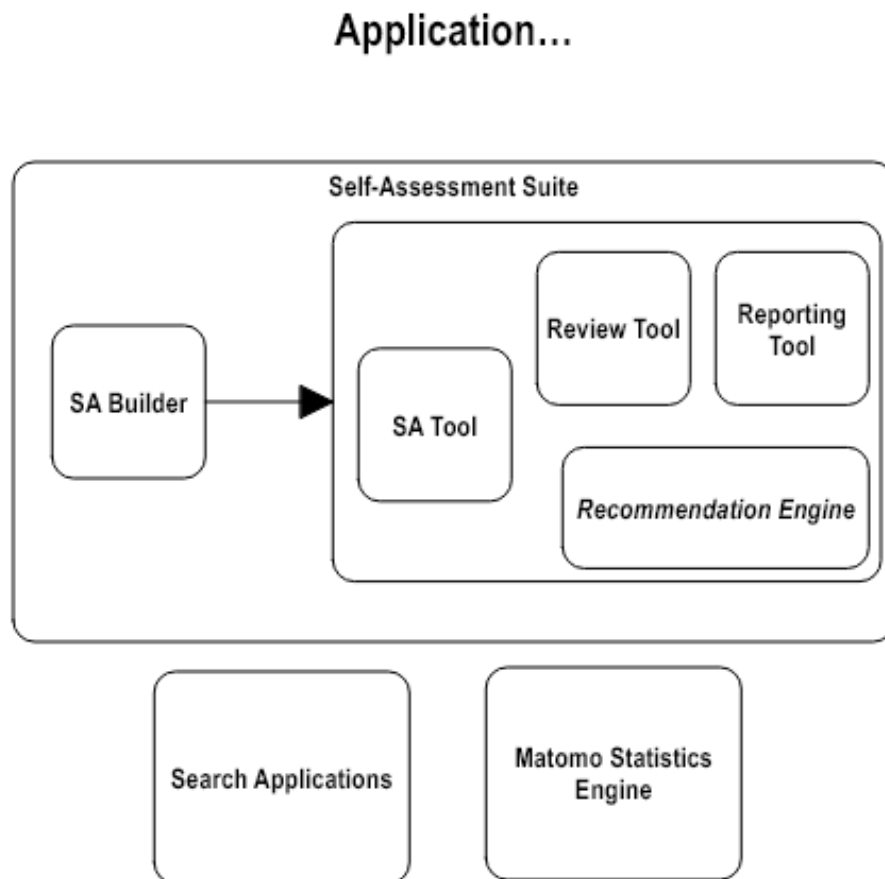


Figure 15: LCAMP Application layer.

LCAMP Application layer Legend:

- **SA Builder:** An IT infrastructure layer that is used to build secure architectures, providing a platform to review and optimize security postures.
- **SA Tool:** An IT infrastructure layer used to analyse infrastructure security and identify potential risks, vulnerabilities, and misconfigurations.



- **Review Tool:** An IT infrastructure layer used to review and analyse security configurations and postures, providing a platform for security teams to review and assess risks.
- **Reporting Tool:** An IT infrastructure layer used to generate reports on security postures and identify potential threats.
- **Recommendation Engine:** An IT infrastructure layer used to suggest best practices and recommendations based on security postures.
- **Search Applications:** An IT infrastructure layer used to facilitate searching of data, applications, and other resources.
- **Matomo Statistics Engine:** An IT infrastructure layer used to analyse website and application usage, providing data and insights for optimization and improvement.
- **Zoho Creator:** An IT infrastructure layer used to build custom applications and to integrate data sources and applications.

For applications which are deployed in the Cloud in Zoho data centres in Amsterdam, we are implementing a low-code solution via Zoho Creator. This is broken into several sub-services. Broadly we have the following set of services: application we use aPaaS, integration iPaaS, database we use dbPaaS, API management we use apimPaaS, Communications we use cPaaS and for functions - fPaaS.

