



Learner Centric Advanced Manufacturing Platform



Open Innovation Community

**Applied Research and Innovation in the LCAMP Open
Innovation Community**

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Project summary	<p>The fifth industrial revolution is built upon the technologies of the fourth, with an increased emphasis on a human-centric, sustainable and resilient industrial base, emphasising the digital and green transitions. A key pillar of this economic transformation is the role played by Advanced Manufacturing systems such as Robotics, 3D & 4D printing, artificial intelligence and high-performance computing. I5.0, requires VET to develop 'learning centric approaches' that focus on the holistic competences of humans that plan, manage, oversee or operate technologies.</p> <p>LCAMP will tackle this by incorporating a permanent European Platform of Vocational Excellence for Advanced Manufacturing, seeded from a consortium of 20 partners and over 50 associate organisations including leading VET/HVET centres, companies,</p>



	<p>regional government, R&D centres, associations of companies and clusters.</p> <p>By collaborating across borders, LCAMP's goal is to support and empower regional AM CoVEs to become more resilient, innovative, and better equipped to train, upskill, and reskill young and adult students to successfully face the digital and green transitions. We will help regions grow and be more competitive through their VET systems.</p> <p>The Alliance is service-oriented, planning to establish permanent structures for:</p> <ul style="list-style-type: none"> • Teaching & Learning: establishing AM skills frameworks and curricula; launching or revising AM programmes (including micro-credentials); creating or capacity-building learning factories (special AM labs, jointly run by VET and industry). • Cooperation and Partnerships: launching a skills & jobs observatory for advanced manufacturing; accelerating industry/VET/regional cooperation ideas via an open innovation community and providing consultancy to SMEs on integrating SME/VET connections. • Governance & Funding: creating a one-stop-shop portal for all our services; ensuring a business case for continuing services to stakeholders in the long-term, while enhancing participation overall.
Work Packages	<p>WP01: Project management and coordination.</p> <p>WP02: Learner Centric Advanced Manufacturing CoVEs Alliance.</p> <p>WP03: Observatory.</p> <p>WP04: Open Innovation Community.</p> <p>WP05: Human-Centric Learning for Advanced Manufacturing.</p> <p>WP06: Industry 4.0 technology absorption through the Collaborative Learning Factory.</p> <p>WP07: SME-VET connection.</p> <p>WP08: Advanced Manufacturing Excellence Discovery Platform.</p> <p>WP09: Dissemination.</p> <p>WP10: Roadmap for Continued Development Learner Centric Advanced Manufacturing CoVEs Alliance.</p>



Glossary and acronyms

Acronyms

AI - Artificial Intelligence

AM - Advanced Manufacturing

B2B - Business to business

Cedefop - European Centre for the Development of Vocational Training

CLF - Collaborative Learning Factory

CoVE - Centres of Vocational Excellence

DG - Directorate General

DUI – Doing, Using, Interacting

EaFA - European Alliance for Apprenticeships

EC - European Commission

ECVET - European Credit System for Vocational Education and Training

EDP – Entrepreneurial Discovery Process in S3

EIT - European Institute of Innovation and Technology

EntreComp - The Entrepreneurship Competence Framework

ERDF – European Regional Development Fund

EQAVET - European Quality Assurance in Vocational Education and Training

EQF - European Qualifications Framework

ESCO - European Skills, Competences and Occupations

EU - European Union

GDP- Gross Domestic Product

GPT – General Purpose Technology, it is the same as KET

HE - Higher Education

HVET - Higher Vocational Education and Training

ICT – Information and Communication Technologies

I4.0 - Industry 4.0

I5.0 - Industry 5.0

JRC – Joint Research Centre of the European Commission

KET - Key Enabling Technology



KIC -Knowledge Innovation Communities

NESTI - OECD working party of National Experts on Science and Technology Indicators, NESTI

OECD - Organisation for Economic Cooperation and Development

R&D -Research and Development

R&I – Research and Innovation

S3 – Smart Specialisation Strategy

SMART- Specific, measurable, achievable, realistic, timely. Applied mainly to objectives.

TDR – Transdisciplinary Research

TVET - Technical and Vocational Education and Training

VC - Venture Capital

VET - Vocational Education and Training

WEF -World Economic Forum



Glossary

Advanced Manufacturing: the application of digitalisation (Artificial Intelligence, Big Data, Internet of Things, Internet of Machines, etc.) and cutting-edge manufacturing developments (3D printing, Additive Manufacturing, High precision Machining, etc.) to manufacturing processes with the aim of increasing flexibility, productivity, and efficiency.

Collaborative Learning Factory: International network of VET/ HVET providers that link their regional autonomous LFs or manufacturing labs to set up a common infrastructure to manufacture products and provide training in collaboration. Based on open innovation principles, in the Collaborative Learning Factory the common product is subdivided into sub-products. The development, manufacturing, and assembly process of each subproduct is led by an independent LF and shared with the network. The final assembly of all the subproducts is carried out in a final assembly line, located in a partner's lab. The structure allows for different types of participants as well as the collaboration in different stages of the value chain including:

- Co-design of product(s)
- Co definition of manufacturing processes
- Co-creation of digital workstations
- Setting up and scaling up LFs, Integration of I4.0 technologies in existing LFs
- Creation of didactic materials and training contents
- Participation of students in joint projects involving any of the LFs: producing parts, modifying processes, tailoring product's features, sharing data
- Involvement of cooperative mobility actions as an option.

Community: Etienne Wenger (1998) conceives communities as social configurations in which shared enterprises are defined as worth pursuing and our participation is recognizable as competence. He argues we all belong to communities of practice, sometimes even without being aware of it. In most cases, these communities are not explicitly defined, do not have a name or any other form of formal, labelled, membership sign. Furthermore, even if in many cases there is no formal membership mark, we know who belongs and who does not belong to a certain community. And we can distinguish communities by our degree of involvement in them: we can be core members or have what Wenger calls a “peripheral” form of membership. Wenger also associates “community” with “practice” to build the expression “community of practice”.

Centre of Vocational Excellence (CoVE): A multifunctional vocational education and training centre which, in addition to training, has an impact on the interaction with other actors and on the competitiveness of the region (considering competitiveness in the sense of beyond GDP) within its regional (and especially local) system.

Industry 4.0: The application of digitalisation (Artificial Intelligence, Big Data, Internet of Things, Internet of Machines, etc.) and cutting-edge manufacturing developments (3D printing, Additive Manufacturing, High precision Machining, etc.) to manufacturing processes with the aim of increasing flexibility, productivity, and efficiency.

Industry 5.0: I5.0 recognises the power of industry to achieve societal goals beyond jobs and growth to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the centre of the production process. (European Commission 2021a)



Innovation: a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process)¹.

Innovation in VET: Innovation in VET can refer to:

- Introducing improved products or processes (or combination thereof) that differs significantly from the VET centre's previous products or processes and that has been made available to potential users (product) or brought into use by the VET centre (process).
- The contribution of a VET centre to the local, regional or national innovation system, especially when it goes further than skilling.
- The sum of both. If both happen at the same time and if this is added to a high-quality training provision, then we are talking about a centre of vocational excellence.

Knowledge: We will follow Lundvall in his classification of four types of economically relevant knowledge (Lundvall 2016: 112-115):

- Know-what: knowledge about facts that can be regarded as "information". Although, in general, the relevance of knowledge-what has diminished due to the easy access (in terms of effort and money) we all have to large amounts of information through the internet, it is also true that knowledge-what can still be important for some professionals as doctors or lawyers. Examples of know-what can be the name of the first king of France, the temperature at which water boils, the number of inhabitants of a city, an many others.
- Know-why: scientific knowledge about principles and causes of natural, social or human phenomena. We have organisations, such as universities, specialised in the reproduction of this type of knowledge. Although it is true that, as we have indicated when discussing the science of such models of innovation, this type of knowledge is not as important as thought in the last century, it is also true that it has been, and still is, very important in some industries (chemical industry, electrical industry, electronical industry, and others).
- Know-how: skills to do things, practical knowledge. Although this type of knowledge has traditionally been related to production works and to manufacturing, it is also true that all endeavours involve a large extent of know-how: management, research, and even consumption.
- Know-who (where and when): to know key persons and to be connected with networks. This is one of the key elements for innovation when it is regarded as systemic, understood as a social system where different elements interact around knowledge.

Learning factory: The International Association of Learning Factories defines a learning factory as a learning environment where processes and technologies are based on a real industrial site which allows a direct approach to product creation process (product development, manufacturing, quality-management, logistics). Learning factories are based on a didactical concept emphasizing experimental and problem-based learning. The continuous improvement philosophy is facilitated by actions and the interactive involvement of the participants. (IALF, 2021). The learning factory concept is implementable in different ways (Abele E, 2015). To achieve effective competency development, the core of the learning factory concept is a high degree of

¹ "unit" means any actor responsible for innovations, including households and their individual members.



contextualisation (close to real factory environments) and a hands-on experience for trainees. The main aspects of Learning Factories (Abele E, 2015) are:

- Training in real manufacturing settings;
- Contextual learning that is close to industrial practice;
- Integration of new knowledge and technologies being developed in industry, specifically in I4.0;
- Innovation and reinforcement of broad competences: problem-solving, creativity, systemic thinking, etc.;
- Working on real industrial “products”; Emphasis on the concept of added value and value chain;
- Organisation and production processes (time, cost, quality, etc.);
- Tools and technologies (CAD, CAM, additive manufacturing, simulators, etc.);
- Real-time data management and processing;
- Process automation and industrial robotics.

Model: On the one hand, we can understand models as representations, normally simplified representations, of the part (or parts) of the world under study. These types of models are important in the natural and social sciences. Scientists devote a lot of effort to design, develop, test, interpret, discuss, support, or argue against models (Frigg and Stephan 2020). We can find models in physics, chemistry, biology, economy, or sociology to name just a few disciplines. On the other hand, the word model can refer to a way of doing something, like business models, management models, marketing models, etc. These models go further than describing how a part of the world under study works by trying to say how something will work, and they define objectives, activities, vision, mission, revenue streams, and similar elements. It is in this second sense of the word model that we should understand the open innovation community model.

SME: The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million (European Commission 2003).

Vocational Education and Training (VET): The LCAMP Alliance will adopt the definition of VET of the [Council Recommendation on vocational education and training for sustainable competitiveness, social fairness and resilience](#): Vocational education and training is to be understood as the education and training which aims to equip young people and adults with knowledge, skills and competences required in particular occupations or more broadly on the labour market. It may be provided in formal and in non-formal settings, at all levels of the European Qualifications Framework (EQF), including tertiary, if applicable.

Vocational Education and Training Centre (VET Centre): A VET centre is to be understood as any education and training provider which aims to equip young people and adults with knowledge, skills and competences required in particular occupations or more broadly on the labour market. It may be provided in formal and in non-formal settings, at all levels of the European Qualifications Framework (EQF), including tertiary, if applicable.



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1 EXECUTIVE SUMMARY

This report presents the Innovation Model of the LCAMP Open Innovation Community. It starts from the analysis of various elements that are relevant for the Community (CoVEs, VET, SMEs, advanced manufacturing, Industry 4.0 and Industry 5.0, innovation, communities of practice, or models) and how these elements can interact with each other in a holistic way that leads to innovation in VET centres and SMEs. The next part merges all the parts of the analysis together and outlines how the LCAMP Open Innovation Community will work. This model will be piloted between June 15, 2023, and December 15, 2023. The document is deliverable 4.1 of the LCAMP project, awarded by the European Commission in the Erasmus+ call for Centres of Vocational Excellence in 2022.



2 INTRODUCTION

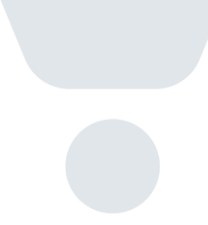
This document presents and articulates the LCAMP Open Innovation Community Model. Far from being an established fact, the object of our document is a new creation of the LCAMP consortium. The document will, therefore, describe what the LCAMP open innovation community is, why we want to create it, who is and who can become part of the community, how we foresee the community working, and with which organisations it will work. The community will be an important part of the LCAMP Alliance and it will also use an online collaboration tool to support its work. The model presented in this document will be piloted between June 15, 2023, and December 15, 2025 to determine utility and potential areas for improvement.

Even though the LCAMP Open Innovation Community is a new creation, it relates to several existing elements that have been discussed for some time. The LCAMP Open Innovation Community refers to both an entity and a referendum, aligned with pre-existing initiatives while also creating a new approach to content and collaboration. To this end, this document is organized into two parts:

- Analytic: Analysis of the elements, exploring their meaning and how they should be interpreted.
- Synthetic: Construction of the model, combining the elements analysed in the first part.

The analytic part deals with the constituents of the phrase “LCAMP Open Innovation Community Model”, which are: “LCAMP”, “Open Innovation”, “Community”, and “Model”. To be more precise, we have added elements that will be helpful in clarifying those constituents in depth, leading to the following six sections:

- LCAMP
- VET and SMEs
- Advanced Manufacturing
- Open Innovation
- LCAMP digital platform
- Community
- Model



The synthetic part consists of the construction of a model making use of the results of the analysis. What we will do in the synthesis is to combine the results of the previous analysis in a creative way and create a new open community.

The document intersperses grey boxes showcasing cases, discussions, controversies, or anecdotes related to the topics under discussion in each section. To facilitate the understanding of the analysis and to enable a fast way of reading it, each section closes with a box of “key messages” allowing a reader to read the main ideas of each section. The document also has some annexes that are related to different aspects discussed within the document. The aim is to provide additional information on certain aspects for interested readers.



3 HOW TO READ THIS DOCUMENT

This document is composed of two parts: an analytic part and a synthetic part. All sections of the analytic part can be read in isolation as standalone reads. They give the theoretical basis of the synthetic part, that can be read alone as well.

The document intersperses grey boxes with anecdotes, controversies, examples, etc. related to the topic of each section. A reader might choose to ignore them, to read everything, or to read just the grey boxes.

At the end of every section, the reader will find a grey box summarising the key messages related to the topic.

The synthetic part, the actual “model” of the open innovation community is better understood if it is read after the analytic part, but it can be read as an independent document as well.



4 ANALYTIC PART

By “analysis” we mean that we will break the phrase “LCAMP Open Innovation Community Model” into its simplest components to facilitate its understanding.

- The **LCAMP** project partnership
- with co-funding of the European Commission
- will create an **Open Innovation Community**
- (which will have a **collaborative space** in the **LCAMP digital platform**)
- to work on **Open Innovation** initiatives
- related to **Advanced Manufacturing technologies**
- with **VET centres** and **SMEs**
- following a specific **model**

Who?	What?	For what?	For whom?	How?
The LCAMP project partnership	Create: - an Open innovation Community - a collaborative space inside the LCAMP digital platform	To work on open innovation initiatives in AM technologies	For VET centres and SMEs	Following a model

Table 1: Elements of analysis.



4.1.1 First constituent: LCAMP

This section analyses the context of the Learner Centric Advanced Manufacturing Platform for CoVEs (LCAMP), its main goals, and the main drivers behind the project in two subsections:

- LCAMP in the European initiative on vocational excellence.
- The LCAMP Alliance.

The section closes summarising the key ideas in a wrap up.

4.1.1.1 LCAMP in the European initiative on Vocational Excellence²

European cooperation on Vocational Education and Training (VET) has its roots in the Treaty of Rome in 1957, which established the European Economic Community (EEC). One of the EEC's objectives was to promote the coordination and cooperation of Member States in the sphere of vocational training.

VET has been a matter of European cooperation since the founding of the European institutions, and mentioned in relevant policies and initiatives over the years:

- In 1953, the first report of the [European Coal and Steel Community](#) pointed out that VET could improve safety in some occupations as mining. After that a “Permanent Commission for Vocational Training” was established.
- In 1957, the [Treaty of Rome](#) included a specific Article (128) on VET³.
- In 1960, The Council of Ministers fostered the implementation of the VET programme of 1957.
- In 1963, the Council adopted a Decision of 2 April 1963 that laid down [general principles for implementing a common vocational training policy](#).
- In 1975, [Cedefop](#), the European Centre for the Development of Vocational Training, was launched to support with its research activity the goals of the Treaty of Rome.
- In 1986, Leonardo da Vinci was introduced (among other European Action Programmes) to support innovation in Lifelong Learning.

² For this subsection about CoVEs we have studied Joao Santos’ interventions at various conferences and events, which are available on the Internet. In addition, Boudewijn Grievink, KATAPULT, and José Manuel Galvín, ETF, have kindly offered to review the section.

³ The Council shall, on a proposal from the Commission, adopt measures designed to ensure the coordination and cooperation of Member States in the sphere of vocational training.



- In 1991, the [Memorandum on Vocational Training in the European Community](#) was published.
- In 1992 the [Maastricht Treaty](#) established community policies in six areas, including VET.
- In 1995, Leonardo supported collaboration among different agents to strengthen mobility and innovation. In the same year, the [European Training Foundation \(ETF\)](#), Cedefop's twin European agency to work with neighbouring and candidate countries⁴, was created.
- In 2000, heads of state and government tackled education policy at the [European Council in Lisbon](#). The European Union set the goal of becoming the most competitive and dynamic knowledge-based society in the world by 2010.
- In 2001, The European Council set three goals:
 - improving the quality and effectiveness of education and training systems in the European Union;
 - facilitating access for all to education and training systems;
 - opening up education and training systems to the wider world. We can set the start of the "Bruges-Copenhagen process" in the same year. "The Process is named after the "Bruges" initiative of the heads of vocational education and training (October 2001), which resulted in November 2002 in the education ministers of 31 European countries (EU Member States, candidate countries and those in the European Economic Area-the EEA) adopting the Copenhagen Declaration "on enhanced European cooperation in vocational education and training".
- In 2002, with the [Copenhagen Declaration](#), the European dimension in VET was reinforced.
- In 2004, the [Maastricht Communiqué](#) linked VET with the Education and Training 2010 work programme (later Education and Training 2020).
- In 2010 the [Bruges Communiqué](#) on Enhanced European Cooperation in Vocational Education and Training set out the EU 2020 VET agenda.
- In 2012, the [Rethinking Education Communication](#) called member States to promote dual VET and proposed that excellence be pursued by aligning VET policies with regional/local economic development strategies namely for smart specialisation.

⁴ The ETF works with EU Neighbourhood countries in the external dimension of HCD policies in VET and LLL and Employment. the SEMED Countries (Egypt, Jordan, Lebanon, Morocco, Palestine, Tunisia, Israel, Algeria and Libia); with candidate partner countries (Bosnia and Herzegovina, Kosovo, Montenegro); with candidate countries (Albania, North Macedonia, Turkey and Serbia), with EU partnership East (Armenia, Azerbaijan, Belarus, Georgia, Republic of Moldova, Ukraine) and with central asia (Kazakhstan, Uzbekistan, Tajikistan, Kirghizstan, Turkmenistan). They try to assist this countries in VET labour market, LLL.



- In 2015, the [Riga Conclusions](#), showed the commitment of the ministers of the Member States to promote high-quality VET.
- In 2016 the new [European Skills Agenda](#).

As the list shows, although education and training are the focus of each Member State, VET systems have been a subject of European cooperation since the 1950s. In the last few years, the collective consciousness of investing in skills and VET at the European level has been increasing. During the 2014-2020 funding period, especially toward the end, the European Commission started to focus on VET excellence with the aim of assisting Member Countries in developing excellent VET systems to make sure good quality VET is available across Europe. We will jointly refer to a series of measures aimed at modernising VET in Europe and neighbouring countries as the “European initiative on vocational excellence”.

The initiative on [Centres of Vocational Excellence \(CoVE\)](#) was launched in 2018, with the financial support of the Erasmus+ programme. The 2018 [Communication on Building a stronger Europe](#) announced an initiative to “support the development of international platforms of Centres of Vocational Excellence”, stating that “the Centres of Vocational Excellence should promote an active role for VET in local and regional economic development”.