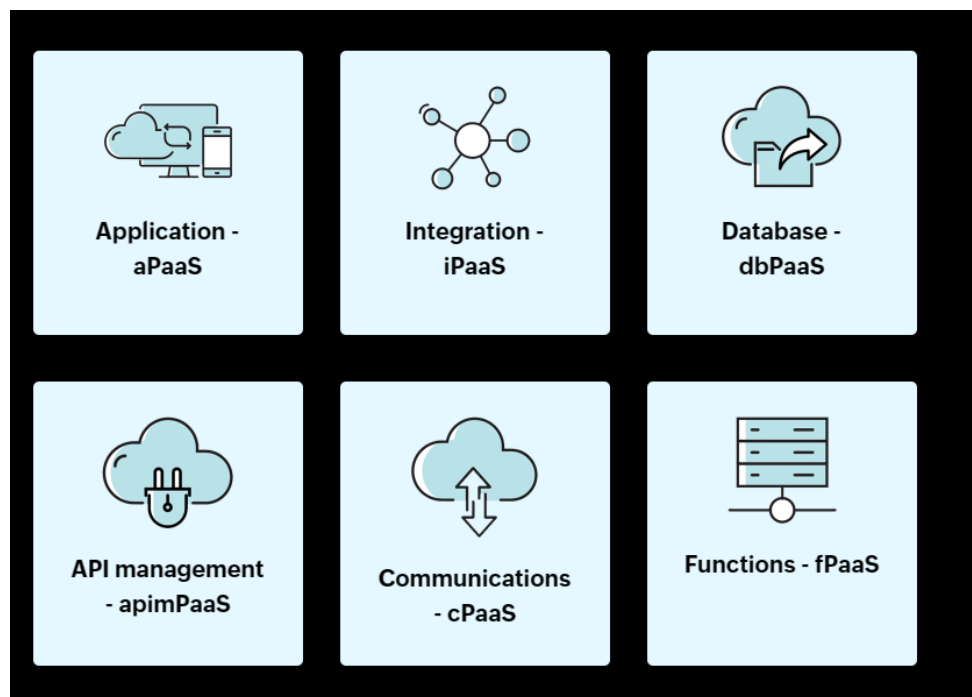


Figure 16: Zoho low-code app creation solution

Zoho creator legend:

- **aPaaS:** Application Platform as a Service is a cloud-based IT infrastructure layer that provides an integrated environment for developing, testing, managing, and deploying applications.
- **iPaaS:** Integration Platform as a Service is a cloud-based IT infrastructure layer that enables the integration of various applications, data sources, and services.



- **dbPaaS:** Database Platform as a Service is a cloud-based IT infrastructure layer that provides a managed database service to set up, operate, and scale databases in the cloud.
- **apimPaaS:** API Management Platform as a Service is a cloud-based IT infrastructure layer that provides a platform for managing and monitoring APIs.
- **cPaaS:** Communication Platform as a Service is a cloud-based IT infrastructure layer that provides an integrated environment for building real-time communication applications.
- **fPaaS:** Function Platform as a Service is a cloud-based IT infrastructure layer that provides a platform for developing and managing serverless functions.



5. USE CASES

This section is currently under development. It presents an evolving set of use cases described through technical steps, organised by tool (e.g. course publishing tool, job profile builder, etc.).

At this stage, the section serves as a working framework to guide discussions among LCAMP partners on the functional requirements of each tool. As development progresses across work packages, the use cases will be refined and expanded to reflect validated workflows and technical specifications.

5.1. EDUCATORS PUBLISHING COURSES

Technical steps for educators to upload their courses to the Course database with the LCAMP Course Tool. Educators must also link the Course to its Learning Outcomes. Learning Outcomes are the national skills/competences provided by the Courses and are defined with related ESCO skills, which will enable us to recommend courses to Job Seekers.

There are two ways that the courses will be added to the Courses Table:

- Adding the course manually OR
- Adding a list of course(s) by uploading a .csv or .xls according to the instructions.

We have worked with WP5 to define a competence framework to categorise Learning Outcomes. KIC also developed a supporting tool to help match qualifications to ESCO skills (Skill Finder & Framework builder tools). In connection with WP5 were completing D5.1, D5.2 and D5.3. Currently 66 micro credential courses are published the platform available at this link: [Course catalogue - Open Innovation Community](#)



5.1.1.UPLOAD COURSE

Upload Course	
User Stories	Educator user will: 1. Upload their Courses to Course database Admin user will: 1. Provide login to organisations 2. Upload courses from online course databases
Pre-Requisites	1. A Course database to collect course information. 2. List of organisations that will input course information. 3. List of mandatory and non-mandatory parameters we want to collect for each course 4. Frontend dashboard to upload courses accessible via login provided to organisations
User Flow (non-admin user)	STEP 1: Login STEP 2: Select input method 1. "Add Course" - Fill in course information manually 2. "File Upload" - Upload in .xls, .csv STEP 3: Click Submit
System Response (when this happen at the end)	Course(s) saves in the Course Database AND under User's My Courses List.
Data Schemas / Structures	Course Information Published/Unpublished status
Business Rules	Educator can only submit courses provided by their organisation Educator may edit the Course info from My Courses tab while unpublished.
GENERAL TASKS	1. Prepare list of parameters for courses (DHBW/KIC) 2. Upload partner course information (ALL) 3. Upload external course databases (KIC)
SOFTWARE REQUIREMENTS	1. Course manual submission (fill-out-form) 2. Course multiple submissions (file upload .xls, .csv)
Post-Condition (ex. error messages')	Missing paramters on Submit click: >"Invalid entries found. Rectify and submit again."
Related Use Cases	After Submitting a user may: >continue to "Publish Course - STEP 2" OR >save course as "unpublished".
Support tools	scraper tool to collect information from external course databases
Backlogged Requirements (parked for late)	