CoVEs provide a comprehensive framework for the VET sector to pursue Vocational Excellence through actions that support the implementation of the policy objectives and priorities announced in the [2020 European Skills Agenda](#), the [Council Recommendation on VET](#), and the [Osnabruck declaration](#).

The initiative introduces a “European dimension” to Vocational Excellence by supporting projects that involve a wide range of local stakeholders enabling VET institutions to rapidly adapt skills provision to evolving economic and social needs. They operate in a given local context, creating skills ecosystems for innovation, regional development, and social inclusion, while working with CoVEs in other countries (at least 4) through international collaborative networks.

Features that characterise these VET centres include a set of activities and services that can be broadly grouped under the following 3 clusters:

- Teaching and learning
- Cooperation and partnerships
- Governance and funding

The European initiative on vocational excellence is also embedded in a wider policy underpinned by the [European Pillar of Social Rights](#) (European Commission 2017), which defines 20 principles. The first is directly related to VET and there are three more principles where VET also plays an important role (European Commission 2017):



Principle 1: Education, training and life-long learning

Everyone has the right to quality and inclusive education, training and life-long learning in order to maintain and acquire skills that enable them to participate fully in society and manage successfully transitions in the labour market.

Principle 3: Equal opportunities

Regardless of gender, racial or ethnic origin, religion or belief, disability, age or sexual orientation, everyone has the right to equal treatment and opportunities regarding employment, social protection, education, and access to goods and services available to the public. Equal opportunities of under-represented groups shall be fostered.

Principle 4: Active support to employment

- a. Everyone has the right to timely and tailor-made assistance to improve employment or self-employment prospects. This includes the right to receive support for job search, training and requalification. Everyone has the right to transfer social protection and training entitlements during professional transitions.*
- b. Young people have the right to continued education, apprenticeship, traineeship or a job offer of good standing within 4 months of becoming unemployed or leaving education.*
- c. People unemployed have the right to personalised, continuous and consistent support. The long-term unemployed have the right to an in-depth individual assessment at the latest at 18 months of unemployment.*

Principle 5: Secure and adaptable employment

- a. Regardless of the type and duration of the employment relationship, workers have the right to fair and equal treatment regarding working conditions, access to social protection and training. The transition towards open-ended forms of employment shall be fostered.*
- b. In accordance with legislation and collective agreements, the necessary flexibility for employers to adapt swiftly to changes in the economic context shall be ensured.*
- c. Innovative forms of work that ensure quality working conditions shall be fostered. Entrepreneurship and self-employment shall be encouraged. Occupational mobility shall be facilitated.*
- d. Employment relationships that lead to precarious working conditions shall be prevented, including by prohibiting abuse of atypical contracts. Any probation period should be of reasonable duration.*



All European skill- and employment-related policies, including the European initiative on Centres of Vocational Excellence, are strongly anchored in the EU pillar of social rights. This means that everything we do in Europe is, at the end of the day, for people. The European Pillar of Social Rights contributes to the [Sustainable Development Goals](#) (United Nations 2015), which also have a target related to Education (United Nations 2015: 14):

Goal 4

Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.

Taking the European Pillar of Social Rights as a basis, there is a whole policy setting to support the modernisation of VET:

- The *European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience*, adopted on July 1 2020.
- The *Council Recommendation on vocational education and training (VET) for sustainable competitiveness, social fairness and resilience*, published on November 24, 2020.
- The *Osnabrück Declaration on vocational education and training as an enabler of recovery and just transitions to digital and green economies*, published during the

German Presidency of the Union, on November 30, 2020.

The 2020 *European Skills Agenda for Sustainable Competitiveness, Social Fairness and Resilience* (European Commission 2020a) puts forward a vision to equip people with the right skills for the twin transitions.

The Council Recommendation on VET focuses on 6 clusters of actions (European Commission 2020b):

- VET is agile in responding to labour market changes
- VET is flexible in providing progression opportunities to Higher Education, labour market, etc.
- VET is driving innovation, providing the skills needed for the green and digital transitions.
- VET is attractive.
- VET is inclusive and provides opportunities for all.
- Quality assurance at all levels of VET provision.



The recommendations ask all European Member States to submit to the European Commission (by May 2022⁵) their national implementation plans specifying national arrangements and financial framework measures to be taken for the implementation of this Recommendation. This will allow analysis of those plans and cluster the countries facing common challenges through peer learning activities. These plans should be aligned to the big policy objectives of the *Council Recommendation* and the *Osnabrück Declaration*, and the deadline for submitting them closed in May.

Under the German Presidency of the European Union in 2020, the *Osnabrück Declaration*, which gives more action-oriented initiatives to achieve big objectives in VET, was adopted. While the Council Recommendation sets out a broader vision for the reform in VET, the Osnabrück declaration sets out a shorter and more concrete actions around four main objectives (European Commission 2021b):

- Resilience and excellence through quality, inclusive, and flexible VET
- Lifelong learning. Relevance of C-VET and digitalisation.
- Sustainability.
- European education and training area. International VET dimensions.

Without going into too much detail, an evident conclusion from the policy setting is that for Europe it is not enough to have a successful strategy for digitalisation, greening or industry. We must put the focus on people, make them the centre of everything and invest in skills. And the same applies to economic competitiveness: wealth without social justice, equity, and opportunities for all is worthless. To put it bluntly: Nothing without skills and nothing without people⁶.

This policy setting is completed with a generous, unprecedented, amount of funds ([Recovery and resilience facility](#), [REACT-EU](#), [ESF+](#), [Erasmus+](#), [InvestEU](#), [Just Transition Fund](#), etc.), tools (those developed by Cedefop, those developed by the ETF, [ESCO](#), [Europass](#), the [Recommendation on individual learning accounts](#), the [European approach to micro-credentials](#), and others), and policy initiatives (the [Pact for Skills](#), the [European Alliance for Apprenticeships](#), the [VET Skills Week](#), the Erasmus+ programme with specific actions like the Blueprints for skills and the Centres of Vocational Excellence under the second Key Action of the programme, and more).

⁵ Within 18 months of the adoption of the Council Recommendation.

⁶ We will come back to the relevance of society and human centricity in the next section, discussing innovation and some specific topics like technological determinism, regional innovation systems or Industry 5.0.



Box 1: Blueprint Alliances for sectoral cooperation on skills

First introduced by the Skills Agenda for Europe in 2016, Erasmus+ Blueprint Alliances per sector suggest an increased and collaborative role of VET in alliances for the development of specific sectors. The European Skills Agenda 2020 has confirmed the Blueprint as a key initiative to create new strategic approaches and cooperation for concrete skills development solutions in the industrial ecosystems as introduced by the updated EU industrial policy (European Commission, 2020). Blueprint Alliances gather key stakeholders from industrial ecosystems.

Blueprint Alliances include a range of different stakeholders:

- business
- trade unions
- research institutions
- education and training institutions
- public authorities

Each Blueprint Alliance must develop a sectoral skills strategy through a specific implementation plan (European Commission, 2020). This mimics the S3 or, as this skills analysis does not remain neutral and is targeted for specific societal challenges, S4 strategies. Moreover, the website of the Blueprint Alliances specifies that 'There will also be synergies with other policy frameworks and initiatives, such as regional smart specialisation strategies, industrial clusters, Centres of Vocational Excellence or [Knowledge & Innovation Communities](#) (KICs) of the European Institute of Technology (EIT).'

From the first pilot phase (which began in 2017), the following sectors were chosen: automotive; maritime technology; space data; textile/clothing/leather; and tourism. In 2018, the second wave of pilots was rolled out: additive manufacturing; green technology and renewable energy; construction; maritime shipping; paper-based value chain; and steel (European Commission, 2018). For certain sectors, the role of VET is outlined under these sector alliances in the second wave. For example, for the steel sector, it is suggested that the Blueprint can help to "assess the current situation of the different national VET systems, deliver new curricula at national and regional level to address future skills mismatches in the steel sector" (European Commission, 2018, p. 19). In this perspective, VET has the potential to help to identify skills mismatches and then help in the implementation of innovation plans, for specific sectors.



At the same time as the new policy framework for skills, employment, education, and vocational training discussed above was being developed, the European Commission carried out an inquiry about excellence in vocational training. What promotes VET centres to be seen as excellent by the learner and what facilitates the obtaining of employment after finishing a course? What promotes VET centres to be seen as excellent by the employer and demonstrates that the VET centre is providing training in the skills they need from their workers? What promotes VET centres to be seen as excellent by the workers of the VET centre enabling them to feel satisfied at work?

The European Commission started looking for examples of excellence in VET and, at the request of neighbouring countries, especially eastern countries like Ukraine which wanted help to modernise their VET systems, the European Training Foundation also started researching VET excellence. The final objective of both exercises was to define a series of characteristics that will be helpful in modernising VET in Europe and neighbouring countries.

As a result, two mapping reports were published between 2019 and 2020. In 2019 a [Mapping of centres of vocational excellence](#) in Europe was published (European Commission 2019). The mapping was carried out by Ecorys between mid-November 2018 and February-2019. The European Training Foundation carried out a similar study in partner countries. The ETF report, entitled [Centres of Vocational Excellence, An Engine for Vocational Education and Training Development](#) (European Training Foundation 2020), was published in 2020. Both mapping exercises used the same template.

Box 2: What is a CoVE?

It is clear that Europe is making a commitment to excellence in VET. The same is true for other countries in the world. But what is a CoVE?

[Cedefop](#) defines CoVEs as follows:

In education and training, ecosystem of local partners, such as VET providers, employers, research centres, development agencies, and employment services who cooperate to develop high quality curricula and qualifications focused on sectoral skill needs, and contribute to regional, economic and social development, innovation, and smart specialisation strategies.

As we can see, Cedefop sees CoVEs as ecosystems aimed at:

- Developing high quality curricula and qualifications focused on sectoral skill needs, and



- Contributing to regional, economic and social development, innovation, and smart specialisation strategies.

Based on the following typology, the ETF has a definition which includes a variety of options:

- One single institution. A VET provider providing high quality VET and setting the example in the country/region.
- One institution (not necessarily a VET provider) coordinating VET providers, companies and other stakeholders and promoting VET excellence in the country/region.
- A cluster of organisations collaborating at the local/regional/national level. This has often a sectoral dimension.
- An international approach. A platform, a big array of actors that engage with stakeholders.

In LCAMP we will understand a CoVE as follows:

A multifunctional vocational education and training centre which, in addition to training, has an impact on the interaction with other actors and on the competitiveness of the region (considering competitiveness in the sense of beyond GDP) within its regional (and especially local) system.

The European Commission identified 25 typical activities in excellent VET centres and clustered them in three groups or three key success factors. As a result we now have only 20 activities, split into three categories: Teaching and Learning, Funding and Governance and Network and Cooperation. See the Erasmus+ programme guide for the latest set of activities.



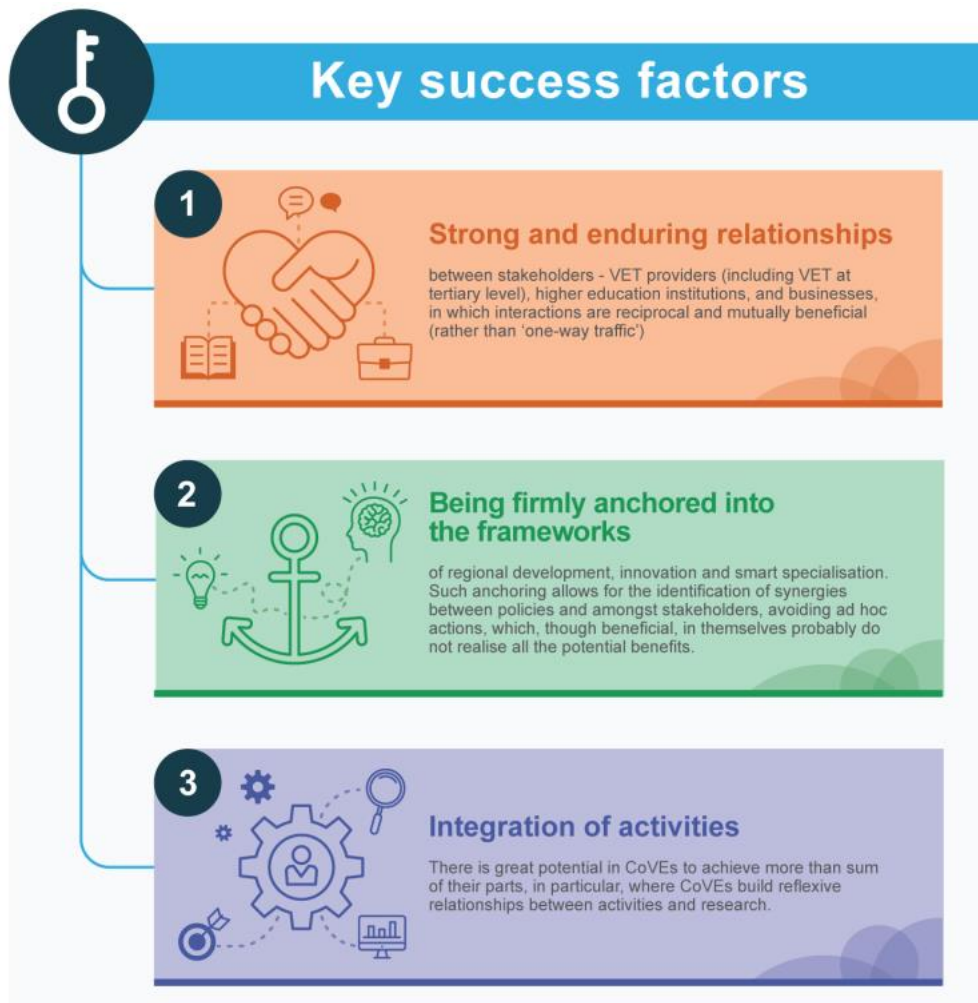


Figure 1 : CoVe, Key success factors. Source: European Commission 2019.

The three key success factors of VET excellence can be seen as moving towards a systemic understanding of VET and the CoVE initiative can be understood as if its aim is to create skills ecosystems at local level. We know that VET can support regional development but, to do that, we cannot look at VET in isolation and try to make it good independently of all other organisations active in each context. A real link between the regional or local needs and VET is vital. In this regard, the European initiative on Vocational Excellence aims at modernising European VET by making it more proactive in developing skills ecosystems in the areas where VET operates, mostly at local levels.

At the end of the 2014-2020 funding period, the European Commission defined a specific action to promote the international (European) dimension of VET excellence through the Erasmus+ programme. At the beginning, an amount of 200 million euros were supposed to be allocated to create around 50 platforms of centres of vocational excellence in the 2021-2027



funding period, but in the end, they managed to get 400 million Euros to create around 100 platforms of centres of vocational excellence.

However, before launching the proper action in the 2021-2027 Erasmus+ programme, the Commission carried out two pilot calls to receive feedback from a group of lead users. Five pilot projects were approved in the 2019 (the call was launched in 2018, under Lot 1 of the Sector Skills Alliances action, in Key Action 2 of the 2014-2020 Erasmus+ programme). These five projects were awarded a funding of between 700.000 and 1 million euros. A second Erasmus+ pilot call was published about one year later (under the Key Action 3 of the Erasmus+ programme), resulting in 7 projects being awarded a grant of around 4 million euros.

One of the five pilot projects of the first pilot was the [Excellent Advanced Manufacturing 4.0](#), EXAM 4.0 project, which ran for 26 months between November 2019 and December 2021. LCAMP can be considered as a scale up of EXAM 4.0, to the point that some of the most relevant things that we want to build in LCAMP will further develop some parts of EXAM 4.0 (the Alliance, the Collaborative Learning Factory, the Platform, the Industry 4.0 competence framework, etc.) while adding new elements, such as an Observatory of trends in advanced manufacturing, an Open Innovation Community to collaborate in technology implementation projects between VET and SMEs, a connection with the Horizon Europe project ADMA Transformers with the aim of using their scanning methodology, the new Industry 5.0 paradigm, and a skills profiler, to name a few. Another feature of the scale up is the incorporation of new partners and new countries that were not part of EXAM 4.0.

In addition to the aforementioned policy setting, the launch of the two pilot Erasmus+ CoVE project calls, and a number of initiatives on skills and labour market put forward by the European Commission in response to the COVID-19 pandemic, two important networking-related, community building, events happened before the start of the 2021-2027 funding period and the launch of the first non-pilot call in Erasmus+. On the one hand, the embryo of what was to become the Community of Practice of CoVEs (CoVEs CoP) was born. On the other hand, the ETF launched the ENE network.

The [CoVEs CoP](#). The leaders of the five pilot projects of 2019 started meeting in what at that time were called “intervision meetings” and later became the Community of Practice of Centres of Vocational Excellence. At the beginning, many actors like the European Commission, the JRC, the ETF, Cedefop, the OECD, UNESCO-UNEVOC, ILO, EARLALL, some regional governments (like the Basque Government), EfVET, and others were included in the meetings. The leaders of the 7 new projects of 2020 joined the group as well, which meant that the community grew from 5 project leaders to 12. This was a bottom up and voluntary initiative by



the Project leaders of the Erasmus CoVEs themselves, focussing on how to implement CoVEs in the most successful way, sharing knowledge and solutions and inspiring each other.

The meetings of the project leaders continued and, at request of the projects, the rest of the institutions, except from the European Commission and the ETF, were asked to leave the group. The intervision meetings gave way to the creation of the Community of Practices of Centres of Vocational Excellence (CoVEs CoP). The intervision group also organised, during the pandemic in 2020, a huge virtual event focused on CoVEs. The online conference, entitled “Skills ecosystems for innovation, regional development, and social inclusion” gathered more than 1,700 participants from around 105 countries all over the world.

During 2020, the same group was called to meetings to support the European Commission in the development of a so called “Support Service for CoVEs”. The European Commission had an agreement with the JRC to build a support service for centres of vocational excellence in three hubs (Edwards, J.H., Redford, D. and Paiva, T. 2021)⁷:

- Knowledge sharing.
- Networking and collaboration.
- Information and support.

After several online meetings, the CoVE CoP had its first face-to-face meeting at Tknika in November 2021 and [Boudewijn Grievink](#) and [Iñigo Araiztegui](#) presented it at the International VET congress, *VET in the Era of Humanity, Technology and Intelligence*, organised by the VET Vice Ministry of the Department of Education of the Basque Government, in San Sebastián.

In 2022, the CoVEs CoP met physically for the second time in San Sebastián, coinciding with the World Federation of Colleges and Polytechnics congress, TVET Excellence for All. And, in November 2022, the CoP organised, in collaboration with the European Commission, Katapult, and the Basque Government, the first [Forum on Vocational Excellence, Global partnerships for Vocational Skills](#), in San Sebastián, gathering around 280 participants and the participation of high-level representatives like Commissioner Nicolas Schmit. The Forum was such a success that it will become a recurring event. The next one will be [September 25 and 26 2023 in Amsterdam](#), during the European Year of Skills (May 9, 2023, to May 8, 2024).

The Community of Practice continues to expand with the Project leaders of the Erasmus Centers of Vocational Excellence and is developing tools and sharing information that help implementing the CoVE projects. An important element in the discussions within the CoP is the continuation of the CoVEs after the project period, so these CoVEs continue to bring together

⁷ As far as we know, this initiative has been abandoned.



stakeholders in skills ecosystems all across Europe. Some examples of the tools that the CoP jointly created are:

- Handbook Connect on how to involve SMEs in CoVEs, taking the perspective of the SMEs.
- A match making map, for finding new partners

Furthermore, the Community meets every month online, to discuss topics that are relevant for the project leaders at that point in time, ranging from project management related matters to the discussion of bigger trends and how the projects in various countries are dealing with growth and change. At [CoVEs CoP](#), all CoVEs are represented on an interactive map, making it easier for interested stakeholder to find them.