Figure 17: Uploading Courses



5.1.2.PUBLISH COURSE

Publish Course	
User Stories	Educator user will: 1. Link courses to Skills 2. Publish/unpublish Courses
Pre-Requisites	1. Frontend dashboard of user's uploded courses. 2. A Competence framework to record Skills
User Flow (non-admin user)	STEP 1: Select an unpublished course STEP 2: Add LO(s) 1. "Add existing" - Select from list 2. "Add new" - pop-up window "Record Learning Outcome"
System Response (when this happen at the end)	Assign Skills to Course(s). Course(s) becomes published, meaning it is visible to users in the LCAMP Course catalogue and may be recommended to users.
Data Schemas / Structures	Relationship database: >Course (one) to Skills (many)
Business Rules	Educator needs to assign X related Skills to be published. Educator may unpublish the Course from the My Courses tab. Educator should be able to see all published/upublished courses by their organisation on My Courses List.
GENERAL TASKS	1.2.1 Decide on competence framework (DONE) 1.2.2 Define Skills in competence framework (Partners) 1.2.3 Add Skills to Courses (Partners)
SOFTWARE REQUIREMENTS	1.2.4 Add Skill to Course function 1.2.5 Publish Course to Platform function
Post-Condition (ex. error messages)	Missing skills on Submit click: >"To publish a Course add at least X Learning outcomes."
Related Use Cases	User may "Record Learning Outcome" while publishing.
Support tools	/
Backlogged Requirements (parked for late	X to be determined (min. 1)

Figure 18: Publishing Courses



5.1.3.RECORD NEW SKILL

Record new Skill	
User Stories	Educator user will: 1. Create a new Skill 2. Link Skills to related ESCO skills
Pre-Requisites	1. Database of ESCO skills (Skill Finder tool) 2. A Competence framework to record Skills.
User Flow (non-admin user)	STEP 1: Create new SKill STEP 2: Define Skill fields (under Data schemas) STEP 3: Select min. 2 related ESCO Skills from ESCO Database STEP 4: Save new Skill to competence framework STEP 5 (OPTIONAL): Assign Skill to Course: 1. assign to current course 2. select from course(s) from My Course lists
System Response (when this happen at the end)O	Save new Skills and related ESCO skills levels to competence framework.
Data Schemas / Structures	Learning outcome structure: • Skill description (string), • Parent Skill, • Child Skill, • Related skills • EQF Level (1-8)* - also recorded in course • Reference to national curriculum (URL)
Business Rules	Educator must link the Skill to at least 1 Course.
GENERAL TASKS	1.3.1 Record new Skills and connect to Courses
SOFTWARE REQUIREMENTS	1.3.2 Save related ESCO Skills function
Post-Condition (ex. error messages')	Missing paramters on Submit click: >"Invalid entries found. Rectify and submit again."
Related Use Cases	
Support tools	Skill Finder tool (ESCO skill matcher)
Backlogged Requirements (parked for late	

Figure 19: Recording New Skills



5.2. EMPLOYERS PUBLISHING JOB PROFILES

Technical steps for employers publishing job openings on the LCAMP website using our job publishing tool (ref.: 4.1).

5.2.1.CREATE JOB PROFILES

User Stories (smaller steps in a phase)	Employer user will: 1. Create Job opening 2. Link Job opening to ESCO Skills
Pre-Requisites	1. Employer profile is created and approved
User Flow	STEP 1: Create a new Job opening STEP 2: Provide basic information about the job STEP 3: Link Job opening to required and additional ESCO Skills STEP 4: Publish job opening on LCAMP platform STEP 5 (OPTIONAL): Create a job call post for social media
System Response (when this happen what does the system do ex. Account creation)	Job opening is created, meaning it is visible to users in the LCAMP Platform and may be recommended to users.
Data Schemas / Structures	Job opening information: 1. basic information (title, description) 2. company information 3. required ESCO Skills 4. additional ESCO Skills 5. additional information 6. contact information
Business Rules	Employer must link at least 1 required and 1 additional ESCO skills to the job opening to publish it
Tasks	TASK to be allocated soon.
Post-Condition (ex. error messages')	Missing info on Submit click: >"Invalid entries found. Rectify and submit again."
Related UCs (ex. lost password when registering)	/
Backlogged Requirements (parked for late)	

Figure 20: Creating Job Profiles



5.3. JOB SEEKERS

Users are students OR existing employees OR unemployed, looking for jobs.

Technical steps for job seekers finding job profiles they are interested in AND getting recommendations for courses, based on the GAP analysis, using the LCAMP website

5.3.1. CREATE JOB SEEKER PROFILE

Create Job Seeker profile	
User Stories (smaller steps in a phase)	Job Seeker user will: 1. Fill in their Skill profile 2. Recieve recommended courses 3. Recieve recommended job openings 4. Recieve Gap analysis
Pre-Requisites	1. Skill profiler assessment
User Flow	STEP 1: Register at the platform (basic user info) STEP 2: Select you job interests STEP 3: Fill in skill profile 1. Upload CV AND/OR 2. Complete self-assessment STEP 4 (OPTIONAL): recieve Job and Course recommendation STEP 5 (OPTIONAL): Manually search for Jobs and recieve GAP Analysis
System Response (when this happen what does the system do ex. Account creation)	Job Seeker profile is created. Job Seeker recieves recommendations based on skill profile.
Data Schemas / Structures	Job Seeker profile details (to be decided) Job Seeker skills profile (linked via Skills and related ESCO skills to the competence framework)
Business Rules	Job Seeker must fill in skill profile to start using the platform.
Tasks	TASK to be allocated soon.
Post-Condition (ex. error messages')	/
Related UCs (ex. lost password when registering)	Improve Skill Profile
Backlogged Requirements (parked for late)	

Figure 21: Creating Job Seekers' Profile



5.3.2. IMPROVE SKILL PROFILE

Improving Skill profile	
User Stories (smaller steps in a phase)	Job Seeker user will: 1. Complete courses 2. Add new skills to skill profile 3. Improve level of existing skill in skill profile
Pre-Requisites	1. Course Catalogue 2. Job opening Catalogue
User Flow	STEP 1: Select a job opening 1. from recommendations OR 2. from Job opening Catalogue STEP 2: Recieve GAP analysis by comparing Job Seeker's skill profile with Job opening skill requirements STEP 3: Recieve Course recommendations based on missing skills STEP 4 (OPTIONAL): Job Seeker provide a credential to confirm course completion.
System Response (when this happen what does the system do ex. Account creation)	After completing a Course, Skills and related ESCO skills are added to Job Seeker's skill profile.
Data Schemas / Structures	Form items structure: 1. Type of input field (radio/scale/text) 2. Prompt based on type (statement/question) 3. Expert area (allows customization based on Type of Expert)
Business Rules	Job seeker can only improve their skill profile by recieving a new skill OR upgrade an existing skill's level.
Tasks	TASK to be allocated soon.
Post-Condition (ex. error messages')	When Completing course: >"Congratulations on completing [Course name]. Appropriate learning outcomes were recorded to you skill profile."
Related UCs (ex. lost password when registering)	/
Backlogged Requirements (parked for late)	/

Figure 22: Improving Skills Profile

5.4. VET INSTITUTIONS CONDUCTING LEARNING FACTORY READINESS ASSESSMENT (D6.2)

5.4.1.MULTI-DIMENSIONAL ASSESSMENT ARCHITECTURE

The Learning Factory Self-Assessment Tool demonstrates sophisticated evaluation methodology implementation:

Assessment Framework Technical Design

The tool evaluates institutions across four interconnected dimensions, each requiring different data collection and analysis approaches.



The Learning Factory Self-Assessment Tool evaluates institutions across four interconnected dimensions, each requiring sophisticated data collection and analysis approaches. The Learning Methodologies Assessment uses structured questionnaires to measure current teaching methods, incorporating specific metrics for Industry 4.0 integration and quantitative analysis of hands-on learning components through adaptive questioning logic that dynamically selects questions based on previous responses. The Learning Programs Analysis employs curriculum mapping tools for detailed analysis of existing training modules, measuring industry alignment against current manufacturing needs while assessing program flexibility and tracking competency outcomes against industry standards. The Value Chain Integration Evaluation focuses on process flow analysis to assess how learning activities mirror real manufacturing processes, measuring the effectiveness of industry partnerships and analysing how closely learning environments replicate actual manufacturing conditions to evaluate knowledge transfer effectiveness. Finally, the Equipment and Digitalisation Assessment conducts comprehensive technology infrastructure audits, analysing digital tool integration effectiveness while identifying upgrade pathways and providing cost-benefit analysis tools for potential technology investments.

The assessment tool's technical sophistication extends to its automated report generation system, which demonstrates advanced data visualization and recommendation engine implementation through sophisticated algorithms that collect and synthesize responses across all assessment dimensions, calculate maturity levels using complex scoring models, and generate personalized AI-driven suggestions tailored to specific institutional contexts along with automated implementation roadmaps and resource allocation guidance. The tool's availability in six languages showcases advanced localisation capabilities through an internationalisation framework that enables dynamic content translation with real-time language switching without data loss, cultural adaptation algorithms that adjust assessment criteria for different educational systems, regional customization for local industry requirements, and collaborative translation management tools that enable continuous improvement of translations across all supported languages.

This comprehensive expansion demonstrates how each use case builds upon the platform's technical infrastructure while serving specific user needs. The interconnected nature of these systems showcases the sophisticated architecture underlying the LCAMP platform's seemingly simple user interfaces.

5.5. OPEN INNOVATION COMMUNITY - COMPLETED IMPLEMENTATION AND ACTIVE OPERATION

The Open Innovation Community represents the successful completion of milestone MS8 (Open Innovation Community is created inside the Alliance and has a collaboration space in the LCAMP platform) and demonstrates how the LCAMP platform facilitates complex multi-stakeholder collaboration in advanced manufacturing innovation. Following extensive research and development work, the community now operates as an active collaboration environment supporting real-world innovation projects.



5.5.1. PROJECT LIFECYCLE MANAGEMENT - LIVE IMPLEMENTATION

The community demonstrates sophisticated project tracking and collaboration capabilities through its active project portfolio. Current implementations show how the platform manages complete project lifecycles from initial conception through execution and evaluation. The project registration system captures comprehensive information including detailed descriptions, methodological approaches, institutional requirements, and industry partner needs, providing clear frameworks for collaborative engagement.

5.5.2. KNOWLEDGE SHARING INFRASTRUCTURE - DEMONSTRATED RESULTS

The community platform showcases advanced content management capabilities through its project showcase functionality. Each project entry demonstrates the platform's ability to present complex collaborative initiatives in accessible formats, enabling community members to quickly understand project scope, identify synergies with their own work, and assess opportunities for participation or replication in their own contexts.



Figure 23: Open Innovation Community Project Overview Interface



6. DATA STRUCTURES

List of data structures in connection to the user journeys and tools. The data structures for the learning courses which are being entered into the course publishing tool are the currently in a semi-final format. The data structures for the job opportunity descriptions, the open innovation community membership, and the skills framework are all currently in development.