Last but not least, the Community is a fruitful Platform for meeting other practitioners in VET and developing spin off projects like the forward-looking project on applied research in VET, [AIR in VET](#), and BARCOVE.

The [ENE Network](#). More or less simultaneously with the meetings of the monitoring group, the European Training Foundation started developing the ETF Network of Excellence or, in short, ENE network, under the leadership of José Manuel Galvín and Georgios Zisimos, focussing on the international dimension of Vocational Excellence, namely the collaboration of European VET providers with neighbouring countries. ENE celebrated its launch event on December 3, 2020, and is now composed of 272 members from 43 countries who are working in 8 topics:

- Work-based learning.
- Pedagogy and professional development.
- Entrepreneurial dimension of vocational excellence.
- Industry 4.0 and digitalisation.
- Autonomy and institutional development (financing, leadership, governance).
- Going green – supporting sustainable goals.
- Smart specialisation – mobilising innovation, ecosystems and SMEs.
- Social inclusion and equity.

The ETF is working on an internationally comparable self-assessment tool, [ISATCOVE](#), and a CoVE label as well. Most of all they are carrying out studies, including one about to be published on applied research in VET and another about VET excellence .



Following the core principles of the European initiative on vocational excellence, LCAMP aims at assisting regions in developing VET systems with a strong role in their regions, and this document, deliverable 4.1 of the project, presents and establishes the LCAMP Open Innovation Community Model, understanding that:

- It will be part of a platform, understood both as an online tool (developed in work package 8) and a community (developed in work package 2);
- It is focused on advanced manufacturing, understood as the implementation of industry 4.0 technologies in manufacturing VET centres and manufacturing companies (as developed in work package 6 and work package 7); and,
- It is focused on learner centric approaches (as developed in work packages 5 and 6).

At the end of the project, we aim to have a self-sustaining Alliance, with an important number of members (not just project partners) and a digital platform to facilitate the cooperation. In anticipation of this there is a work package to prepare the transition (work package 10).

4.1.1.2 *The LCAMP Alliance*

The Open Innovation Community should be part of the LCAMP Alliance. However, the Alliance is not officially created yet. The first draft of the constitution of the LCAMP Alliance is due by November 15, 2023. We have finalised our strategic plan and the first annual plan will be delivered by June 15, 2023, at the same time as this Open Innovation Community model. The relationship between the Alliance and the open innovation community described in this document is important, for one will inevitably affect the other. As a result, this document might undergo modifications influenced by the Alliance and vice versa. Due to the mutual influence of the Alliance and the OIC, we consider it important to review what we have of the Alliance at this point and to summarise it here with the aim of having both initiatives in alignment.

In the Strategic Plan of the LCAMP Alliance, published on March 15, 2023, we defined 10 principles, 11 challenges, the vision, the mission, the core values, 7 working fields with strategic objectives related to them, potential members, stakeholders and target audience of the Alliance.

Principles of the LCAMP Alliance:

- **Principle 1: Economic growth must not follow a predefined path.** Governments (from the local to the national level), companies, VET centres, and other agents, have the capacity of shaping the future and of supporting a specific path of economic growth.



- **Principle 2: Interaction relationships through systems, ecosystems, networks, communities, platforms, quadruple helixes, etc.** The concept of the ecosystem is important in our understanding of the following: VET as part of a skills and innovation ecosystem; Advanced Manufacturing and Industry 5.0, because technology, science, and society shape each other in a process of co-construction, and the implementation of new technologies does not follow a linear path but an interactive movement where interactions among different social agents are key; Innovation, because it is the result of knowledge-related interactions between users, companies, universities, and many other actors.
- **Principle 3: Against technological determinism.** Technology and society shape each other in a process of co-construction. The “big-bang” type of invention, if it exists at all, is very rare. Most new technologies appear as a result of a long process of small changes in which several actors participate. It is important to acknowledge the relevance of other stakeholders (aside from the builders of technology) in the creation of new technologies. In this sense, the role of users particularly important (von Hippel 2006, Oudshoorn and Pinch 2005; Oldenziel and Hard 2013).
- **Principle 4: Digitalisation will be more constructive than destructive.** More employment will be created, and, although millions of workers will have to be up- and re-skilled, job quality will improve. This scenario is positive because it means that job quality, and with it, the well-being of European citizens, will improve in terms of safety, complexity of the tasks to be carried out by workers, salary, etc.
- **Principle 5: Digitalisation goes beyond introducing new tools in our work.** Digitalisation modifies how we work, how we communicate and how we live. An approach to digitalisation that considers questions such as “what skills do our students need to handle digital technology A and B? What skills do workers need to use digital technology C?” do not grasp the complexity of the issue. The adoption of most new technologies literally changes our lives, and we should address digitalisation with this broad mindset.
- **Principle 6: Education, including VET, does play, and will continue playing, a key role in achieving the aims of becoming a sustainable, fair, and highly digitalised Union.** Education systems, including VET, will be a key driver for us to achieve the goal of becoming a competitive, green, digitalised, and fair society.
- **Principle 7: Broad conception of technology and knowledge.** We adopt a wide definition of technology. For us technology will mean (Bijker 1995): a) the knowledge required to handle a specific technology, or artifact, or a group of them; b) the artifacts



themselves, like a computer, a robot, or a pencil; c) the reflection about the previous two, as in reflecting about I4.0, I5.0, digitalisation or advanced manufacturing. As for knowledge, there are different types that are relevant to our field of activities (Jensen et al. 2007): know-what, know-why, know-who, and know-how. All of them are important, but we are aware that VET gives special status to knowing how to do things, followed by knowing why or what. This type of “know-how” is key in making anything work and, therefore, VET is a key agent in achieving the twin transitions.

- **Principle 8: the importance of incremental innovation and traditional industrial sectors.** VET can be an important supporter of incremental innovations for the competitiveness of European companies. Sometimes, innovation and research tend to focus on the frontiers of knowledge and work with brand-new high-tech sectors. While investing in the frontiers can be important for the future, the present compels us to not forget the more traditional sectors. These more traditional industries employ millions of people, and they need to continue innovating if they are to continue being competitive.
- **Principle 9: the importance of the local level and the smaller companies.** The proximity of VET to the local context makes it an excellent agent to promote local well-being and economic competitiveness. In a similar way, SMEs are very relevant companies for local wellbeing and tend to be connected to VET centres. SMEs are important for well-being at the European level because they make up a big share of the total number of European companies and because they employ millions of people. VET is especially well-placed to work at the local level and to collaborate with SMEs. VET serves the explicit needs of SMEs while expanding their capabilities and anticipating their future growth areas.
- **Principle 10: working together works.** VET centres should follow their regional and local strategies and align their activities with them, connect with other agents at local and regional levels (companies, associations, governments, researchers, etc.), and connect with other similar ecosystems at the international level. The reason to connect with others is that knowledge and technology, as defined above, are to some extent universal phenomena. We hope that by working together, we can learn more and have a bigger impact.



Challenges:

- **Challenge 1: Narrow conception of VET.** VET encompasses entry-level secondary education, upper-level secondary education and higher education.
- **Challenge 2: Ignorance about VET innovation capacity beyond the EU.** The EU lacks a clear understanding of VET innovation and capacity. There has been very little effort made to capitalize on lessons learned and steps taken by AM VET centres in Canada, Australia, and beyond.
- **Challenge 3: Divergence of European VET systems.** This affects seriously the capacity of VET centres to cooperate. It makes mobility of students more difficult, and it makes it challenging to compare study programmes. There is a need for cooperation among European initiatives related to AM and VET.
- **Challenge 4: The role of VET in Regional Smart Specialisation Strategies.** There is a need to clarify the role of VET in R&D activities and its contribution to Regional Smart Specialisation Strategies.
- **Challenge 5: Making the VET training offer more flexible.** There is a need to upskill and reskill thousands, possibly millions, of workers in Europe. To make lifelong learning a reality in Europe, we need adaptability, permeable and modular approaches to training. An AM company worker cannot always plan for a long course.
- **Challenge 6: VET and the Twin transitions.** VET providers and SMEs need support frameworks for the twin transitions.
- **Challenge 7: Soft and hard skills.** VET systems should continue to focus on the hard, technical, skills but try to include, without harming their development, the other type of skills.
- **Challenge 8: Support to apprenticeships and work-based learning.** Such learning approaches efficiently lead students to acquire the skills needed to perform specific jobs.
- **Challenge 9: Connecting centres of vocational excellence.** There is no VET Advanced Manufacturing network or community focused on technology. Practices from related fields, such as the EIT Manufacturing KIC, show the value of communities for mutual support and knowledge generation. It makes sense to have such a community for VET.
- **Challenge 10: The need to approach advanced manufacturing and Industry 4.0 in a new way under the new Industry 5.0 paradigm of the European Commission.** In order to meet the demands of Industry 5.0 there is a need to explore new teaching/learning methods such as Learning Factories which bring together learning-conducive workplaces and supported by state-of-the-art and accessible infrastructure,



equipment, technology, and versatile pedagogies and tools (simulators, Virtual Reality, etc).

- **Challenge 11: VET as a motor of innovation for SMEs.** There is a need for regional innovation systems to understand the potential relevance of VET in the regional innovation ecosystem (not only as a provider of training).

Potential members:

- Education providing agents: VET centres, Universities of Applied Sciences, Academic Universities, Chambers, Intercompany institutions, and colleges.
- Research, innovation, and development agents: VET centres, Companies with R&D labs, Universities of Applied Sciences, Academic Universities, Technological Centres and Scientific labs.
- Policymakers: at the local, regional, national, or international levels.
- International organisations: especially those related to AM and VET.

Stakeholders:

- Education providing agents: VET centres, Universities of Applied Sciences, Academic Universities, Chambers, intercompany institutions, and colleges.
- Research, innovation, and development agents: VET centres, Companies with R&D labs, Universities of Applied Sciences, Academic Universities, Technological Centres and Scientific labs.
- Policymakers: at the local, regional, national, or international levels.
- International organisations: especially those related to AM and VET.
- Students, student unions.
- Workers, unemployed persons, worker unions.
- Employers, entrepreneurs.
- Researchers, engineers, technologists.
- Policymakers, politicians, authorities at various levels.



Target audience:

- VET centres and SMEs.
- Students of initial and continuing VET.
- Teachers of VET.
- SME workers.
- Unemployed persons.
- Job seekers.

Vision:

The LCAMP Alliance aims at becoming the European reference platform for knowledge generation and exchange, collaboration and service provision for VET and companies working in the Advanced Manufacturing field.

Mission:

Collaboration and networking between VET, companies, research institutions and the policy level working in the Advanced Manufacturing field to reduce skills mismatches in the industry and to transfer knowledge between VET and companies.

Values:

- Agility
- Cooperation
- Defence of the European project
- Quality
- Transparency
- Trust

Fields of activity:

- Field one: The LCAMP Alliance.
- Field two: The observatory of trends.
- Field three: The open innovation community.
- Field four: Skills intelligence.
- Field five: The Collaborative Learning Factory.



- Field six: The approach to collaborate with SMEs.
- Field seven: The online platform.

The current deliverable, the Open Innovation Community, is therefore an important part of the alliance, responsible for the third field of activity, and with an influence on the observatory of trends, the collaborative learning factory, the approach to collaborate with SMEs and the online platform.

4.1.1.3 LCAMP: wrap up

This section has outlined the main principles behind the European initiative of centres of vocational excellence, the differences between national and international initiatives, and has mentioned the main actors involved in VET excellence. We have also shown that, since the first pilot call for international projects launched in 2018 by the European Commission, LCAMP (or EXAM 4.0 followed by LCAMP) has always been an active player.

The main principles that guide our work have been summarised above. It will be important to keep them in mind because the open innovation community is part of the alliance and, as such, it should be aligned to its main principles, objectives and fields of activity.

LCAMP

Key messages

- The European initiative of centres of vocational excellence is aimed at modernising VET systems in all Member Countries so that they become a relevant part of their local/regional/national systems and drive innovation.
- The initiative consists of:
 - Policy setting: European Pillar of Social Rights, European Skills Agenda, Council Recommendation on VET, Osnabrück Declaration, national plans in Member States.
 - Policy initiatives: Pact for Skills, European Alliance for Apprenticeships, platforms of CoVEs, etc.
 - Assistance tools: Europass, ESCO, ISATCOVE, etc.



- International projects: the Erasmus+ CoVEs, the ETF and Cedefop tenders, etc.
 - Knowledge resources: Research carried out by Cedefop, the ETF and the JRC, as well as several resources developed by the Erasmus+ projects and many other initiatives, etc.
 - Community initiatives: the CoP CoVEs, the ENE network.
 - Economic support: Erasmus+, European Social Fund, etc.
- The main aim of the Erasmus+ projects, like LCAMP, can be summarised in the slogan “think global, act local”.
- This deliverable will specify how VET will contribute to the regional innovation systems and to the S3, supporting innovation at VET centres and SMEs in Advanced Manufacturing at local or regional level but being connected with an international community of peers.



4.1.2 Second constituent: Vocational Education and Training (VET) centres and Small and Medium Sized Enterprises (SMEs)

VET centres and SMEs are key elements of the LCAMP project and the main agents to be involved as collaborators in the LCAMP Open Innovation Community. But what will be considered as a VET centre? What will be considered as an SME? Why do we focus on SMEs? What is the relationship between VET centres and SMEs? This section analyses the two main members and target groups of the project and the open innovation community: vocational education and training centres and small- and medium-sized enterprises in five subsections:

- What is a VET centre?
- VET innovation, innovation in VET
- What is an SME?
- Innovation in SMEs and innovation support for SMEs
- Applied research in VET: the case of Canada.

The section closes summarising the key ideas.

4.1.2.1 What is a VET centre?

In LCAMP we adopt the VET definition of the *Council Recommendation on vocational education and training for sustainable competitiveness, social fairness and resilience*, released November 2020⁸:

Vocational education and training is to be understood as the education and training which aims to equip young people and adults with knowledge, skills and competences required in particular occupations or more broadly on the labour market. It may be provided in formal and in non-formal settings, at all levels of the European Qualifications Framework (EQF), including tertiary level, if applicable

This definition implies that VET:

- Involves young students and adults. In other words, all age groups, all European citizens, are potential VET students.
- Aims to equip any person with knowledge, skills and competences related to the labour market--VET can have other functions, such as entrepreneurship or research.

⁸ For more details about our choice of the meaning of VET consult the LCAMP Alliance Strategic Plan, D2.2 of the project.



- Studies do not need to be connected to a particular occupation--they can be, but they can have a broader focus, although always in connection with the world of work.
- Takes place in formal and informal settings.
- Covers VET at tertiary level--higher VET is a part of VET, not a part of Academic Education.

From an international perspective, this definition is convenient because it allows us to be inclusive by acknowledging that different contexts exist.

We will, therefore, consider a VET centre as follows:

A VET centre is to be understood as any education and training provider which aims to equip young people and adults with knowledge, skills and competences required in particular occupations or more broadly on the labour market. It may be provided in formal and in non-formal settings, at all levels of the European Qualifications Framework (EQF), including tertiary level, if applicable

On the national, regional, or local level, we can classify VET providers as having only one function or more than one function. The primary function of all VET providers in Europe is to train students, giving them the knowledge, competences, and skills required by a specific job or occupation. This training is usually extended to reskilling and upskilling functions as part of continuing VET. Cedefop defines Initial and continuing VET as follows (Cedefop. Terminology of European Education and Training Policy. Glossary):

- Initial education and training: General or vocational education and training carried out in the initial education system, usually before entering working life.
 - Some training undertaken after entry into working life may be considered initial training (such as retraining);
 - Initial education and training can be carried out at any level in general or vocational education (full-time school-based or alternate training) or through apprenticeship pathways.
- Continuing education and training: Education or training after initial education and training - or after entry into working life, aimed at helping individuals to accomplish the following:
 - Improve or update their knowledge and/or skills;
 - Acquire new competences for a career move or retraining;
 - Continue their personal or professional development.



Note that continuing education and training is part of lifelong learning and may encompass any kind of education (general, specialised or vocational, formal or non-formal, etc.). It is crucial for the employability of individuals.

We will refer to VET centres which have as their sole function providing initial and continuing VET, or only initial, or only continuing, as “unifunctional” because they perform a single function: training. But many VET providers extend the scope of their activities further: technical services for companies, working as incubators for entrepreneurs, providing services for the community, etc. We will refer to these as “multifunctional VET centres”. Multifunctional VET centres are centres that perform the activities of an “unifunctional VET centre” (training) and complement them with other activities that differ from training (Retegi and Navarro 2018). The European initiative on Centres of Vocational Excellence is advocating for multifunctional VET centres (Erasmus+ Programme Guide):

The concept of Vocational Excellence proposed here is characterised by a holistic learner centred approach in which VET:

- *Is an integrated part of skills ecosystems, contributing to regional development, innovation, smart specialisation and clusters strategies, as well as to specific value chains and industrial ecosystems;*
- *Is part of knowledge triangles, working closely with other education and training sectors, the scientific community, and business;*
- *Enables learners to acquire both vocational (job specific) as well as other key competences through high-quality provision that is underpinned by quality assurance;*
- *Builds innovative forms of partnerships with the world of work, and is supported by the continuous professional development of teaching and training staff, innovative pedagogies, learner and staff mobility and VET internationalisation strategies;*

The Council Recommendation (European Commission, 2020) claims that:

Centres of Vocational Excellence are intended to be world-class reference points for training in specific areas for both initial training of young people as well as for continuing up-skilling and re-skilling of adults, through flexible and timely offer of training for the skills needs of companies. They operate locally, being closely embedded in the local innovation ecosystems and clusters and bringing together a wide range of local partners, such as providers of vocational education and training, employers, research centres, development agencies, and employment services (among others), to develop "skills



ecosystems" that contribute to regional, economic and social development, innovation, and smart specialisation strategies.

The (theoretical) combinations between VET providers and functions, gives us the following typology of twelve types of VET providers⁹.

		Functions of the VET provider			
		Unifunctional		Multifunctional	
		Initial training	Continuing training	Various services not including SME assistance	Various services including SME assistance
A-type provider	VET				
B-type provider	VET				
C-type provider	VET				
D-type provider	VET				
E-type provider	VET				
F-type provider	VET				
G-type provider	VET				
H-type provider	VET				
I-type provider	VET				

⁹ The typology can be greatly extended if we include more variables, such as specifying the “other services” in detail, governance models, funding schemes, level of education, amount of work based learning, classification of the potential projects with SMEs according to an international standard (such as OECD definitions in the Frascati Manual or in the Oslo Manual, or NASA’s TRL levels), etc. We will not do it because we are not aiming at that.



J-type provider	VET				
K-type provider	VET				
L-type provider	VET				

Table 2: Theoretically possible types of VET providers.

Whether these theoretically possible types exist or not is beyond the scope of this project. On the one hand, a CoVE (according to the discussion in the previous section) will always be a multifunctional VET provider, whether it achieves these functions alone or as part of a network and, on the other hand, multifunctional VET providers can be actors supporting innovation in SMEs. There is a specific subsection which addresses the Canadian Colleges approach to Applied Research, which supports this point. Furthermore, there are additional movements that recognise the role VET can play in supporting SMEs to innovate.

4.1.2.2 VET Innovation, Innovation in VET

We are able to identify two main discourses about innovation and VET. On the one hand, there is a conception of innovation as an internal element, in terms of implementing new curricula, new teaching and learning methodologies, new activities, new technologies, new management systems, and so on. On the other hand, there is a conception of innovation as an external element, one that understands that VET plays a role in a concrete innovation ecosystem. We will refer to the first as “VET innovation A” and the second as “VET innovation B”.

As we will discuss with more detail in the fourth constituent, the last edition of the *Oslo Manual* defines innovation as (OECD 2018):

Introducing improved products or processes (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the VET centre (process).