WORK IN PROGRESS!

6.1. LEARNING COURSES DATA STRUCTURES

Table 1: Learning Opportunity Data Structures

LABEL	PROPERTY NAME ⁸	EXPECTED VALUE	CARDINALITY	DESCRIPTION
eIDAS identifier	elm:eidasLegalIdentifier	number	0..1	The official identification number of the organisation, as awarded by the relevant national authority.
Awarding Body	elm:providedBy	Organisation	1..*	The organisation providing or directing the learning opportunity. In the case of, e.g., joint qualifications, there may be several organisations directing the learning opportunity.
Title	dc:title	Rdf:langString	1..*	The title of the learning opportunity. One value per language is permitted.
Thematic Area	elm:ISCEDFCode	Concept	0..*	Thematic Area according to the ISCED-F 2013 classification. It should be provided using the ISCEDF controlled vocabulary.
EQF Level	elm:EQFLevel	Concept	0..1	The qualification level as specified by a European Qualification Framework. It should be provided using the EQF QDR List of qualification frameworks.
Credit System	elm:framework	Concept	1..1	The framework used to assign the credit points to the learning specification. It could be provided using the EDC Controlled List of Educational Credit Systems.
Credit Points	elm:point	Xsd:string	1..1	The credit points assigned to the learning specification.

⁸ Properties that exist in the European Learning model are linked to the ELM Browser.



Fees	elm:priceDetail	Price Detail	0..*	Information about the pricing of the course, including fees and scholarships/subsidies available.
Location	elm:location	Location	0..*	The location of the learning opportunity.
Course Description	dc:description	Rdf:langString	0..*	A free text description of the learning opportunity.
Admissions Procedure	elm:admissionProcedure	Note	0..1	Specific information on how to apply for the course.
Duration Type	dc:temporal	Period of Time	0..1	The temporal duration, associated with a period of time.
Maximum Duration	elm:maximumDuration	xsd:duration	0..1	The maximum duration (in months) that a person may use to complete the learning opportunity for which this learning achievement specification is designed.
Volume of Learning	elm:volumeOfLearning	xsd:duration	0..1	The estimated number of hours the learner is expected to spend engaged in learning to earn the award. This would include the notional number of hours in, in group work, in practicals, as well as hours engaged in self-motivated study.
Default Language	elm:defaultLanguage	Concept	0..1	The base language of the learning opportunity, to be considered authoritative.
Entry Requirements	lm:entryRequirement	Note	0..1	Specific entry requirement or prerequisite of individuals for which this qualification is designed to start this learning opportunity.
Admissions Procedure	elm:admissionProcedure	Note	0..1	Specific information on how to apply for the course.
Learning Entitlement	dc:title	Rdf:langString	1..*	The title of the learning entitlement. One value per language is permitted.
Related ESCO Skills	elm:relatedESCOSkill	Concept	0..*	A link to an ESCO skill. It should be provided using the ESCO skills-controlled vocabulary.
Related ESCO Occupation	elm:limitOccupation	Concept	0..*	The ESCO occupation or occupational which the individual may access through the entitlement. It should be provided using the ESCO Occupations.
Custom Related Skills	elm:relatedSkill	Concept	0..*	A link to a related skill or the level of a related skill on a skill framework (except ESCO). It should be provided using a controlled vocabulary.



Homepage	foaf:homepage	Web Resource	0..*	The homepage of the learning opportunity.
Mode of Learning	elm:mode	Concept	0..1	The mode of learning, and or assessment. It should be provided using the EDC Controlled List of Modes Of Learning and Assessment.
Learning Opportunity Type	Dc: type	Concept	0..*	The type of the learning opportunity. It should be provided using the EDC Controlled List of Learning Opportunity Types.
International Exchange Programmes	elm:additionalNote	Note	0..*	An additional free text note about the learning opportunity.
Internship Opportunities	elm:additionalNote	Note	0..*	An additional free text note about the learning opportunity.



7. LCAMP PLATFORM WP8 TECHNICAL DEVELOPMENT PROCESS

7.1. SPRINT METHODOLOGY

The timeline is developed to serve the three Specific Objectives (SO) of the Work Package 8, which the LCAMP platform falls under:

- **SO3:** Provide a one-stop-shop service for accessing all services, data and information generated by the project.
- **SO4:** Localise Content appropriately for different languages and stakeholders.
- **SO5:** Maintain a technical service infrastructure, ensuring high level maintenance and service continuity, across a variety of platforms.

The SOs are linked to the Milestones which need to be achieved by a specific month within the LCAMP project, with their achievement verified by descriptive indicators (see *Figure29*).

Component	Description	2022		2023				2024				2025				2026	
		3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd	3rd	4th	1st	2nd
Milestone 3: Infrastructure established, Indicator 6: The infrastructure of the LCAMP platform is built																	
Status	Month 5: All technical development tools, and hosting are prepared to allow for the development and publication workflow to be implemented		COMPLETED														
Deliverable 8.1: Platform Roadmap created (continually updated)																	
Status	Month 6: First version of the roadmap, including prioritisation of features, technical requirements for user stories, bug tracking strategy, etc.			COMPLETED									COMPLETED	ONGOING			
Deliverable 8.2: Advanced Manufacturing Excellence Discovery Platform																	
Status	From Month 12, continually updated until Month 48: The platform will be the service portal for all services offered by the consortium. It will include: dashboard tool for skills analysis, skills assessment tools, course discovery database, tools to assist collaboration on transnational projects, tools to aid sharing of resources					LAUNCHED	ONGOING										
Localization	Platform localized into ES, FR, DE, IT, TR, SL, EUS. Contains thematic information portals for various stakeholders including SMEs, students, VET institutions, large enterprises and research partners.												IN PROGRESS		COMPLETED		
Milestone 4: Suites are created, Indicator 7: LCAMP platform suites are created																	
Status	Month 12: Different entry pages for different stakeholder groups are launched, each consisting of suites of services offered by the project for that specific target group.					COMPLETED											
Milestone 5: LCAMP platform is localised for different regional users, Indicator 8: Platform infrastructure in all country languages																	
Result/Target	Month 44: Main features of the platform are available in the main languages represented in the partnership: EN, GE, ES, FR, IT, TR, SL, EUS	ONGOING															
Languages	8 languages implemented across platform	ONGOING															
Milestone 5: LCAMP platform is localised for different regional users, Indicator 9: Content Management Strategy developed																	
Status	Month 6 and continually developed: Content management strategy established and continuously refined			ESTABLISHED	ONGOING												
Legend:																	
Green = Completed activities and milestones																	
Orange = Ongoing activities																	
Yellow = Planned activities																	

Figure 24: Work Package 8 Timeline.



7.2. WP8 TECHNICAL SPRINTS

Within the general LCAMP project timeline, in which we follow the deadlines as specified by the project application, there is a more detailed internal technical timeline. The internal timeline is framed by monthly Sprints lead by the developers' team of WP8 and attended by representatives of all partners. Currently these sprints happen on every third Thursday of the month and are recorded in case any of the partners cannot attend in person on a given month. The role of the sprints is to share the developments of the past month with the consortium, get their feedback and any questions, and prioritise the tasks for the upcoming month. The recordings are available on Youtube (see *Figure 13*) and only via link.

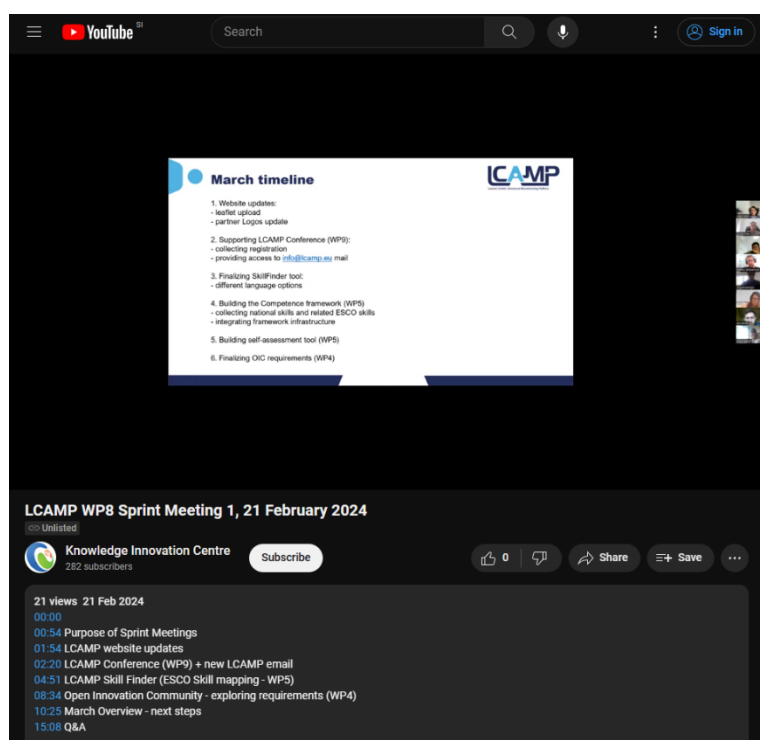


Figure 25: WP8 Sprint Meeting Recording

The following is a list of Sprint Meetings held with the relevant attendance and links to meeting recordings:

This table focuses on demonstrating systematic meeting management and providing access information for team members.