Following this definition, VET innovation A refers to:



Introducing improved products or processes (or combination thereof) that differs significantly from the VET centre's previous products or processes and that has been made available to potential users (product) or brought into use by the VET centre (process).

VET Innovation B refers to:

The contribution of a VET centre to the local, regional or national innovation system, especially when it goes further than skilling and when it has an impact in the introduction of improved products or processes (or combination thereof).

As a necessary condition, a centre of vocational excellence should be involved in both, innovation A and innovation B, and, if both happen at the same time and if this is added to high quality training provision, then we are talking about a centre of vocational excellence.

Our community is concerned about both, and we will propose two main elements to work on each one of them:

- Innovation A will mostly be addressed through the collaborative learning factory.
- Innovation B will mostly be addressed through ADMA.

Of course, both types are interrelated and it should not be understood as a clear division. We can foresee that ADMA will also affect innovation A and that the collaborative learning factory will have an impact on innovation B. This distinction is rather analytical and its limits will be difficult to parse in the seamless web of everyday practice.

4.1.2.3 What is an SME?

We will use the definition of SME from the European Commission *Recommendation concerning the definition of micro, small and medium-sized enterprises*, 6 May 2003:

An enterprise is considered to be any entity engaged in an economic activity, irrespective of its legal form. This includes, in particular, self-employed persons and family businesses engaged in craft or other activities, and partnerships or associations regularly engaged in an economic activity. (European Commission 2003).

The Commission also defines an SME according to the number of staff and revenue (European Commission 2003):

The category of micro, small and medium-sized enterprises (SMEs) is made up of enterprises which employ fewer than 250 persons and which have an annual turnover not exceeding EUR 50 million, and/or an annual balance sheet total not exceeding EUR 43 million.



Next they distinguish subtypes of SMEs, within the category (European Commission 2003):

- a small enterprise is defined as an enterprise which employs fewer than 50 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 10 million.
- a microenterprise is defined as an enterprise which employs fewer than 10 persons and whose annual turnover and/or annual balance sheet total does not exceed EUR 2 million.

The definition above is not the only existing definition. Different organisations and countries can understand what an SME is in different terms. We consider it worthwhile to stick to the definition of the European Commission.



Figure 3 : SME data. Source : [EU SMEs strategy en.pdf.pdf](#)

Beyond the definition of SME, it is important to highlight the importance they have in Europe:

- There are 25 million of SMEs in Europe.
- SMEs employ around 100 million people. They provide two out of three jobs.
- SMEs account for more than 50% of the European GDP.
- SME challenges are Europe-wide challenges that are relevant to every European citizen. There is no European who does not know an SME worker or an entrepreneur.
- SMEs are diverse, with different business models, different sizes, different sectors, different ages, and therefore different needs.
- The twin, digital and green, transition will only be achieved if SMEs are able to participate, but they need support.
- There cannot be wellbeing in Europe without competitive SMEs.



Additionally, SMEs need to innovate. As we will see when discussing the fourth constituent of the analysis, innovation has become a survival condition for many companies and the question is not if they should innovate, but how can we help them to innovate?

4.1.2.4 *Innovation in SMEs and Innovation support for SMEs*

SME innovation is a complex issue. SMEs will need to implement new technologies (digitalisation and other manufacturing developments) but it is important to recognise that the implementation of new technologies is not a straightforward process.

The LCAMP alliance has a principle stating that we are against a deterministic conception of technology. In the case of SMEs, it means that we do not think that there is a “one size fits all” approach to technology implementation. Each SME is different and will implement technologies with different goals. This means that the specific culture and mindset of the SME will influence what, how much, and to what end they implement new technologies.

In addition, as stated in the principles of our alliance, we believe that once a social group (an SME in this case) starts using a new technology, it changes their way of living and working. In the same way that a social group does not live and work the same with or without fire, with or without electricity, an SME will modify its working relationships depending on the technologies they implement under a specific culture.

And of course, new ways of working are usually related to changes in tasks (tasks that disappear, tasks that are newly created, tasks that continue being relevant regardless of the new technologies, etc.) and, as the ability of workers to perform tasks is supported by skills, new technologies mean new skills.

In summary, SME innovation (technologically) means that: the organisational and managerial culture and mindset of the SME is important, that technologies will have different meanings depending on the culture of the SME, that new technologies will have deep effects on work and that skills are needed to support them. The role VET can play is evident, in particular as a skilling actor. But we should also realise that the implementation of new technologies is a complex process. An SME needs to be aware of the latest developments and the technological trends, and have contact with people who can assist them in the implementation of technologies that can be useful to them. VET can be important for this work.



4.1.2.5 *Applied research in VET: the case of Canada*

To our knowledge, Canada has the most firmly established system of applied research in VET. Considering that the above discussion has been very theoretical, we have decided to introduce a real case. This section shows the results of a field research carried out by Camosun College between March and April 2023.

It is important to understanding that applied research in Canada is often seen as a collaborative activity between a college and a company, a university and a college, or a company and another industry partner. According to Colleges and Institutes Canada (CICan), “Applied research is undertaken in order to apply new knowledge, directed primarily towards a specific practical aim or objective. Each applied research project consists of a set of research and development activities, is organized and managed for a specific purpose, and has its own objectives and expected outcomes, even at the lowest level of formal activity. Applied research projects meet the following five criteria:

- To be aimed at new findings (novel)
- To be based on original, not obvious, concepts and hypotheses (creative)
- To be uncertain about the final outcome (uncertain)
- To be planned and budgeted (systematic)
- To lead to results that could be possibly reproduced (transferable and/or reproducible).”

This perspective is generally shared by the organizations and entities presented in this section, with occasional minor adjustments, and it directs the activities of members involved in applied research collaborations.

The distributed process that characterizes an open innovation community can be found in a variety of Canadian contexts ranging from small local groups to large trans-national organizations. What they share is the desire to manage, in a defined and purposeful way, the knowledge and information necessary for innovation to thrive amongst the members of the group without the interference of organizational boundaries. This section is focused on educational organizations that have a stake in the applied research conversations occurring between colleges, universities, businesses, and industries. There are more organizations that could have been included here (Genome Canada is one excellent example) but these have been excluded because their mandate was deemed to be too narrowly focused on a particular discipline, field, or area of research. Do not consider this to be an exhaustive list, but rather a sample of the



kinds of open innovation communities that are present and active across the Canadian research and innovation landscape.

National Communities

Canada's national communities of practice range from governmental entities, to government-supported not for profit organizations, to independent not for profit organizations. Some are dedicated exclusively to the college sector, while others are institution-agnostic, serving the needs of researchers regardless of institutional orientation. Most operate on a membership structure, providing collaborative and collective benefits within the contexts of discrete initiatives. Operations typically include a combination of inter- and intra- organizational collaboration, sharing knowledge and resources with the goal of improving applied research capacity and student/faculty engagement, national advocacy, and the organization and promotion of conferences and professional development.

Example: Canada's National Research and Education Network (NREN) <https://www.canarie.ca/nren/> NREN connects to a global web of more than 100 members around the world. In Canada, NREN also connects teaching hospitals, libraries, museums, innovation centres, federal research labs, and in some provinces, K-12 schools. NREN's thirteen provincial and territorial partners connect directly to over 725 Canadian universities, colleges, CEGEPs, research hospitals, government research labs, school boards, business incubators, and accelerators and serve the research, education, and innovation sectors in their regions. The network connects these partners to each other and to the Global Research and Education Network, providing high-speed access to data-intensive research and education that would not be feasible over commercial networks. NREN is part of CANARIE, a non-profit organization funded largely by the government of Canada. NREN manages network connection, secure data sharing, identity and access management, and research software for educational institutions. They are a facilitator of open innovation, but do not get directly involved in the activities of the community.

Example: Colleges and Institutes Canada (CICan) <https://www.collegesinstitutes.ca/> CICan is the national and international voice of Canada's largest post-secondary education network, an alliance of 141 post-secondary educational institutes from every province and territory. Their work supports Canada's publicly supported colleges, institutes, CEGEPs, and polytechnics. Working through advocacy, educational programs, leadership development, mentorship, and bursaries, CICan strengthens Canada's system of colleges, institutes, CEGEPs and polytechnics. CICan also works with the World Federation of Colleges and Polytechnics (WFCP) to jointly host the World Congress, which features 1,500+ delegates from hundreds of educational institutes gathered together each year to reflect, discuss, share and network around



the pressing issues and opportunities facing educational institutions worldwide. Through conferences and forums, workshops and institutes, standing committees and national/international initiatives, CIGan serves as a conduit for communication and innovation, connecting colleges to collaborative activities across Canada. CIGan's activities include:

- Advocacy for Canadian educational institutions, with a focus on accelerating reconciliation, advancing sustainable development, boosting innovation, developing new campuses and methods of education, and deepening global educational engagement.
- Working with governments and employers to develop programs and projects which position colleges and institutes as solutions providers for economic, environmental, and societal issues.
- Leadership institutes to help educational managers, staff, and faculty develop leadership skills focused on their chosen institutes and areas of expertise.
- Mentorship programs that connect experienced college and institute presidents and directors general with those who are new to their roles, or wish to expand into new administrative roles.
- Bursaries which provide financial support to college and institute students in financial need.

Example: Digital Research Alliance of Canada <https://alliancecan.ca/en/about/alliance>

The Digital Research Alliance is a non-profit organization funded by the Government of Canada, a membership organization that is dedicated to collaboration that is researcher-centric, service-oriented, accountable, and transparent. Their mandate is to transform how research across all academic disciplines is organized, managed, stored, and used, working with other ecosystem partners and stakeholders across the country to help provide Canadian researchers with the support they need for leading-edge research excellence, research, innovation, and advancement across all disciplines. The Digital Research Alliance of Canada “serves Canadian researchers, with the objective of advancing Canada’s position as a leader in the knowledge economy on the international stage. By integrating, championing and funding the infrastructure and activities required for advanced research computing (ARC), research data management (RDM) and research software (RS), we provide the platform for the research community to access tools and services faster than ever before. The Digital Research Alliance of Canada offers direct support and collaborative connection for ARC, RDM, and RS, as well as providing funding opportunities, position papers, and access to the network of members committed to digital advancement on a national scale.

Example: Polytechnics Canada <https://polytechnicscanada.ca/> Polytechnics Canada is a non-profit association representing 13 leading research-intensive, publicly supported



polytechnics and institutes of technology across the provinces of British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario. They are primarily an advocacy organization, organizing for federal action in areas where polytechnics provide solutions for a more innovative, productive and globally competitive country. Their advocacy priorities are related to “Research & Innovation”, “Skills & Talent”, and “Diversity & Inclusion.” Polytechnics Canada focuses on advocacy and training, especially in the areas of “Research & Innovation”, “Skills & Talent”, and “Diversity & Inclusion.” They develop materials and overviews highlighting the contributions that polytechnic institutes make to their local communities and to Canada, including a focus on applied education and applied research.

Example: Tech-Access Canada <https://tech-access.ca> Tech-Access Canada is a national, not-for-profit organization passionate about expanding the reach of its 60 NSERC-funded Technology Access Centres (TACs) to make their R&D support services accessible to all entrepreneurs and innovators across Canada and contributing to the development of a more inclusive innovation economy. Tech-Access Canada includes 60 Technology Access Centre (TAC) members from across Canada, who collectively provide Canada with access to over 2,000 experts in business innovation and applied R&D. A Technology Access Centre (TAC) is an applied research and innovation centre, affiliated with a Canadian college or CEGEP (a publicly funded post-secondary education institute integrated with the education system of Québec,) that provides companies with access to cutting-edge technology and equipment, as well as a multi-disciplinary team with the expertise to turn brilliant ideas into market-ready products. TACs offer value-added R&D and innovation services to Canadian businesses—particularly small and medium-sized enterprises (SMEs)—to develop new prototypes, scale-up processes and solve unique business challenges. They also provide customized training for industry to upgrade technical skills, and de-risk the financial investment of implementing new equipment and adopting emerging technologies. Tech-Access Canada supports the growth, competitiveness, and success of its members by:

- Facilitating the sharing of best practices to help TAC members achieve operational excellence.
- Connecting innovators and entrepreneurs to the TAC(s) within the network with the expertise to advance the development and commercialization of their product or solve their innovation challenge.
- Championing the TACs as major players in Canada’s innovation ecosystem and excellent incubators for top talent and future serial innovators.



- Advocating to senior government officials and heads of agencies on priorities to advance the applied research efforts of the membership and ensure all Canadian innovators can access their R&D services.
- Fostering collaborative partnerships with industry, government, universities, associations, and other innovation stakeholders to advance applied research in Canada.
- Delivering programs that provide opportunities for TAC members to engage in R&D projects with Industry partners.

Regional Communities

Canada's regional communities of practice are organized independently by colleges and affiliated applied research institutes. Each of these organizations is funded and arranged by member organizations, and most either operate on a provincial level, or as an alliance of multiple smaller provinces. At the time of writing, the provinces of Saskatchewan and Manitoba do not have independent communities of practice; instead, local colleges align with regional universities or government organizations. Each regional organization operates under similar principles. They operate as non-profit organizations, with executive boards led by key faculty from member organizations. Operations typically include a combination of inter-organizational collaboration, sharing knowledge and resources with the goal of improving applied research capacity and student and faculty engagement, advocacy with regional and national governments, and the organization and promotion of conferences and professional development for staff and faculty.

Example: Alberta Research-Data Management Information Network (ARMIN) <https://concordia.ab.ca/research/research-at-concordia/armin/> ARMIN, organized by Concordia University of Edmonton, was officially formed in May 2022 in order to organize and assist Alberta-based colleges and universities in developing Research Data Management (RDM) strategies and organize shared data repositories. Their vision is to develop a province-wide RDM network in Alberta that will enhance the research and scholarly activities of smaller post-secondary and other institutions and will facilitate the eligibility of ARMIN members for Tri-Agency funding. ARMIN includes representatives from Tri-Agency eligible institutions across Alberta, and reaches out to fellow institutions in other provinces for collaboration and information. ARMIN hosts collaborative sessions and online presentations for members covering research topics, enhancing the ability of member organizations to develop and maintain RDM policies and repositories.

Example: Atlantic Colleges Atlantique (ACA) <http://atlanticcollegesatlantique.ca/> Atlantic Colleges Atlantique (ACA) is the association of the seven public institutions and 40 campuses delivering college programming in Atlantic Canada. Beyond the geographic reach and diversity of communities, cultures and language where ACA member-based institutions are



working, colleges are well connected with the region's large and small employers, industry and trade groups, cultural and settlement associations, as well as education professionals and government staff. The ACA is made up of the seven public institutions and 40 campuses delivering college programming in Atlantic Canada. The ACA website is fairly limited in scope, with further information available upon request.

Example: British Columbia Applied Research and Innovation Network (BCARIN)

<http://bcarin.ca> The British Columbia Applied Research and Innovation Network (BCARIN) is a collaborative and cross-disciplinary organization of British Columbia colleges and institutes. BCARIN's purpose is to support member institutions' applied research and innovation initiatives that contribute to creating exceptional learning experiences for students, workplace skills development, economic growth, and healthy communities. BCARIN's current member institutions include fourteen colleges and polytechnics from British Columbia and Yukon. Members of BCARIN must belong to Colleges and Institutes Canada (CICan), and be accredited to administer funding from the three major Canadian federal granting agencies—the Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC), and Social Sciences and Humanities Research Council of Canada (SSHRC). BCARIN serves as a collective voice to raise awareness regionally, provincially, and federally, of the capacity and vibrant applied research cultures within British Columbia Colleges and fellow Institutions. They also collaborate to foster best practices in applied research and innovation and facilitate the sharing of resources between members. BCARIN is also working to develop a system to connect interested organizations and individuals with research problems to appropriate member colleges, streamlining the process of project inquiry and connecting research institutions with those in need of their services.

Example: Colleges Ontario <https://www.collegesontario.org/en> Colleges Ontario, representing Ontario's 24 public colleges, promotes the pivotal role of Ontario colleges in strengthening the economy by producing graduates with the professional qualifications and expertise to succeed in rewarding careers. Colleges Ontario champions policy measures to strengthen the quality of programs available to students and implements province-wide marketing and communications campaigns to promote the full range of programs offered to students. Colleges Ontario's activities include developing new research and policy proposals, implementing provinciewide marketing and communications campaigns, advocating for legislation and policy measures to strengthen post-secondary education, and providing professional development program, conferences, and symposiums, including the annual Higher Education Summit, one of North America's premier conference on post-secondary education.



Example: Fédération des cégeps (Federation of CEGEPs) <https://fedcegeps.ca/>

The Fédération des cégeps represents CEGEPs (colleges specific to Quebec) through advocacy, development assistance, and coordination, and through services and support in carrying out their educational goals. Their mandate is to offer support and information on a wide variety of subjects of value to their member organizations, including legal affairs, student affairs, human and information resources, labour relations, research and funding. The Federation is made up of Quebec's 48 member CEGEPs. The Federation manages seven commissions and two standing committees that investigate current affairs and advise the general assembly of CEGEP members on educational and research affairs. They hold annual forums for the presidents of member organizations, and four several smaller communities of practice for college professionals in the fields of college success, library services, psychological and social workers, and technology integration.

Local Communities

In addition to the national and regional networks there are other smaller-scale collaborations focused on local needs and opportunities. Some of these are formal small business roundtables and regular gatherings organized between like-minded manufacturers with occasional participation by local post-secondary institutions. Others are informal connections fostered by shared interests, initiatives, or projects. What they share is a dedication to open interchange, innovative problem-solving, and connected outcomes.

4.1.2.6 VET and SMEs: wrap up

LCAMP's focuses on advanced manufacturing, which can be understood as the application of digital and cutting-edge manufacturing technologies to manufacturing processes. In this sense, our work is relevant for SMEs because in Europe only 25% of SMEs have successfully integrated digital technologies, compared to 54% of big. In fact, the main goal of the community presented in this document will be to facilitate knowledge interactions between VET centres and SMEs as a means of keeping both of them innovative.

This section has specified how we understand VET centres and SMEs. We have emphasised the importance of multifunctional VET centres and the importance of understanding VET innovation as an internal as well as an external process. We have also seen that SMEs have some barriers to engaging in innovation, and that VET can be a vehicle for learning and advancement. We have closed the section with the results of a field research of the Canadian system of applied research.



VET and SMEs

Key messages

SMEs are a vital element for the present and the future of wellbeing in Europe. SMEs have to lead the twin, digital and green, transitions and they need to keep innovating.

- VET can be helpful in assisting SMEs to ride the twin transitions and to become more innovative by means of joint projects, training of students, upskilling and reskilling of workers.



4.1.3 Third Constituent: Advanced Manufacturing (AM)

Advanced manufacturing, smart industries, smart factories, manufacturing of the future, industries of the future, Industry 4.0, Industry 5.0... there are a plethora of terms to refer to industrial transitions or to paradigms of industrial transformation. This section analyses one of the key elements of the LCAMP project and the key pivot point of the open innovation community: advanced manufacturing. We will include in this analysis a short discussion about advanced manufacturing and industry 4.0 and introduce the new industry 5.0 paradigm. A reflection about Collaborative learning factories in VET centres will follow and the section closes with the ADMA methodology. This is the structure of subsections:

- Advanced manufacturing.
- Industry 5.0.
- The collaborative learning factory.
- The ADMA methodology.

4.1.3.1 *Advanced Manufacturing*

We will use the terms “Advanced Manufacturing”, “Smart Factories”, “Smart Industry”, and “Industry 4.0” as synonyms (European Parliament 2015). We know that Industry 4.0 can be used in a broader sense and refer to the implementation of certain technologies in several fields apart from manufacturing, we also know that, if we get too technical, as shown in the image below, Advanced Manufacturing can refer to one Key Enabling Technology that is narrower than all the technologies normally included in I4.0 (European Commission 2018), but for the LCAMP alliance, as our focus is on manufacturing, we will not make any distinction.