Table 2: Meeting Schedule and Logistics

MEETING	DATE	RECORDING LINK	KEY TOPICS COVERED
Sprint 1	21 Feb 2024	https://www.youtube.com/watch?v=LeOzhOqC29g	Purpose of Sprint Meetings LCAMP website, conference LCAMP Skill Finder Open Innovation Community March Overview
Sprint 2	20 Mar 2024	https://www.youtube.com/watch?v=94d8oGHPgNY	CAMP website updates LCAMP Updated Roadmap 03:55 LCAMP Skill Finder April Overview
Sprint 3	17 Apr 2024	https://youtu.be/LikqXUQIKio	Preparations for the Aalen LCAMP Conference 2024 WP3 Support with Expert Panel Tool WP4 Support with Open Innovation Community WP5 Support with Preparation of Course Catalogue Updates by the KIC Project Manager
Sprint 4	17 Jul 2024	https://youtu.be/RxYjIPYI9Dg	Updates to the Platform Next Steps
Sprint 5	21 Aug 2024	https://youtu.be/ft6UHbWCK94	What's New on the LCAMP Platform? Next Steps
Sprint 6	18 Sep 2024	https://youtu.be/4l1m-RWcPYc	WP5 Course Catalogue Backend 1st LCAMP Platform Design Workshop: Part 1: First Time login (as individual) Part 2: Skills Self-Assessments Part 3: Job Call Builder (for business)
Sprint 7	19 Nov 2024	https://youtu.be/9Aj2KE04ixY	D5.3 Online Micro-credentials Course Catalogue D6.1 Collaborative Learning Factories Self-Assessment Tool What's Next for LCAMP Development?
Sprint 8	15 Jan 2025	Physical Meeting (Slovenia)	Comprehensive overview of the LCAMP Platform
Sprint 9	27 Feb 2025	https://youtu.be/LfJli-iTPbw	WP6 T6.2 Collaborative Learning Factories WP4 Open Innovation Community
Sprint 10	24 Apr 2025	https://youtu.be/hnOv74_vDK0	WP9 LCAMP Conference WP8 Updates to the Platform, Skill Finder WP5 Learning Pathways Plan & Job Profiles



			WP4 Open Innovation Community WP6 Collaborative Learning Factory Assessment Tool
Sprint 11	15 May 2025	Physical Meeting (Sweden)	Comprehensive overview of the LCAMP Platform including the D5.4 way forward.

This table demonstrates sustained partner participation and engagement patterns, which is what external stakeholders most want to understand.

Table 3: Partner Engagement Analysis

PARTNER	ENGAGEMENT LEVEL
Tknika	Consistently Engaged
Mecanic Vallée	Consistently Engaged
DHBW	Moderate Engagement
Miguel Altuna	Moderate Engagement
AFM	Consistently Engaged
CMQEIF	Moderate Engagement
AC Toulouse	Moderate Engagement
Earlall	Moderate Engagement
Simumatik	Low Engagement
Made	Consistently Engaged
CNG	Moderate Engagement
Skupnost	Moderate Engagement
Camosun	Low Engagement
Gebkim	Low Engagement
TSC MB	Moderate Engagement
AFIL	Consistently Engaged
Forcam	Low Engagement
Kocaeli Ministry	Low Engagement



7.3. CONTENT STRATEGY

MANAGEMENT

7.3.1. TYPES OF CONTENT TO BE UPLOADED TO THE PLATFORM

The content uploaded to the LCAMP platform is determined collaboratively by each Work Package (WP) Leader in consultation with the partners actively supporting the respective work package. Content types are closely aligned with the functional areas and objectives of each tool or platform section and reflect the evolving needs of end-users and stakeholders.

Key content types include:

- **Course Listings:** Structured according to the European Learning Model, including metadata such as EQF level, ESCO skills, credit points, delivery mode, and learning outcomes.
- **Job Profiles:** Standardised profiles linked to required and optional skills, supporting skill-gap analysis and targeted course recommendations.
- **Project Showcases:** Within the Open Innovation Community, including descriptions, outcomes, partner roles, and innovation relevance.
- **Assessment Tools:** Such as the Learning Factory Self-Assessment Tool, along with institution-generated responses and improvement roadmaps.
- **News & Events:** Announcements, updates, conference information, and calls for collaboration or participation.
- **Platform Help & Training Materials:** User manuals, instructional videos, demo recordings, and FAQs.

All content must adhere to quality standards set out by the WP Leaders, including consistency in formatting, metadata, accessibility, and localisation requirements (where applicable).

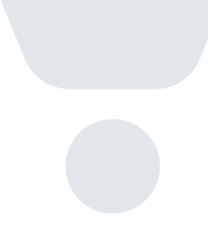
7.3.2. RESPONSIBILITY FOR CONTENT CREATION, FORMATS, VOLUME, AND SCHEDULES

The existing responsibility for generating and uploading content lies primarily with the respective **Work Package Teams**, under the coordination of the **WP Leader**. Each WP defines the type, volume, and frequency of content contributions through its internal planning and partner collaboration.

The composition of these teams reflects LCAMP's consortium structure, which is categorised into four partner roles:

- **WP Leaders** – Oversee content strategy, quality control, and schedule alignment for their respective platform areas. They coordinate closely with both contributors and technical teams.
- **Main Contributors** – Actively produce and validate primary content such as course data, job profiles, and assessment tools. They may also take on subtasks like localisation or pilot testing.
- **Supporting Partners** – Provide input by testing tools, supplying relevant data, and validating content relevance, particularly in local or institutional contexts.
- **Associate Partners** – Though not funded under the project, they contribute indirectly via dissemination, content feedback, and supply of data and expertise.





Currently, content generation is coordinated primarily by the Work Package (WP) Leaders, supported by their respective WP teams. These teams include partners drawn from the three core clusters of the LCAMP Skills Alliance, each contributing according to their area of expertise:

- **Teaching & Learning:** Represented by VET/HVET centres, primarily responsible for uploading course data, training-related content, and pedagogical tools.
- **Cooperation & Partnerships:** Includes companies, associations, and R&D centres that contribute job profiles, innovation project showcases, and data supporting collaboration models.
- **Governance & Funding:** Composed of regional education authorities, European networks, and associations contributing content on policy frameworks, funding mechanisms, and sustainability planning.