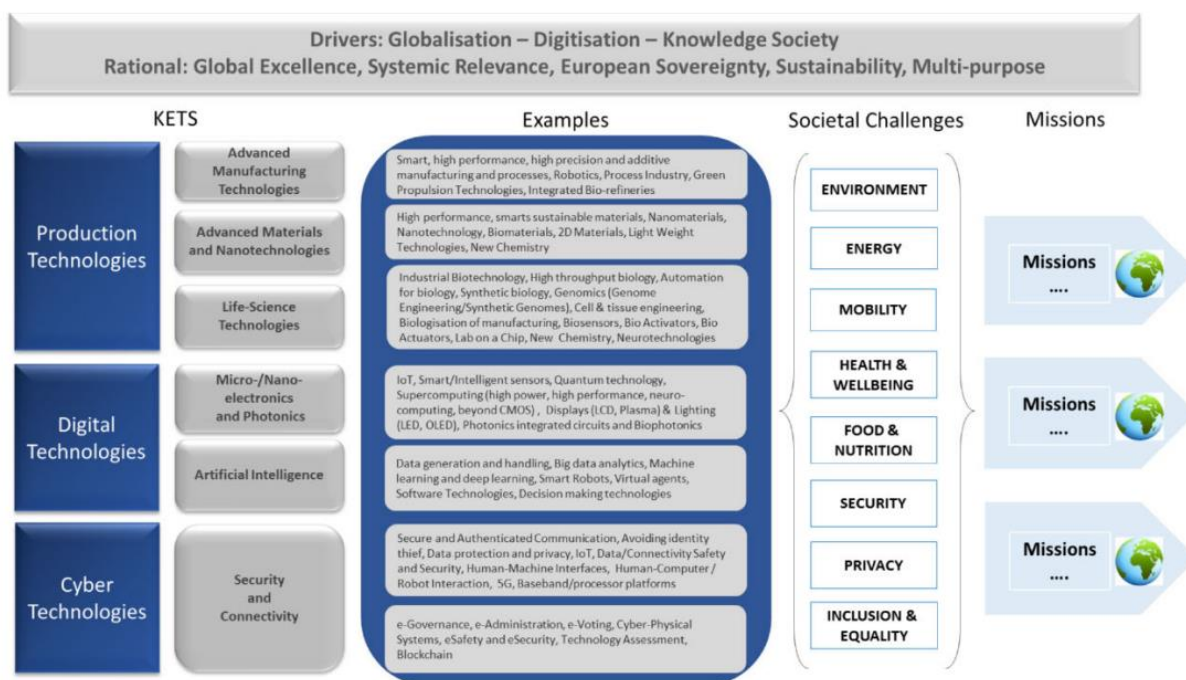


Figure 4 : KETs. Source: European Commission 2018.



We can also find varying definitions of I4.0 and advanced manufacturing:

Source	Term	Definition
European Parliament	I4.0	Industry 4.0 is a term applied to a group of rapid transformations in the design, manufacture, operation and service of manufacturing systems and products. The 4.0 designation signifies that this is the world's fourth industrial revolution, the successor to three earlier industrial revolutions that caused quantum leaps in productivity and changed the lives of people throughout the world. (European Parliament 2015)
Beyond 4.0 project	I4.0	Industrie 4.0 is defined as a specific form of technological transformation. The digitisation of production through AI and automation/robotics, both physical (manual) tasks and, increasingly, some cognitive (mental) tasks currently performed by humans can be automated. The concept can be applied to manufacturing but increasingly to services. Industrie 4.0 offers companies an integrated production system that, through the new digital technologies, links not only functions within companies but also opens up these companies to suppliers and customers. Value can be created by generating efficiency savings throughout the supply chain and by having direct links to customers and being able to provide bespoke or customised goods and services. This digitisation of production contrasts with companies that have hitherto used robotics and advanced automation for production because those companies were 'closed' organisations, with internal production only enveloped.
German Industrie 4.0 Platform	Industry 4.0	Industrie 4.0 refers to the intelligent networking of machines and processes for industry with the help of information and communication technology. There are many ways for companies to use intelligent networking. (Industrie 4.0 Platform, consulted on April 25 2023)
President's Council of	Advanced Manufacturing	Advanced manufacturing is a family of activities that depend on the use and coordination of information,



<u>Advisors on Science and Technology (PCAST) in the US</u>		automation, computation, software, sensing, and networking, and/or make use of cutting edge materials and emerging capabilities enabled by the physical and biological sciences, for example nanotechnology, chemistry, and biology. It involves both new ways to manufacture existing products, and the manufacture of new products emerging from new advanced technologies (PCAST 2011)
<u>NGen, Advanced Manufacturing Supercluster</u>	Industry 4.0 or the Fourth Industrial Revolution	<p>Change, in this case, refers to the transition of manufacturing as we know it in Canada today and the Fourth Industrial Revolution — a blurring of boundaries between the physical, digital, and biological worlds.</p> <p>It's a fusion of advances in artificial intelligence (AI), robotics, the Internet of Things (IoT), 3D printing, genetic engineering, quantum computing, and other technologies. It's the collective force behind many products and services that are fast becoming indispensable to modern life.</p> <p>This term is often closely associated with smart factories, where many of these innovations manifest themselves and introduce new business processes that transform organizations and unleash new capabilities in the people who work within them.</p> <p>https://www.ngen.ca/blog/why-canadian-manufacturers-need-to-understand-the-fourth-industrial-revolution</p>

Table 3: Various definitions of I4.0.



In the end, at least in Europe, Industry 4.0 became the predominant term but without a clear definition and with a new term, Industry 5.0, ready to replace it. It is interesting to note that, as we can see in the map below, at the beginning, Industry 4.0 related initiatives took different names in Europe:

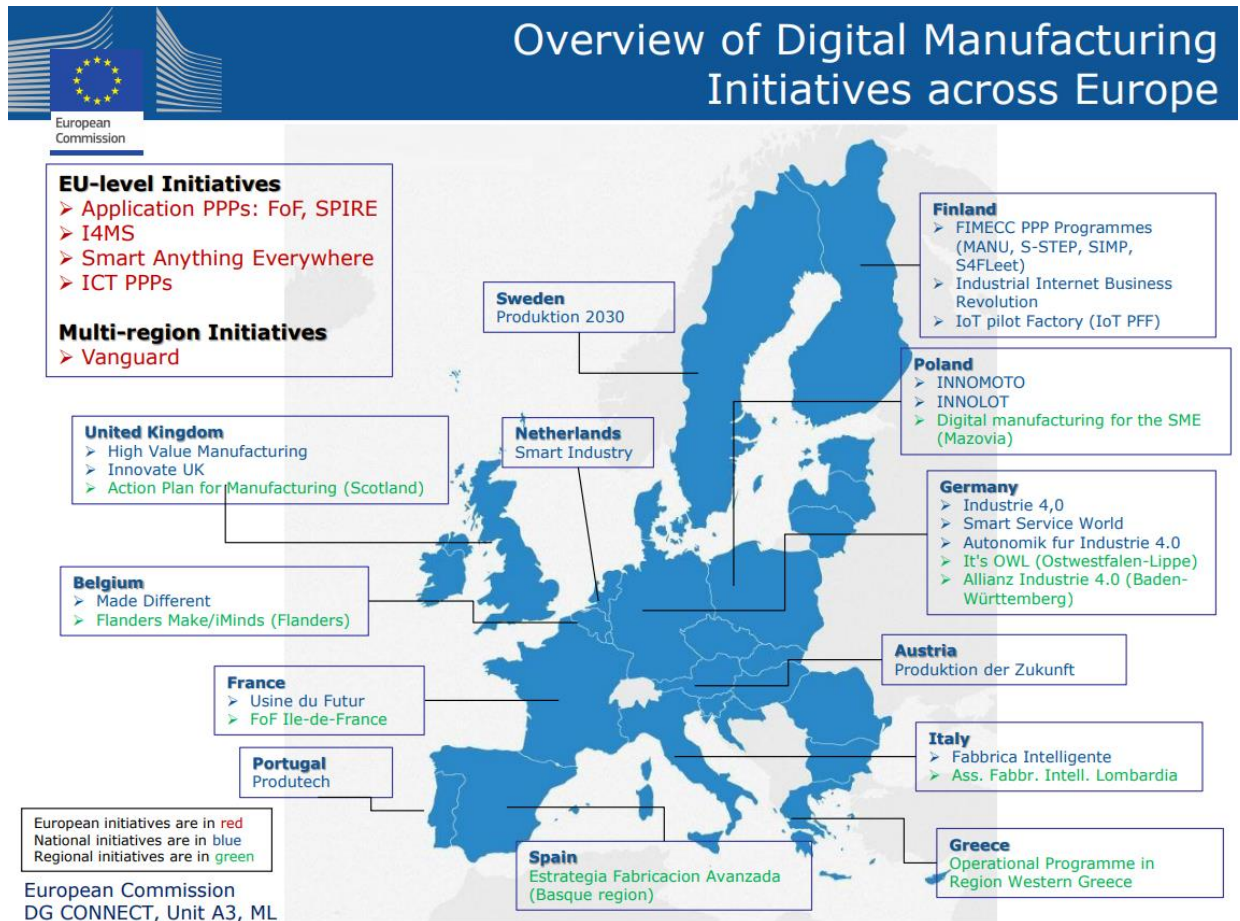


Figure 5: Digital Manufacturing initiatives across Europe. Source: [European Co-operation on innovation in digital manufacturing | Shaping Europe's digital future \(europa.eu\)](https://ec.europa.eu/innovation/en/digital-manufacturing/)

We will understand Industry 4.0 and Advanced Manufacturing as the application of digitalisation (Artificial Intelligence, Big Data, Internet of Things, Internet of Machines, etc.) and cutting-edge manufacturing developments (3D printing, Additive Manufacturing, High precision Machining, etc.) to manufacturing processes with the aim of increasing flexibility, productivity, and efficiency. And following the general trend, we will refer to it as Industry 4.0.



4.1.3.2 Industry 5.0

Industry 4.0 took technology as the starting point and, in recent years, the European Commission is showing concern that the realisation of Industry 4.0 is progressing slowly. To overcome this problem, they propose a new paradigm: Industry 5.0¹⁰.

Industry 5.0 adds a social and more human orientation, such as social fairness or sustainability, to the technological approach of Industry 4.0. The table below shows a few differences between Industry 4.0 and Industry 5.0 (European Commission 2022, 2021a)

From...	To...
Taking emergent technology (digital connectivity and artificial intelligence) as a starting point and examining its potential for increasing efficiency	Putting core human needs and interests at the heart of the production process.
Asking what we can do with new technology	Asking what technology can do for us.
Asking the industry worker to adapt his/her skills to technology	Using technology to adapt the production process to the needs of the worker.

Table 4: I4.0 to I5.0.

The European Commission (2021a) defines Industry 5.0 as follows:

I5.0 recognises the power of industry to achieve societal goals beyond jobs and growth to become a resilient provider of prosperity, by making production respect the boundaries of our planet and placing the wellbeing of the industry worker at the centre of the production process.

It is characterised by:

- Sustainability, understood as reducing energy consumption, reducing greenhouse emissions, and avoiding the depletion and degradation of natural resources.
- Resilience, both individual and collective.



- Human-centric approaches, so that technology serves people and the well-being of workers is important. Workers are empowered and workplaces become more inclusive and safer with the implementation of technologies.

It is important to point out that Industry 5.0 is not a new industrial revolution but an evolution of Industry 4.0 and that many of the things being included in Industry 5.0, such as human centricity or sustainability, were already there. In this sense, we can talk about a paradigm change in how we approach digitalisation and the implementation of a few cutting-edge technologies in the industry.

Box 3: Industrial Revolutions?

The World Economic Forum (WEF), Schwab, has popularised the idea that we are now in the Fourth Industrial Revolution. But the truth is that there is no historical empirical fact that “is” an industrial revolution. Industrial revolutions are interpretative elements to understand some of the things that happen to the economy and the society. Indeed, there have been many different conceptualisations of industrial revolutions over the years. A variety of economic disciplines, such as economics, history, business management or engineering, have analysed them with varying proposals. Depending on the source used, we can be in the second, third, fourth, fifth or sixth industrial revolution and, as Carlota Pérez points out, they are all perfectly right because the revolution in which we are right now will depend on the elements upon which we are focusing (Pérez and Murray Leach 2022). The main difference of the last years seems to be that what used to be a concern of academic disciplines is now part of the popular discourse. The danger of it is that many people have accepted that we are in the fourth industrial revolution as if it were a historical fact comparable to “King Charles III was born on 14 November 1948”.

In the same vein, it might be relevant to clarify that Industry 5.0 and the Japanese concept of “Society 5.0” are different things. The Japanese numbering is not related to industrial revolutions but to different stages of social evolution:

- Society 1.0 hunting gathering economy,
- Society 2.0 agricultural economy,
- Society 3.0 industrial society (corresponds to our first, second and part of the third industrial revolutions),



- Society 4.0 characterised by the dominance of information and the relevance of digitalisation,
- Society 5.0 balances economic development with societal and environmental problems.

Society 5.0 is not manufacturing-focused and it aims to resolve several problems by integrating physical and virtual spaces. The use of technology in the Japanese 5.0 Society is not related only to economic competitiveness, but to every sphere of human life, for the benefit of every citizen.

LCAMP has always aligned with the new I5.0 paradigm¹¹. Industry 5.0 is interesting for VET in general, and for the Open innovation Community this document intends to create because:

- It is related to cutting edge technologies that both companies and VET centres will have to implement and where they can assist each other.
- It is related to huge skills needs; industry and VET will have to collaborate in order to adapt the training provision of young students, and the reskilling and upskilling processes of adults.
- There will be huge innovation-related needs at the organisational, product and process levels where VET centres and SMEs can collaborate and where researchers and

¹¹ We have probably been the first and only one Erasmus+ CoVE project focused on I5.0. Even if we would not call I5.0 a “fifth industrial revolution” now, the project, submitted on September 7, 2021, included the term I5.0 even in its summary: “The fifth industrial revolution is built upon the technologies of the fourth, with an increased emphasis on a human-centric, sustainable and resilient industrial base, emphasising the digital and green transitions. A key pillar of this economic transformation is the role played by Advanced Manufacturing systems such as Robotics, 3D & 4D printing, artificial intelligence and high-performance computing. I5.0, requires VET to develop 'learning centric approaches' that focus on the holistic competences of humans that plan, manage, oversee or operate technologies. LCAMP will tackle this by incorporating a permanent European Platform of Vocational Excellence for Advanced Manufacturing, seeded from a consortium of 20 partners and over 50 associate organisations including leading VET/HVET centres, companies, regional government, R&D centres, associations of companies and clusters. By collaborating across borders, LCAMP’s goal is to support and empower regional AM CoVEs to become more resilient, innovative, and better equipped to train, upskill, and reskill young and adult students to successfully face the digital and green transitions. We will help regions grow and be more competitive through their VET systems. The Alliance is service-oriented, planning to establish permanent structures for:

- Teaching & Learning: establishing AM skills frameworks and curricula; launching or revising AM programmes (including micro-credentials); creating or capacity building learning factories (special AM labs, jointly run by VET and industry)
- Cooperation and Partnerships: launching a skills & jobs observatory for advanced manufacturing; accelerating industry/VET/region cooperation ideas via an open innovation community and providing consultancy to SMEs on integrating SME/VET connections.
- Governance & Funding: creating a one-stop-shop portal for all our services; ensuring a business case for continuing services to stakeholders in the long-term, while enhancing participation



scientists might be helpful, lending support to the creation of a community with a shared interest in knowledge interactions around technology.

- It is an interesting field in which to carry out further research and enhance knowledge. We can expect new research, innovation, and cooperation projects to be born from this new paradigm in LCAMP's OIC.
- It encompasses the twin transition under a single paradigm, giving an easier interpretative framework.

This new way of seeing industry is also interesting for Europe in terms of scientific or theoretical correctness, social and ethical relevance, and coherence with the European policy setting.

Scientific or theoretical correctness. The technologically deterministic approach of Industry 4.0 is theoretically wrong. It is important to check our theories and to make them as good as possible to use them to make new policies, to define new organisational practices and to reform VET accordingly.

Social and ethical relevance. In line with other initiatives like [beyond GDP](#), [beyond growth](#), or the European Pillar of Social Rights, the new approach to industry is fairer than the previous one. We do not hide our values, instead we try to have instil our actions with beneficial social values.

Industry 5.0 principles are also in line with the wider policy context of the European Commission, including the Green Deal, the Digital Strategy, and the general principle of putting the person at the centre of everything.

VET students and centres, as well as SMEs, can benefit from Industry 5.0 in several ways. For example:

- New educational opportunities: Industry 5.0 requires a new set of skills and competencies that go beyond technical knowledge. VET and higher VET institutions can develop new educational programs to prepare students for Industry 5.0 jobs.
- Increased innovation: Industry 5.0 promotes innovation by encouraging collaboration between humans and machines. SMEs can benefit from this approach by creating new products and services that combine the strengths of humans and machines.
- Improved productivity: Industry 5.0 can increase productivity by automating routine tasks and allowing humans to focus on more complex and creative work. SMEs can benefit from this approach by improving their efficiency and competitiveness.
- Environmental sustainability: Industry 5.0 emphasizes the importance of sustainability and aims to reduce the environmental impact of industrial activities. SMEs can benefit



from this approach by adopting more sustainable practices and reducing their carbon footprint.

Industry 5.0 presents a transformative vision for the future of industry that can benefit VET, as well as SMEs, by providing new educational opportunities, promoting innovation, improving productivity, and supporting environmental sustainability.

4.1.3.3 *The Collaborative Learning Factory*

The Industry 5.0 paradigm is also valid for VET centres if we understand that VET centres must implement digital technologies and cutting-edge manufacturing developments with the aim of becoming more resilient, sustainable, and human centric organisations.

LCAMP's approach to Industry 5.0 in VET centres materialises in the Collaborative Learning Factory. Learning Factories are complex learning environments that enable the development of independent and high-quality competences, which are linked to training, education, and research, including Industry 4.0 (Mora & Guarin, 2017). This goes hand in hand with the need for new approaches (Abele, 2015) that:

- Allow training in realistic manufacturing environments;
- Modernise the learning process and bring it closer to industrial practice;
- Leverage industrial practice through the adoption of new manufacturing knowledge and technology;
- Boost innovation in manufacturing by improving capabilities of young engineers and technologists, e.g. problem-solving capability, creativity or systems thinking capability.

The learning factory concept is implementable in different ways (Abele, 2015). To achieve effective competency development, the core of the learning factory concept is a high degree of contextualisation (close to real factory environments) and a hands-on experience for the trainees. The main aspects of Learning Factories (Abele, 2015) (Mora & Guarin, 2017) are:

- Training in real manufacturing settings;
- Contextual learning that is close to industrial practice;
- Integration of new knowledge and technologies being developed in industry, specifically in I4.0;
- Innovation and reinforcement of broad competences such as problem-solving, creativity, systemic thinking, etc.;



- Working on real industrial “products” with an emphasis on the concept of added value and value chain;
- Organisation and production processes (time, cost, quality, etc.);
- Tools and technologies (CAD, CAM, additive manufacturing, simulators, etc.);
- Real-time data management and processing;
- Process automation and industrial robotics;

As mentioned before, LCAMP is an up-scale of the EXAM4.0, where we developed a prototype, and ran the first pilot of, a Collaborative Learning Factory.

In particular, the aim was to promote collaboration by making the most of the opportunities offered by Industry 4.0. In addition to co-creation in all phases of the manufacturing process, an IT infrastructure was defined for the exchange of data (PLM-MES-ERP systems and IIoT platform).

The LCAMP collaborative learning factory consists of an international network of VET/ HMET providers that link their regional autonomous LFs or manufacturing labs to set up a common infrastructure to manufacture products in collaboration. Based on open innovation principles, in the Collaborative Learning Factory, the common product is subdivided into sub-products. The development, manufacturing, and assembly process of each subproduct is led by an independent LF and shared with the network. The final assembly of all the subproducts is carried out in a final assembly line, located in a partner’s lab.

The structure allows for collaboration at different stages in the value chain, and for different types of participants engaging in:

- Co-design of product(s);
- Co definition of manufacturing processes;
- Co-creation of digital workstations;
- Setting up/scaling up LFs, Integration of I4.0 technologies in existing LFs;
- Creation of didactic materials and training contents;
- Participation of students in joint projects involving any of the LFs: producing parts, modifying processes, tailoring product’s features, sharing data;
- The co-work may involve mobility actions optionally

This international consortium aims to enrich local independent LFs and to foster international collaboration, following CoVEs philosophy: “think internationally, act regionally” In particular, the aim is to promote collaboration by making the most of the opportunities offered by Industry 4.0. LCAMP’s efforts will allow VET centres to:



- Improve the training of their students mixing in the same process hard and soft skills;
- Implement Industry 4.0 technologies in VET centre labs;
- Improve the technological knowledge of VET teachers and students;
- Close the distance between real factories and VET centre labs;
- Operate on a smaller scale while making use of the capacity of multiple VET centres

Apart from being a vehicle to promote technological innovation in VET centres, the Collaborative Learning Factory offers many opportunities to support SME innovation, especially when combined with ADMA.

4.1.3.4 *The ADMA methodology*

SMEs play a crucial role in the business fabric of any country, generating employment, fostering competition, and stimulating the local economy. However, they often face unique challenges due to their limited size and resources. It is in this context that technological innovation offers the most value.

Technological innovation is not limited to large corporations or technology companies. SMEs can adapt quickly, be agile, and take advantage of the opportunities offered by the constantly evolving technology landscape. The key is to identify the specific needs of each business and find technology solutions that fit their goals and resources.

Technological innovation is crucial to the growth and success of SMEs today. Embracing new technologies not only allows them to improve their operational efficiency and market reach, but also gives them the opportunity to be disruptive and make a significant impact on their industries. It is time for SMEs to embrace the potential of technological innovation and position themselves at the forefront of the digital economy.

In view of the need for SME innovation, and the need to continue providing resources to support vocational education and the training of teachers, it is necessary to use new tools and methodologies. Thus, after conducting a study on recent methodologies helping SMEs in their technological innovation process, we found that the [ADMA methodology](#) could be suitable for vocational training teachers while also supporting SMEs in their environment and on their way to technological innovation, providing knowledge both in the classroom and in the companies. To this end, it was necessary to carry out field research (see annex II) to see first-hand that the ADMA methodology was the right one to introduce in the LCAMP project.

The conclusion of the field research was that our approach to support SME innovation will be based on the ADMA methodology. Launched by the [Directorate General for Internal](#)



[Market, Industry, Entrepreneurship and SMEs](#) (DG GROW) and the [European Innovation Council](#) and [SMEs Executive Agency](#) (EISMEA) of the European Commission in 2018, the Advanced Manufacturing Support Centre developed an assistance methodology for SMEs that is very well aligned with the main ideas of the Industry 5.0 paradigm. In its 7 transformation areas, ADMA defines a holistic approach encompassing technological and non-technological aspects.



Figure 6: ADMA dimensions. Source: ADMA.

ADMA described a one-stop-shop approach to SME support in 4 phases (vision and ambition, registration and scan, transformation plan, and implementation plan).

Work package 7 of LCAMP is aimed at working with ADMA. On October 1, 2021 the scale up of the ADMA project started, under the name of [ADMA TanS4MErs](#). The project's objective is to support factories to become 'Factories of the Future', considering the ecological, digital, and societal challenges involved. LCAMP has signed a Memorandum of understanding



with ADMA TranS4MErs coordinator, [Irish Manufacturing Research](#), and a group of LCAMP partners have already certified as ADMA TranS4MErs after completion of the training course.

The ADMA TranS4MErs methodology follows ADMA but emphasizes the transformation plan and its implementation. It introduces the TranS4MEr role, which is essential in this process as they assist SMEs throughout their transformation journey. TranS4MErs have a comprehensive understanding of the specific challenges that SMEs face and the most appropriate tools to use for their transformation. Together with the SME, the TranS4MEr co-creates the Transformation Plan (TP), which prioritizes implementation and jump-starts the SME's transformation process. This is a crucial step where the SME establishes a relationship with the TranS4MEr and receives guidance on how to use the virtual xChange platform to seek out domain experts, toolkits, etc., to address the priority challenges listed in the ADMA TP. In the Revamp Phase, the SME receives tokens from the voucher system, which they can use to pay for education modules, tech tools, expert advice, and other resources. This provides SMEs with access to the necessary resources to implement their Transformation Plan and to become a Factory of the Future.



Figure 7: The ADMA TranS4MErs three-step approach¹²

¹² The information presented here is based on the ADMA TranS4MErs deliverable from March 2023, which is the final outcome of the project. AFIL, a consortium member of the LCAMP project, participated in both the ADMA 2018-2021 and ADMA TranS4MErs projects.



The primary objective of ADMA TranS4MErs is to assist SMEs across Europe to become companies that can successfully navigate the digital, ecological, and societal challenges and remain competitive: Factories of the Future. The process to reach that goal is called the Transformation Journey and SMEs often need support and guidance to make the right choices and stay on track. Therefore, to ensure that each SME receives the necessary assistance, each company will be matched with an ADMA TranS4MEr, who will be their contact throughout the transformation journey. The TranS4MErs will provide valuable assistance and guidance, ensuring they are well-quipped to face the challenges ahead.

The SME journey comprises various stages, including the link to the TranS4MEr match, voucher applications and service selections. These steps are described below:

- Step 1, the SME registers on the TranS4MEr platform.
- Step 2, the SME applies for the Design Voucher, which will enable the SME to be matched with a TranS4MEr and create a Transformation and Implementation Plan.
- Step 3, the SME will be matched with a TranS4MEr of their choice. The TranS4MEr is a trained person who will be the helping hand/trusted advisor and guide the SME throughout the journey. The TranS4MEr may even bring potential SMEs to the xChange platform and support them during the Scan process.
- Step 4, the SME takes the scan, which is a questionnaire that uncovers strengths and weaknesses in 7 areas related to advanced manufacturing (Advanced Manufacturing Technologies, Digital Factory, ECO Factory, End-to-end Customer Focussed Engineering, Human Centred Organisation, Smart Manufacturing, Value Chain Oriented Open Factory)
- Step 5, after completing the scan, the SME has a debrief session with the TranS4MEr to go over the scan results and relate them to the SME's situation. During this, priorities are discussed and the TranS4MEr draft a Transformation Plan. This plan analyses the SMEs transformation maturity in the 7 areas, identifies opportunities for change and selects the one, or two areas, where the transformation journey should begin. It is discussed and reviewed with the SME to reach the final plan. Then the TranS4MEr drafts the Implementation section which goes into more detail about the selected areas. Based on the analysis of potential solutions and conclusions made to match specific objectives, the ADMA TranS4MEr guides the selection of Services, including training and expertise, that the SME may benefit from in its transformation journey and help set the KPIs. The draft is reviewed and finalized together with the SME.



- Step 6, the SME submits the Transformation and Implementation Plan for evaluation, which simultaneously serves as the application for a Revamp Voucher.
- Step 7, if the SME is granted the Voucher 2 (Revamp), the actual implementation will begin with confirming the services as reserved in the plan and then the services can be accessed.

Ideally, while training and other actions are taking place, the TranS4MEr is on stand-by to hear about the learning and suggest the next step. After the implementation, KPIs are measured and included in the SME Progress tracking, which has two recipients: the SME to support its journey, and the Program Management to support the program development. SMEs who do not wish to apply for vouchers can still embark on a transformation journey. After registering, they can bypass the voucher application process and proceed directly to taking the scan and perusing the service catalogue to select the services they wish to implement. They can then contact the service provider directly and make their own arrangements. If SMEs choose to follow the supported voucher-scheme journey, TranS4MEer will also assist them in collecting a success story that can inspire new users. The feedback obtained will help TranS4MEers, service providers, and program managers improve their services and processes. The SME will conclude the transformation journey within this framework, but the intention is for the journey to continue beyond that point.

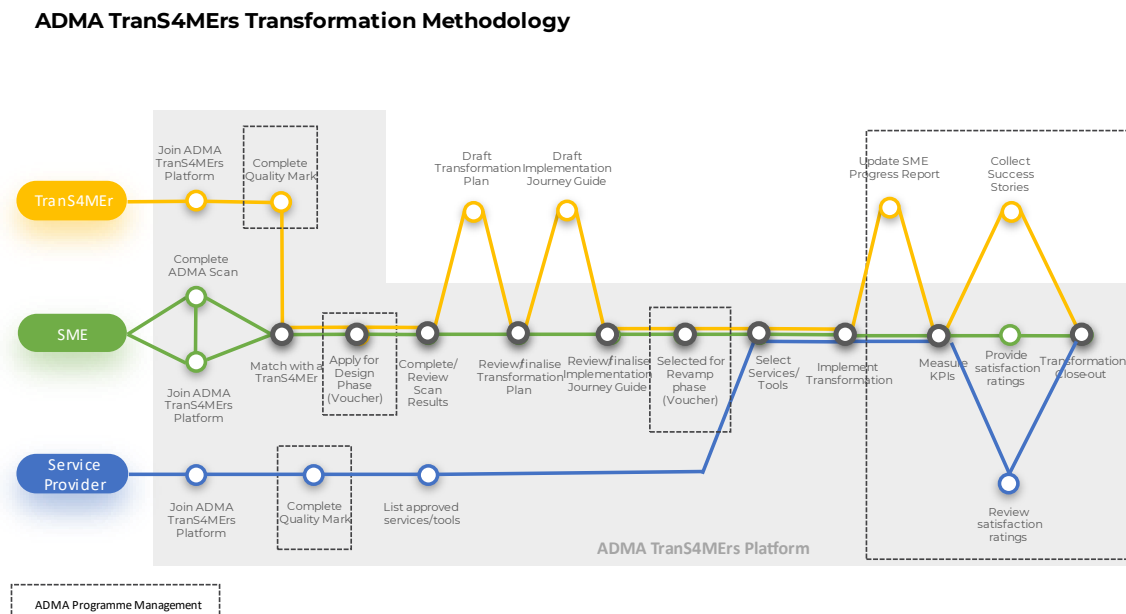
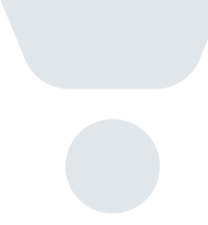


Figure 8: Journey map - a frame for the improved methodology.





Knowing the value that could be obtained by the ADMA TRANS4MERS project and its methodology of scanning SMEs implementing innovation, it was necessary to carry out field research on what is being done in the project and it was very interesting to conduct interviews and hold conversations with the TRANS4MERS themselves who are already collaborating with companies. These agents have been the first in Europe to use this new innovative methodology and are already helping companies in their digital transformation. The field research is available in annex II. A deep insight into the reality and impact of ADMA has been gained through the field research.

During the interviews with ADMA experts, essential knowledge has been gained about the principles, applications and benefits of this methodology. We understand how ADMA is based on the use of advanced technologies in manufacturing processes, such as automation, robotics, data analysis and artificial intelligence among others. Furthermore, we identified how ADMA can help SMEs improve the efficiency, productivity, and quality of their manufacturing processes. The interviews revealed that ADMA is having a significant impact on companies in the manufacturing sector. The implementation of advanced technologies, such as robotics and automation, has enabled organisations to improve the speed and accuracy of their manufacturing processes. In addition, data analytics and artificial intelligence have facilitated decision-making based on real-time information, which is leading to greater efficiency and optimisation of resources. The use of ADMA has driven product innovation and enabled companies to adapt quickly to market changes.

In conclusion, interviews with ADMA experts have provided a deep understanding of the ADMA methodology and its impact on SMEs. Because of this experience, ADMA will be a central feature of the LCAMP project, focusing on its application in VET.



4.1.3.5 *Advanced manufacturing: wrap up*

This section has discussed how we understand advanced manufacturing and industry 4.0. We have then proposed to interpret advanced manufacturing and Industry 4.0 under the new Industry 5.0 paradigm, which is less an industrial revolution and more a deepening of Industry 4.0. We have then shown that we have two tools to assist VET centres and SMEs in the transition to industry 5.0: the collaborative learning factory and ADMA.

Advanced manufacturing

Key messages

- LCAMP will reinterpret advanced manufacturing under the more encompassing paradigm of industry 5.0.
- Industry 5.0 is DEFINITION OF THE EU COMMISSION
- The LCAMP open innovation community will use the Collaborative Learning Factory as a tool to support the transition of VET centres to I5.0.
- The LCAMP open innovation community will use ADMA to support the transition of SMEs to I5.0.



4.1.4 Fourth Constituent: Open Innovation

The noun “innovation”, the verb “innovate”, and the adjective “innovative” have all become buzzwords that can have several meanings depending on the context, or even “fashion terms” used to denote nothing at all. The addition of the adjective “open” does little to improve the situation. The omnipresence of the term in our societies is understandable considering that innovation, especially technological innovation, is related to economic growth, company competitiveness, improved wellbeing, sustainability, and many other desirable effects.

Since social science innovation research started in the 1960s, knowledge about innovation has grown (Fagerberg 2005: 1-2) and we should build on that research to give the concept a serious treatment that:

- steers us away from the irresponsible use of the term “innovation”, and
- leads us away from Manichaeism.

We will open this section discussing how we can understand innovation without falling into empty discourses that repeat the usual buzzwords. We will then follow with a reflection about the relevance of innovation. Why has it become a buzzword? Why is it a concern for all governments? Why do we think that sentences such as “innovate or die” are true? Next, we analyse the “values” of innovation. Some people consider it good; others seem to fear technological innovation and predict all types of disasters, ranging from the devastation of nature to the destruction of human life, the end of employment, or even the idea of people becoming slaves of “intelligent” machines. After that, we will analyse how innovation happens or, to be more precise, the different ways in which the process of innovation has been described. This part will analyse how technological innovation has been related, and unrelated, to science and research.

This section, the longest of the document, is composed of 10 subsections:

- What is innovation?
- Why is innovation important?
- The “dark side” of innovation.
- How does innovation work?
- Open and user Innovation.
- Learning and innovation.
- Innovation and entrepreneurship.
- EU policies to support entrepreneurship.
- Entrepreneurship and VET.



- Case study: advanced manufacturing entrepreneurial ecosystem in Spain: UPTEK.
- (Regional) Smart Specialisation.
- VET centres in Regional Smart Specialisation.

4.1.4.1 *What is innovation?*

The most widely used sources for definitions related to Research, Development and Innovation are the different manuals produced to that end by the OECD. According to the 2018 edition of the OSLO Manual (OECD/Eurostat 2018):

An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process).¹³

As we can see, this definition focuses on innovations that happen in markets and companies, the ones which are likely to have an economic impact. It is important to note that, if an innovation refers more to the implementation of a novelty (or improvement), then it can only be empirically confirmed.

Economist Joseph Schumpeter (1883-1950), one of the first economists to pay attention to innovation, introduced an important distinction between invention, which is an act of creativity, and innovation, an economic phenomenon taking place in firms adopting the invention. (Godin 2017). In this Schumpeterian view, inventions can be carried out everywhere, but innovations occur in firms, which turn the invention into innovation. Turning the invention into an innovation requires the capacity to combine different types of knowledge, very different from the knowledge needed to invent, and Schumpeter labelled the persons with the knowledge combination capacity required to succeed in the innovation as “entrepreneurs” (Fagerberg 2005: 5). The relationship between invention and innovation is varied, for there can be almost no distinction between the two or there can be a long time-lag between invention and innovation. The time-lags can be due to factors like insufficient commercialisation conditions, lack of market demand, impossibility in the production side, or lack of complementary factors that are vital to making the innovation work (Fagerberg 2005: 5).

¹³ “unit” means any actor responsible for innovations, including households and their individual members.



Schumpeter identified innovation with five possible types of phenomena (Fagerberg 2005, Godin 2017; Echeverría 2017):

- Introduction of a new good.
- Introduction of a new method of production.
- Opening of a new market.
- Conquest of a new source of supply for raw materials or half manufactured goods.
- Implementation of a new form of organisation.

As we can see, the types of innovation Schumpeter defined are similar to the four types of innovation commonly mentioned: product innovation, process innovation, organisational innovation, and marketing innovation. The previous edition of the *Oslo Manual* (OECD 2005) included the four types of innovation, the last edition (OECD 2018) includes only two: product and process innovations.

The distinction between product and process innovations is easy to identify inside an individual enterprise but it becomes tricky to identify at the level of the overall economy. The reason is that “the product of one firm (or industry) may end up as being used to produce goods or services in another”. (Fagerberg 2005: 7).

Schumpeter also paid attention to an innovation’s degree of novelty with respect to a specific technology, and established the well-known division between “incremental” (marginal) innovation and “radical” (disruptive) innovations. Incremental innovations refer to small improvements that are continuously made to a technology, while radical innovation refers to the introduction of a totally new technology. He related radical innovation with economic change and with waves or cycles of technological progress.

“Schumpeter emphasized the tendency for innovations to “cluster” in certain industries and time periods (along with the derived effects on growth) and the possible contribution of such “clustering” to the formation of business cycles and “long waves” in the world economy (Fagerberg 2005: 6). The idea is that after a breakthrough and applications, there is an explosion in economic activity. Schumpeter distinguished waves of technological advance. “Following Kondratiev, Schumpeter saw the first wave driven by the Industrial Revolution in England (1787-1842); the second in the Age of Railways, the so-called ‘bourgeois Kondratiev’ (1843-1897); and the first half of the third wave developing from 1898 to 1913, in what he termed the ‘neomercantilist’ wave”. (Pérez and Murray 2022: 10).

Appealing as this might be, there are authors who contradict the importance of radical innovation and the belief that these innovations are the most impactful in the economy. On the one hand, all incremental innovations taken together, in sum, have a greater impact and are



more important for the survival of many businesses than a single radical innovation. On the other hand, radical innovations require several incremental improvements to work, so that, even the most relevant radical innovation would not work without the assistance of incremental innovations. An important issue with innovation is also the context. As Jan Fagerberg puts it (Fagerberg 2005: 8):

If A for the first time introduces a particular innovation in one context, while B later introduces the same innovation in another, would we characterize both as innovators? This is a matter of convention. A widely used practice, based on Schumpeter's work, is to reserve the term innovator for A and characterize B as an imitator. But one might argue that, following Schumpeter's own definition, it would be equally consistent to call B an innovator as well, since B is introducing the innovation for the first time in a new context.

Imitation can be a very creative activity as many significant innovations can occur while a new thing is being introduced in a new context. For example, the introduction of an already existing digital technology (which other firms are already using) in another firm for which this technology is new, might lead to organisational innovations or other changes that are related to the new technology but not necessarily part of its implementation.

In relation to the relevance of incremental innovation, we should also emphasise that it is difficult to understand an innovation as something that happens at a single point in time. For most innovations it is difficult to say when they are finished (Fagerberg 2005: 5). This is why we consider it worthwhile to think about innovation as a process.