While the clustering reflects partner expertise, content responsibilities are still formalised and managed through the work packages. The content production schedule is aligned with sprint cycles, major deliverables, and milestone dates as outlined in the project timeline. Partners are notified in advance of submission deadlines, and periodic reviews ensure consistency with platform requirements, technical structure, and end-user needs.



8. QUALITY ASSURANCE

A successful LCAMP platform relies on a robust Quality Assurance (QA) process that guarantees the final product meets the expectations of the project partners and end-users.

8.1. QUALITY ASSURANCE METHODS

Quality assurance is not a one-size-fits-all process. It involves a combination of techniques, strategies, and tools to ensure that the web platform performs at its best. Here are some key methods used in our quality assurance process:

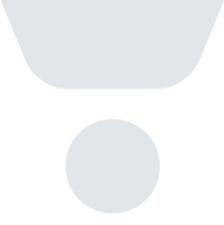
- **Code Reviews:** We conduct regular peer code reviews to identify and rectify coding errors, inconsistencies, and adherence to coding standards. This practice helps ensure that the codebase is clean and efficient.
- **Automated Testing:** Automated tests, including unit, integration, and end-to-end testing, are an integral part of our QA process.
- **Manual Testing:** LCAMP partners manually test the web platform to simulate real-world usage scenarios, focusing on usability, functionality, and compatibility across different browsers and devices.
- **Performance Testing:** Performance testing evaluates the web platform's speed, responsiveness, and scalability under varying loads. This ensures optimal performance for users, even during peak usage.

8.2. INTERNAL QUALITY ASSURANCE PROCESS

The following is the Quality Assurance process being carried out:

1. **Requirement Analysis:** Our QA process starts with a review of project requirements and specifications. During regular Sprint meetings, we work with our LCAMP partners to ensure we are on the same page and agree on the objectives and specifications of the product (e.g. for the Skills profiler).
2. **Test Planning:** After understanding the project requirements, we create a test plan that outlines test objectives, test cases, testing environments, and schedules. This plan acts as a roadmap for our testing efforts.
3. **Test Execution:** We execute the test cases, employing a combination of automated and manual testing. We perform these tests iteratively during the development process, not just at the end, to catch and address issues promptly.
4. **Bug Reporting:** When issues are identified, we log them in our internal bug tracking system within Zoho Projects, which provides detailed information, including steps to reproduce, severity, and priority, as well as any attachments, like screenshots or logs. Critical issues that impact core functionality is given top priority, while minor issues are handled in due course. The bugs are then assigned to the responsible development team-member for resolution. Once a bug is fixed, it undergoes a verification process to





ensure that the issue has been successfully addressed. In practice this involves retesting the feature or functionality associated with the bug.

5. Our bug tracking system is also created for partners who notice any issues on the platform to get in touch and provide the needed information on the issues they encounter.
6. **Documentation:** We maintain documentation of test cases, test results, and any bugs or issues identified and resolved. This documentation helps maintain transparency and track project progress.

By following these quality assurance methods and incorporating a robust bug-tracking process, we ensure that our web platform creation project meets the highest standards of quality and reliability.

These quality assurance capabilities position the platform development team to support future European education technology initiatives requiring similar levels of technical sophistication, multi-stakeholder coordination, and cross-cultural adaptation, demonstrating readiness for next-generation collaborative education platform development.



9. CONCLUSION AND OUTLOOKS

The LCAMP platform has significantly evolved from a foundational concept into a structured, user-centred digital environment that supports Centres of Vocational Excellence (CoVEs) in Advanced Manufacturing. This third version of the Platform Roadmap reflects notable progress, particularly with the successful launch of the **Open Innovation Community** (Milestone MS8) and the delivery of the **Learning Factory Toolkit** (Deliverable D6.2), both of which demonstrate the platform's practical relevance and capacity for impact.

The roadmap continues to serve as a living document, guiding technical development, content generation, and user engagement through a structured and agile approach. The integration of sprint-based planning, a centralised bug tracking system, and systematic partner involvement ensures responsiveness to emerging needs across the LCAMP Skills Alliance.

The platform's architecture and functionalities are now steadily aligning with its broader goals, including support for job profiling, course publishing, and competence-based matching. These developments are built upon cross-cutting collaboration among WP Leaders and partner clusters, ensuring that content and tools are relevant, high-quality, and aligned with user expectations.

Looking ahead, upcoming priorities include:

1. Finalising and deploying the **Job Search Tool** linked to a structured competence framework.
2. Continuing the development of interconnected tools and services with an emphasis on usability, localisation, and accessibility.
3. Strengthening partner engagement through clearer use cases, content schedules, and responsive feedback loops.
4. Enhancing integration opportunities with **European digital education initiatives** and anticipating alignment with **Industry 5.0** priorities.

As the platform progresses towards full implementation, its role as a collaborative, intelligent ecosystem will become increasingly central to supporting VET and HET institutions, industry stakeholders, and policy partners across Europe.



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Learner Centric Advanced Manufacturing Platform



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