4.1.4.2 *Why is innovation important?*

The importance of innovation derives from its relevance to the economic growth, international competitiveness, and survival of companies. Schumpeter was one of the first authors to emphasise the importance of innovation for the economy. He emphasised the role of innovation in producing social and economic change. He defined innovation as “new combinations” of existing resources. This combination activity he labelled “the entrepreneurial function” (to be fulfilled by “entrepreneurs”), to which he attached much importance (Fagerberg 2005: 6). MIT Professor Robert Solow won the Nobel Prize in Economics in 1987 for his work on Growth Theory. He attacked the neoclassical economic conception of growth and instead championed technological advance as the key driver of economic growth. There are many more economists who emphasise the importance of technological innovation for economic growth, and their arguments can be summarised as follows:



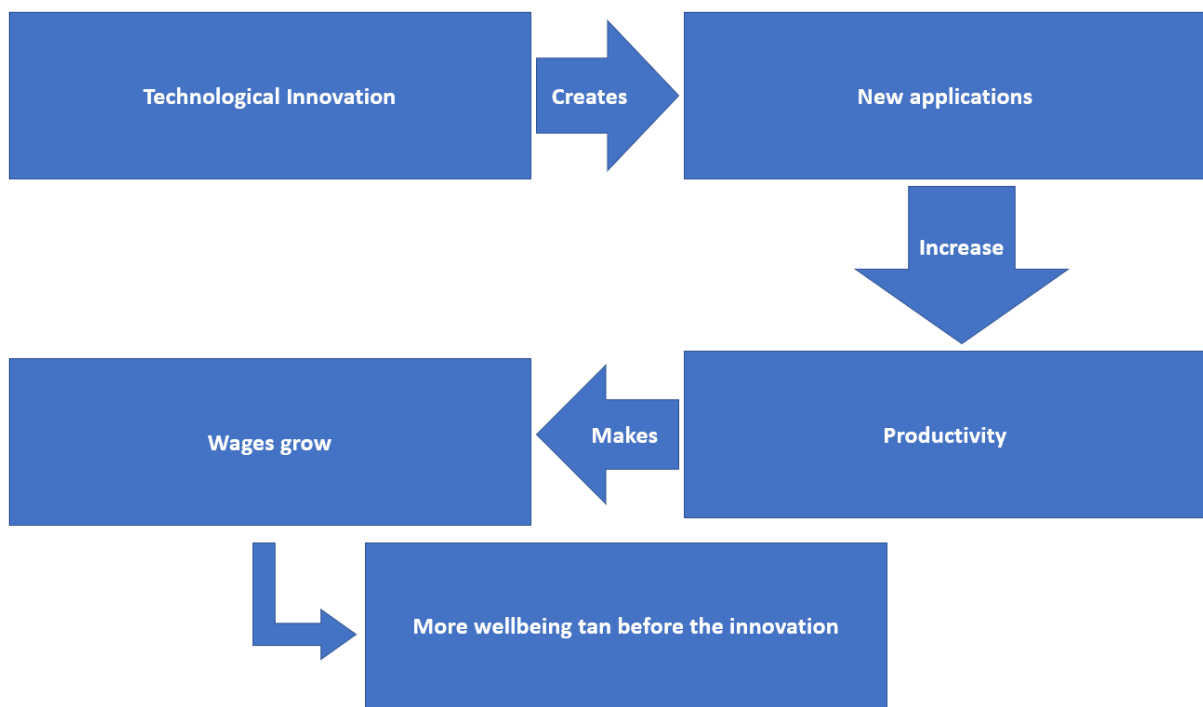


Figure 9: Technological innovation and wellbeing.

Innovation is also important from an international competition point of view. According to an old classification, countries can be advanced or not so advanced, and being innovative is one of the keys to being an advanced country.

Finally, in a slightly different viewpoint, innovation is related to business survival. In this case, more than its importance for growth or competitiveness, it is said that businesses must innovate if they want to avoid closing their doors. In this sense, innovation is not only desirable but necessary.

The implication for any of those arguments, or all of them taken together, is that we all should support, work on, and try to advance technological innovation. Governments must support technological innovation if they want their countries to continue (or start) growing, if they want to maintain (or achieve) social wellbeing, if they want to be internationally competitive, and if they want their national businesses to survive. Businesses must invest and work on technological innovation if they want to continue being competitive and if they want to have more economic growth.

Given its importance, the discussion about innovation's value is resolved; now the question is how to support innovation? Before we turn to that it seems wise to reflect on how innovation works; knowing how something works will make it easier to understand and support



it. How can we support something if we do not know how it works? But before we move to consider how innovation works, we should stop and consider that, as Schumpeter indicated, innovation is destructive as well as it is creative. We should consider the “dark side of innovation”.

4.1.4.3 The “dark side” of innovation

Even if we accept that technological innovation can have beneficial effects on economic growth and that wellbeing can result, there are different ways in which innovation can have negative effects.

The first thing we should consider is that technology and society shape each other in a process of co-construction and that there is no such thing as a new technology appearing in a society and modifying the historical path¹⁴. In this sense, we can understand that, in any society, for any new technology, there will be groups of people supporting it and groups of people opposing it. This view opposes a rather common way of perceiving technological innovation that has been labelled as “technological determinism”. In this sense it is important to emphasise that technological innovation can follow one path or another.

Let us consider what happened for example with the COVID-19 pandemic. In most countries, scientists, like epidemiologists, were given the category of public spokesperson for science investment, mainly to develop a vaccine, and a vaccine was developed in record time. This created groups in favour and against everything and nothing: the pandemic is an invention, the vaccine is dangerous, the pandemic is more dangerous than what they are telling us, COVID is as mild as any other flu, COVID is super-deadly, etc. Most of us can probably remember discussions like the one (invented) below:

- *I am not going to take the COVID vaccine because it has not been tested.*
- *Yes, but even if it has not been tested, from the data we have, it is safer to be vaccinated than the other way around.*
- *COVID is not very dangerous. I would rather risk suffering COVID than the secondary effects of the vaccine.*
- *Your reasoning is statistically flawed: COVID is more dangerous than the vaccine. If we go to the total numbers, regardless of any interpretation: there was a rise in deaths at global level and hospital admissions skyrocketed. You can call it COVID or not, but*

¹⁴ This can be referred to as “technological determinism”. We oppose technological determinism as we explain in the [Strategic Plan of the LCAMP Alliance](#), see “Principle 3 on pages 10 and 11 of the document.



something health threatening happened. Apart from that, we know from history that vaccines work. And we also see how the increase of vaccinated people is lowering both deaths and hospital admissions. This is not an opinion, this is facts.

- *Yes, but there is no way I am allowing science to experiment with my body.*
- *Science is not experimenting with your body, the experiments...*

We all remember how frustrating those arguments were, so we will not continue with the fictitious dialogue. What we want to say is that the introduction of a new technology encounters support, opposition, and indifference and that its success depends a lot on that conflict. It is important to note as well that, where we put COVID-19 vaccine, we could have put artificial intelligence, a new highway, electric cars, and many other things. For analysts of the topic we do not care about the content of those dynamics, what is relevant is to highlight that these dynamics happen and that it is, therefore, unrealistic to assume that technologies are independent of society.

Additionally, a technology can mean different things depending on the use an individual, social group, or company makes of it. Technology creators do not create alone, users of the technology serve as co-producers. The history of technology shows how users (consumers, tinkerers, activists, etc.) have challenged “proper” technology uses envisioned by technology creators. The verbs “consume” and “use” do not refer to passive activities that follow pre-set rules, but active deliberation, decision making, modification, adaptation, and adjustment of technologies. (Oldenziel and Hard, 2013) The same technology can be used to do one thing or another. When it comes to industry, it is important to acknowledge the importance of companies and company cultures, management styles, organisational cultures, and workers in shaping what a technology will mean and the effects it will have ().

There is no correct use for a technology. “What is an alarm clock for?” we might ask. “To wake us up in the morning”, we might answer. But just begin to list all the uses to which an alarm clock can be put and you see the problem. An alarm clock can be worn as a political statement by a rapper; it can be used to make sound on a Pink Floyd recording; it can be used to evoke laughter, as Mr. Bean does in one of his comic sketches as he tries to drown his alarm clock in his bedside water pitcher; it can be used to trigger a bomb; and, yes, it can be used to wake us up. No doubt there are many more uses. Of course, there might be one dominant use of technology; or a prescribed use, or a use that confirms the manufacturer’s warranty, but there is no one essential use that can be deduced from the artifact itself. (Oudshoorn and Pinch 2005).

Second, technological innovation affects employment. Technology does change the way we live and of course the way we work. Work is referred to as an effort done to achieve something. Work can be paid or unpaid and it is always composed by tasks. A company can



bundle a group of tasks and call them a job. If someone wants to apply for the job, she should have the skills (knowledge, competences) to perform the tasks. New technologies can change, destroy, and create tasks that do not exist now. All this makes employment change by means of jobs destruction that exist in a current moment, creation of new jobs, or modification of tasks inside jobs. Related to digitalisation, automation and Artificial Intelligence, some authors have shown serious concerns for the disappearance of millions of jobs that will never be recovered. Another example, perhaps more realistic, can be the migration of work to platforms. Older examples, like the Ludites, can be found in history. It is interesting to note that before the term “technological innovation” made its appearance, other concepts were used to reflect on the effect of technology on society. One of those terms, in the context of the depressions of the second decade of the twentieth century, was “technological unemployment”. As the name suggests, it refers to the destruction of employment caused by the introduction of new technologies (Godin 2020)¹⁵. The first report (1953) of the European Coal and Steel Community (the precursor of the European Commission) stated that “the High Authority could grant financial aid to programmes to offset the possible negative effects of technological advances in the industry on the workforce (compensation, allowances and vocational retraining)”. So, it seems that all these speeches are old wine in new bottles. Of course, seeing that a concern is “old” does not mean that it is irrelevant. It only provides an appropriate perspective and helps us to interpret it better.

Third, it is commonly assumed that innovation is an intentional process, but can we say that of every innovation? It starts getting complicated when we assume the social nature of many innovations. Do social groups really have intentions? Can someone control them? According to Arrow’s “impossibility” or “general possibility” theorem, we cannot be sure (Morreau 2019).

Fourth, the values that drive the support for innovation in our societies, values that we usually assume without stating them clearly (competitiveness, productivity, efficiency, money savings, and the like) are not necessarily good. An ethical or political discussion is out of the scope of this document, but it is important to notice that those or similar values drive public and company policies to support innovation and therefore form a specific value system from which we can say that innovation is good.

Those typically capitalist values can be seen in what we consider innovation as well. When we think about innovation, we are not so much thinking about inventions, but about their

¹⁵ According to the same author, apart from that of “technological unemployment” the concepts of “technological change” and “technological progress” preceded the concept of technological innovation (Godin 2020)



commercialisation or about their spreading in society. The *Oslo Manual* deals with innovations that happen in markets. There is a clear bias towards considering innovation in market terms, but is this the only type of innovation out there? Is there not innovation in literature? In the arts? In fields that do not necessarily have an impact in the market?¹⁶ This is probably the reason why we are living through what Godin (2020) calls “X-innovation” (educational innovation, public sector innovation, social innovation, sustainable innovation, etc.).¹⁷

We should also see that innovation is sometimes supported with specific values in mind. A typical example can be found in the military. Military programmes have been behind some of the most influential technologies of the twentieth century. We can find excellent examples of science, engineering, and technology working together to create cutting edge products and processes which will revolutionise their fields. Think about the world-famous “Manhattan project” one of the reasons behind the support for research and development, with the resulting technological innovation in mind, was that during the two world wars the United States understood that making researchers at universities, industrial laboratories, and manufacturers work together was the key to boosting technological innovation. According to the popular story, on November 17, 1944, President Franklin Delano Roosevelt addressed a letter to Dr. Vannevar Bush asking advice on how to apply the lessons learned during wartime to continue supporting a fast technological progress during peacetime and Dr. Bush answered with the world-famous report *Science, the endless frontier*.

New frontiers of the mind are before us, and if they are pioneered with the same vision, boldness, and drive with which we waged this war we can create a fuller and more fruitful employment and fuller and more fruitful life. (Bush 1945)

Fifth, we tend to say that innovation is good because economists were able to discover a correlation between GDP and innovation. However, in the last years the measurement of GDP as a synonym of wellbeing has been called into question. There is a whole initiative referred to

¹⁶ Some authors go as far as talking about “natural innovation”. Natural innovation processes, such as the appearance of cosmologic entities (galaxies, and stars), geologic entities (continents, volcan, islands) and biological entities (physiologic systems, living beings, ecosystems, new environmental conditions) are older than human beings and had systemic consequences in their environments. They even identify product innovations (appearance of new species), process innovations (fermentation, photosynthesis, use of oxygen in breathing), organisational innovations (emergence of new forms of organising life: social species, such as ants, bees, birds, mammals, etc.), and communicational innovations (new modalities of communication among beings: bacteria, pheromones, emergence of vision, language, etc.) (Echeverría 2017)

¹⁷ This is not a criticism to the *Oslo Manual* because the aim of the *Oslo Manual* is not a conceptual analysis of innovation but to help OECD countries in shaping their innovation policy and to help them in measuring innovation. It is also a powerful tool for comparison.



as “beyond GDP” which is trying to define new indicators that reflect more important things for citizens wellbeing.

Sixth, we normally think that innovative societies are more advanced than the less innovative, but this can be difficult to defend. Behind all these arguments there always lies the assumption that all societies have a common goal and that all pass certain stages of development. This is a negation of cultural variety, in which, normally, rich countries assume that they are more advanced and compare to the rest of the countries saying they are still developing.

The previous six points should not be understood as an opposition to innovation but rather as an opposition to a simplistic way of understanding it. Innovation is a complex phenomenon and any theorisation that considers it good or bad will be wrong.

4.1.4.4 *How does innovation work?*

Havelock (1967) drew a distinction between process and systemic models of innovation; process models deal with the steps leading to an innovation. We will summarise two of those models, one emphasising the role of basic research and the other making market needs the key mover. System models deal with the actors (companies, individuals, organisations) and how these actors interact to bring about an innovation. We will discuss national and regional systems of innovation.

One of the oldest and most popular conceptions of innovation in the 20th century depicts it as a series of steps, starting with basic research and finishing with commercialisation. The invention of the model, known as the science push model, is usually attributed to Vannevar Bush in his 1945 report *Science, the endless frontier*, or to Joseph Schumpeter.



Box 4: Who invented the Science Push Innovation Model?

It is very common to attribute the invention of the Science Push innovation model to either Joseph Schumpeter or to Vannevar Bush, but Benoît Godin (2017) shows that this is not the case.

According to Godin, Schumpeter developed important ideas about innovation and introduced interesting distinctions, such as the difference between invention and innovation, but he did not analyse the process of innovation in itself. Vannevar Bush defended causal links between basic research and technological progress, but he did not develop a model. The first version of the model was presented by Rupert Maclaurin, from the MIT. Maclaurin developed Schumpeter's ideas, analysing innovation as a process composed of several stages, and proposed a theory of technological innovation. Maclaurin participated in one of the committees that assisted Vannevar Bush in the preparation of *Science, the endless frontier*. But there are similar frameworks in the literature concurrent or prior to Maclaurin: historians (Usher 1929), sociologists (Ogburn and Gilfillan 1933, United States National Resources Committee 1937), management schools (Mees 1920, Bichowsky 1942, Furnas 1948), consultants (Stevens 1941), and industrialists (Holland 1928).

Godin argues that the Science Push model is the construction of several agents, industrialists, consultants, business schools, and economists. He differentiates three overlapping steps in the development of the model:

Step	Community	Priorities
Until around 1945 the discussion was centred on the connection between basic research and applied research. They passed from being opposing categories to collaborate with each other: applied research builds on basic research.	Natural scientists developing a rhetoric of basic research as the source for applied research and technology.	Public support of university research understood as “basic research”.



Between around 1934 and around 1960, a third category (and stage) was added to the discussion: development. This creates the standard model: basic research-applied research-development.	Business schools	The strategic importance of technology for industry. The relevance of “development” and not just basic and applied research.
From the 1950s, non-R&D activities as production and commercialisation were added.	Economists	The impact of R&D on the economy and society.
Godin also gives an explanation for the survival of the model despite all the criticisms it has gone through: its crystallisation in statistics.		

This model has been and still is a very common way of conceptualising information. The idea is that some organisations, normally universities, discover new knowledge. This knowledge is not discovered with any practical application in mind, it is just pure knowledge “basic” researchers do research for the sake of knowledge, without any utility in mind. There are then other organisations, normally applied research and development divisions in industry, which work on doing research to find potential applications for this knowledge. The potential applications of applied research are still far from being used but the research is carried out with practical applications in mind. The results of applied research are transferred into production by means of development. Development is an activity, normally carried out by engineers in industrial development labs, that consists of finding productive applications for applied research results. Then these developments, if successful, are implemented in production making new products that are commercially available. This theory is related to the idea that technology (applied science) comes from basic science by finding practical applications.

The implications for policymakers who want to design innovation support policies are clear: they should support basic research and scientists as knowledge and truth seekers with



the hope that then industries and public organisations, through their applied research laboratories, will be able to find some promising applications that could then be put into development and, if they are successful, moved to production and then to the market. The implications for companies are similar: invest in laboratories where scientists are allowed to research things. Most of their findings will be useless but the company will be able to put some of their findings in production (and then into the market) through the development unit.

The science push model has been widely criticised and few will accept such a view of innovation now, but why did it then become so prevalent? According to Godin (2017), this way of understanding innovation became an accepted fact when the OECD crystallised it in the first edition of the OECD *Frascati Manual* in 1963.

It is true that analytically we can distinguish what basic research, applied research, and development are, but when it comes to the real day-to-day life of work it might become rather complicated.

This conception of innovation as a series of steps from scientific discovery to market has been opposed by another similar “linear” understanding according to which innovation starts with a market need and then applied research and development are carried out to create a new product that meets the need. This second “model” of innovation downplays the importance of scientific research and makes market needs the key driver of innovation. Arguments in favour of one or the other way of understanding how innovation happens can be found in the literature.

Box 5: Project Hindsight and TRACES

Project HIDSIGHT is frequently quoted as an example of an argument against the importance of basic research for technological innovation. Project TRACES is an example of the contrary: a report arguing in favour of the importance of basic research for innovation.

The argument on both sides of the discussion is difficult to resolve and, because of that, some authors started to talk about “coupling” of market needs and research. The discussion is similar to the one about the relationship between science and technology (when technology is understood as applied science).

There is still a third group of theories that understand innovation as a systemic endeavour. The most relevant here are the national and regional innovation systems. The concept of the national innovation system builds on the idea that innovation is an interactive,



systemic, process that combines several types of knowledge within and across organisational borders (Chaminade, Lundvall and Haneef 2018).

The national innovation systems approach stresses that the flows of technology and information among people, enterprises and institutions are key to the innovative process. Innovation and technology development are the result of a complex set of relationships among actors in the system, which includes enterprises, universities and government research institutes. For policy-makers, an understanding of the national innovation system can help identify leverage points for enhancing innovative performance and overall competitiveness. It can assist in pinpointing mismatches within the system, both among institutions and in relation to government policies, which can thwart technology development and innovation. Policies which seek to improve networking among the actors and institutions in the system and which aim at enhancing the innovative capacity of firms, particularly their ability to identify and absorb technologies, are most valuable in this context. (OECD 1997)

Innovation is a process that (Echeverría 2017):

- Is promoted (supported) by some agents and opposed (rejected) by others.
- Is developed in time.
- Takes place in an environment.
- Is disseminated and is scalable.
- Implies various agents and systems.
- Generates various results, effects, and consequences in the systems of which it is involved.
- Has results, effects, and consequences that generate values and dis-values in systems and environments.
- Is assessed in terms of the value systems operating in these environments, as well as the benefits and harms that innovation processes bring to each actor. Novelty is relative. Something is new when compared to the previous situation in a context. Place and time are important.
- Incorporates environments and interaction forms that can be beneficial to innovation.

The idea that innovation happens in systems has been a common way of understanding since the 1980s, and it has been influential on policymaking through the national and regional innovation system concept. The concept appeared in an unpublished paper by Christopher Freeman in 1982, Bengt-Ake Lundvall used it in a booklet in 1985, Freeman used it again in 1987, and in 1988 Freeman, Lundvall and Nelson used it again. Since the 1990s, the OECD



has adopted the concept and made it influential for policymakers. The main features of the new approach were (Chaminade, Lundvall and Haneef 2018):

- A move from the science push view of innovation to the paradigm of interaction and networking.
- A move from the linear view of innovation to a systemic view.
- Including new sources of innovation apart from research. For example, experience-based learning taking place within firms or the learning interactions between research and industries have become important sources of innovation.
- The importance of context; there is no one size fits all policy.

Systemic theories were influential in policy making. In the 1990s, many governments adopted the national/regional system approach for innovation policy; the OECD's work was particularly relevant. One very important feature of systemic theories is that they consider learning as the key process going on in an innovation system.

4.1.4.5 *Open and user Innovation*

The idea of open innovation fits perfectly with the way we have seen that the conception of innovation changing from a linear point of view starting in basic research and ending in commercialisation, to a systemic approach in which different actors interact. Open innovation, as conceptualised by Henry Chesbrough, has been opposed to closed innovation. Henry Chesbrough understands that there has been a change in the environment in which firms were operating in the first decades of the twentieth century and continuing today (Chesbrough 2003).

Closed innovation. Although science made much progress¹⁸ during the scientific revolution of the late nineteenth century and the first part of the twentieth century (with Einstein, Bohr, Maxwell, Curie, Pasteur, Planck and others), these scientific advances were of little use to industry. If universities were not able to help industries in the development of new products, then it was industry itself that had to take care of applied research. According to Chesbrough there was a tension between the applied research and development units of these firms.

¹⁸ The concept of progress in science is controversial and has been discussed for several years. Some authors are firm believers of scientific progress, while others do not believe that we can talk about progress in science. As interesting as the discussion is, we will skip it here because it is out of the scope of this document.



Research	Development
Cost centre.	Profit centre.
Interested in discovery of new knowledge: why things happen.	Interested in execution: how to exploit the new knowledge generated by the research unit.
The results of research projects are hard to predict.	Development projects should hit targets.
Research creates possibilities in an open sense, but many of them will never be exploited.	Development projects try to minimise risks.
Research identifies problems and tries to define how to think about them.	Development projects should solve problems within very specific constraints.

Table 5: Research and Development. Source: based on Chesbrough 2013.

Chesbrough says that many firms dealt with the tension between research and development by building “buffers”. Research results were shelved until the development division of the firm decided which ones to act upon. The big companies which invested in R&D facilities were so successful that they were able to create monopolies. Chesbrough describes the knowledge landscape of the first part of the twentieth century as a series of fortified castles isolated from each other, but this situation has changed. The reasons why this “closed innovation” system broke, according to Chesbrough, are:

- Increase in the supply of well-trained people and increase of worker mobility from one company to the other. As a result of that one company can benefit from the research investments of another company.
- Increase of Venture Capital (VC). The knowledge stored in the buffers of closed innovation companies can be exploited through VC-funded start-ups. It is not safe anymore to store promising results in buffers.
- The combination of worker mobility, highly educated people, and VC investment, creates a lot of external options for unused research results.



The result of the dissolution of closed innovation means that firms are now operating in a rich knowledge landscape; there are plenty of good ideas coming from outside the firm and ideas generated inside (even when not desirable) can go outside and be exploited by others. This fits perfectly in a systemic conception of innovation, wherein different agents interact with each other.

User innovation (von Hippel 2005) can also be related to open innovation and its ideas of firms operating in bountiful knowledge landscapes. It recognises the power of users and their relevance in shaping many innovations, and shows that not only researchers, scientists and engineers matter.

Both open innovation and user innovation have a perfect fit in a systemic view, understanding innovation as a phenomenon that happens in systems where different actors (not only academia, RTOs, and industrial R&D laboratories) interact. We see Chesbrough's ideas on open innovation to be quite well-aligned with a systemic view of innovation and to what some authors, and institutions, refer to as the "learning economy". According to Lundvall (2016: 109-11):

- The ICTs have made information gathering and sharing easy, fast, and relatively cheap.
- Due to the need for adapting to rapid and unexpected changes in demand and in the external context in general, knowing how to do things in isolation has decreased in importance and knowing how to communicate and how to cooperate has become more valued.
- Incremental innovation is necessary for the survival of companies and this process emanates from the interactive learning processes among several elements within the system of innovation.
- A steep increase in the costs associated with new product development is encouraging companies to cooperate and share projects.
- The diversity of knowledge sources involved in innovation has increased and no single agent is in possession of all of them.
- Product life cycles are shorter than before.

The consequences of this changes, according to Lundvall are that (2016:110):

- Firms should increase their learning ability, which involves more horizontal communication.
- Firms should cooperate among themselves to get access to a more diversified knowledge base.



Open innovation may be more marketable as a name but is not very different from the theories of systemic innovation and interactive learning.

4.1.4.6 *Learning and innovation*

Provided that a linear conception of innovation (either a science push or a demand pull model) is unable to capture the complex ways in which innovation happens, innovation should be understood in systemic terms.

Box 6: Learning as the key innovation driver

An innovation system is a social system in which different elements interact in the production, diffusion, and use of knowledge (Lundvall 2016: 85-86). If innovation is about knowledge-based interactions, then the key process in innovation is learning. If innovation is key for our wellbeing, then learning is a key economic element, and enhancing learning opportunities and augmenting the number of learning style interactions is the way to support innovation.

What we acquire by means of learning is knowledge, but what is knowledge? The discussion about the nature of knowledge can be traced back to the birth of western philosophy. Relevant discussions can be found as early as the 6th century BC. The reflection about knowledge is also at the roots of the birth of Modernity with authors as Francis Bacon (1561-1626) or René Descartes (1596-1650) and going on in the discussions between rationalists and empiricists between modernity and since then, it continues to be one of the main philosophical fields, whether as a field, epistemology, or applied to something, like in the philosophy of science and others.

Historically economists have also considered that knowledge is an important economic element and have popularised expressions such as “knowledge is power”. Even the popular opinion of the developed countries considers knowledge to be valuable, and expending big amounts of money in education has become quite common for many individuals.

Lundvall gives an interesting classification of knowledge that we would like to follow in our analysis. According to him, there are four types of economically relevant knowledge (Lundvall 2016: 112-115): know-what, know-why, know-how, know-who.



These types of knowledge can be classified by how sticky they are. Some types of knowledge, like know-how and know-who are sticky and other types, like know-what and know-why, are easier to codify. This can explain, as we will see later, that notions like the regional or national innovation system have become popular. Indeed, if some types of very relevant knowledge to innovation are sticky, then it makes sense to centre the analysis in a geographical area because there will be a kind of knowledge geography.

4.1.4.7 *Innovation and entrepreneurship*

Innovation and entrepreneurship are two key drivers of economic growth, job creation and social development. Innovation drives entrepreneurship, which in turn fuels further innovation. In this research paper, we will explore the relationship between innovation and entrepreneurship, and how innovation can boost entrepreneurship, including intra-entrepreneurship. We will also examine how entrepreneurship is defined in Europe, the main EU policies that support entrepreneurship, the relationship between entrepreneurship and vocational education and training, and the relationship between entrepreneurship and innovation.

In Europe, entrepreneurship is defined as the process of creating, developing, and managing a new business venture. According to the European Commission, entrepreneurship is the ability to turn ideas into action, to create economic and social value, and to contribute to the well-being of society (European Commission, 2018).

The European Commission defines innovation as "the implementation of a new or significantly improved product (good or service), process, new marketing method, or a new organizational method in business practices, workplace organization or external relations" (European Commission, 2014). This definition is in line with the Oslo Manual, which is the internationally recognized standard for collecting and using innovation data (OECD, Eurostat, 2005).

The term "intra-entrepreneurship" or "intrapreneurship" is not commonly used in Europe, and there is no standardized definition provided by the European Commission. However, it generally refers to the promotion of entrepreneurial behaviour within existing organizations, often by empowering employees to take risks and pursue new ideas to drive innovation and growth. In this context, intra-entrepreneurship is often seen as a key driver of corporate competitiveness and economic development.



An entrepreneur (or an intrapreneur) combines types of knowledge and is, by definition, an innovator as well. (Lundvall 2016: 115):

To be able to turn an invention into an innovation, a firm normally needs to combine different types of knowledge, capabilities, skills, and resources. For instance, the firm may require production knowledge, skills and facilities, market knowledge, a well-functioning distribution system, sufficient financial resources, and so on. (Fagerberg 2005: 5).

Audretsch et al. (2006) found that innovation and entrepreneurship have a positive relationship and that policies that promote innovation can also promote entrepreneurship, as a 1% increase in innovation is associated with a 2.5% increase in the likelihood of a new venture being created. Baumol (2002) argues that innovation is a major driver of economic growth, and that entrepreneurs play a critical role in driving innovation, by citing data showing that over the past century most economic growth in developed countries has been driven by innovation.

Gartner (1985) introduces a framework for understanding the process of new venture creation that highlights the importance of innovation and creativity. Markman et al. (2005) examined the role of human, financial, and intellectual capital in fostering entrepreneurship and innovation, and suggests that these forms of capital are complementary. Human, financial, and intellectual capital are all important for fostering entrepreneurship and innovation as for every 10% increase in financial capital there was a 9.7% increase in innovation, and for every 10% increase in intellectual capital there was a 10.8% increase in innovation.

Shane (2004) investigated the impact of the Bayh-Dole Act on university patenting and entrepreneurship and suggested that policies promoting technology transfer from universities to the private sector can advance entrepreneurship. Shane and Venkataraman (2000) argued that entrepreneurship is a distinct field of study that focuses on the process of new venture creation and suggested that understanding this process is critical to fostering innovation and economic growth. Wennekers et al. (2005) examine the relationship between entrepreneurship and economic development and suggested that nascent entrepreneurship can be a key driver of economic growth in developing countries as a 1% increase in nascent entrepreneurship is associated with a 0.35% increase in economic growth. Recent research has shown that innovation can indeed boost entrepreneurship, both in terms of traditional entrepreneurship and intra-entrepreneurship.

One study by Xie and White (2017) found that innovation positively impacts the likelihood of entrepreneurial activity, particularly in the context of high-tech industries. Specifically, they found that the introduction of a new product or service, the introduction of a new production



process, and the introduction of new organizational methods, were all positively associated with the likelihood of entrepreneurial activity. Additionally, they found that the effect of innovation on entrepreneurship was stronger in the high-tech industries compared to the low-tech industries. For example, in the high-tech industries, the introduction of a new product or service increased the likelihood of entrepreneurial activity by 36.9%, while in the low-tech industries, it only increased the likelihood by 16.3%. These findings suggest that innovation is a critical factor in the emergence of new entrepreneurial activities, particularly in high-tech industries.

Another study by Rauch and Hulsink (2015) conducted a study on the relationship between innovation and new firm creation using data from 18 European countries. They found that there is a positive association between innovation and the quantity of new firm creation, indicating that higher levels of innovation are associated with more new firm creation. They found that innovation is positively associated with the quality of new firm creation, as measured by factors such as growth potential and survival rates. Specifically, they found that innovative firms are more likely to have higher growth potential and survival rates compared to non-innovative firms. These findings suggest that innovation plays a crucial role in promoting both the quantity and quality of new firm creation.

In terms of intrapreneurship, a study by Cai and Yang (2018) conducted a study that found that innovation-oriented corporate culture and innovation-friendly organizational practices positively affect intra-entrepreneurial behaviour. Specifically, they found that employees are more likely to engage in intra-entrepreneurial behaviour, such as generating new business ideas, when they perceive that their organization has an innovation-oriented corporate culture and when the organization has practices in place that support innovation. The study provides concrete data to support the idea that fostering an innovation-friendly culture and organizational practices can encourage intra-entrepreneurial behaviour.

Similarly, a study by Rostamzadeh et al. (2018) highlighted the impact of innovation-oriented human resource management practices on the development of intra-entrepreneurship within organizations. They found that these practices positively affect the development of intra-entrepreneurship, which in turn leads to improved organizational performance. Specifically, they found that innovation-oriented human resource practices such as recruitment and selection, training and development, and performance appraisal systems that promote creativity and risk-taking behaviour, can positively influence the development of intra-entrepreneurship within organizations. The study provides concrete evidence for the importance of innovation-oriented human resource management practices in fostering intra-entrepreneurship within organizations.

Brem and Viardot (2019) investigated the impact of innovation on entrepreneurial orientation in European SMEs. They found that innovation positively influences the level of



entrepreneurial orientation, which includes a firm's proactiveness, risk-taking, and innovativeness. They collected data from a sample of 306 SMEs in Germany, Switzerland, and Austria.

Kuckertz et al. (2019) explored the relationship between innovation and entrepreneurial intention among European university students. They collected data from a sample of 3,056 university students from six European countries. The survey collected data on the students' attitudes towards entrepreneurship, their perceived desirability and feasibility of starting a business, and their level of innovation. The results showed that innovation had a significant positive effect on entrepreneurial intention, and this effect was mediated by both perceived desirability and feasibility. In other words, students who were more innovative were more likely to see entrepreneurship as desirable and feasible, and therefore more likely to intend to start their own business. The study also found that the relationship between innovation and entrepreneurial intention was stronger for students who had more positive attitudes towards entrepreneurship and perceived higher levels of support from their social environment.

Hatak et al. (2018) used data from the Global Entrepreneurship Monitor survey for 24 European countries and conducted a multilevel analysis to investigate the relationship between innovation and entrepreneurial activity. They found that innovation has a positive effect on the likelihood of starting a new business and the quality of new business ideas. Specifically, they found that innovative individuals were more likely to become entrepreneurs, and that countries with higher levels of innovation tended to have more entrepreneurs and higher quality of new business ideas. The study also found that access to resources, such as finance and networks, moderated the relationship between innovation and entrepreneurship, suggesting that policies that improve access to resources can enhance the positive effects of innovation on entrepreneurship.

The studies suggest that innovation can play a significant role in boosting entrepreneurship, both in the context of traditional new venture creation and within existing organizations through intra-entrepreneurship.

Innovation has a significant impact on the entrepreneurial ecosystem, as it can encourage the creation of new companies and stimulate the growth of existing ones. Below are some ways in which innovation can affect the entrepreneurial ecosystem:

- Creating new business opportunities: Innovation can open up new business opportunities by identifying unmet needs in the market and developing new products or services to meet those needs.



- Driving competition: Innovation can also drive competition, as companies compete to develop the best and most innovative products or services. This can lead to increased quality, lower prices, and greater consumer choice.
- Encouraging investment: Innovation can attract investment from venture capitalists, angel investors, and other sources, as investors seek to support innovative companies with high growth potential.
- Promoting collaboration: Innovation can also promote collaboration between companies, as they work together to develop new technologies, products, or services. This can lead to greater knowledge sharing, increased efficiency, and reduced costs.

Advanced manufacturing, can create a range of entrepreneurial environments:

- Startups focused on developing advanced manufacturing technologies: Entrepreneurs can create startups that develop new and innovative manufacturing technologies or improve existing ones. These startups can attract investment from venture capitalists, angel investors, and other sources.
- Service providers for advanced manufacturing: Entrepreneurs can also create service-based businesses that support the adoption of advanced manufacturing technologies by other companies. These services could include consulting, training, or maintenance and repair services for advanced manufacturing equipment.
- Custom manufacturing: Advanced manufacturing technologies can enable entrepreneurs to create highly customized products in small quantities. This can lead to the creation of niche businesses that focus on producing custom products for specific markets or customers.
- Sustainable manufacturing: Advanced manufacturing technologies can also enable entrepreneurs to create more sustainable and environmentally-friendly production processes. This can lead to the creation of businesses that specialize in sustainable manufacturing processes, such as using recycled materials or reducing waste in the production process.

Overall, advanced manufacturing creates a wide range of entrepreneurial opportunities, from technology start-ups to service-based businesses and sustainable manufacturing enterprises. That is why it will be important for the LCAMP open innovation community to analyse the business environment in the context of advanced manufacturing, to identify opportunities and gaps, and to then design and manage teams that respond to future needs. Start-ups and many technology-based companies typically begin their journey in local incubators, so they are geographically organized based on where they were created. However, in order to interact with



the industry, they need to be visible for their capabilities and what they can contribute to the world of manufacturing.

4.1.4.8 EU policies to support entrepreneurship

EU enterprise policy aims to provide an environment that is conducive to business creation and development, and particularly that of small and medium-sized enterprises (SMEs), which account for the vast majority of companies in the EU and roughly two-thirds of jobs. Businesses, whatever their size, are key to the EU's competitiveness and prosperity. In Article 173 of the Treaty on the Functioning of the European Union (2012), the EU has set itself the goal of creating the best possible conditions for competitiveness. EU enterprise policy seeks to support businesses in a number of ways, including:

- supporting sustainable growth, digitisation, competitiveness and resilience;
- facilitating access to finance (e.g. venture and seed capital to encourage start-ups);
- promoting an entrepreneurial culture (education, training and capacity-building);
- making it easier to transfer business ownership;
- destigmatising business failure and allowing honest entrepreneurs a second chance after bankruptcy;
- reducing regulatory burden and facilitating market access within the EU's internal market and internationally.

The European Union has implemented various policies and initiatives to support entrepreneurship, including:

[The European Entrepreneurship Action Plan](#) (2004) aims to create a more supportive environment for entrepreneurs in Europe by reducing barriers to entrepreneurship and promoting innovation. The plan promotes entrepreneurship education and training for VET and higher VET students, enabling them to develop the skills, knowledge, and attitudes needed to become successful entrepreneurs. It provides funding and support for the development and implementation of entrepreneurship courses, programmes, and initiatives in VET and higher VET institutions. It also supports the development of partnerships between VET and higher VET institutions and SMEs, facilitating the transfer of knowledge, innovation, and technology between the two sectors. These partnerships enable students to gain practical experience and learn from entrepreneurs and SMEs, while SMEs benefit from access to new talent and innovative ideas. Furthermore, the plan provides funding and support for SMEs to develop their entrepreneurial skills and grow their businesses. It offers access to finance, coaching,



mentoring, and other forms of support that enable SMEs to innovate and expand their markets. VET and higher VET students can benefit from the Action Plan by gaining access to entrepreneurship education and training programmes, which can help them develop the skills and knowledge necessary to start and grow their own businesses. These programs can also help students develop an entrepreneurial mindset, which can be valuable even if they don't start their own businesses. VET and higher VET institutions can benefit from the Action Plan by receiving support to develop and implement entrepreneurship education and training programs, as well as by gaining access to best practices and networks for collaboration. This can help institutions better prepare their students for the challenges and opportunities of the modern economy and contribute to the development of a more entrepreneurial culture. The European Entrepreneurship Action Plan is designed to foster a culture of entrepreneurship and innovation across Europe, supporting the development of VET and higher VET students, institutions, and SMEs, and promoting economic growth and job creation.

The [Small Business Act for Europe](#) (2008) intends to promote entrepreneurship and innovation by creating a more business-friendly environment, reducing administrative burdens and providing better access to funding and markets. The main priorities of the act are to promote entrepreneurship, improve access to finance, reduce the regulatory burden, and improve access to markets and internationalisation. These priorities are set out in 10 principles designed to guide the design and implementation of policies at the EU and EU country levels:

- Principle 1: create an environment in which entrepreneurs and family businesses can thrive and entrepreneurship is rewarded;
- Principle 2: ensure that honest entrepreneurs who have faced bankruptcy quickly get a second chance;
- Principle 3: design rules according to the 'think small first' principle;
- Principle 4: make public administrations responsive to the needs of small and medium-sized businesses (SMEs);
- Principle 5: adapt public policy tools to SMEs' needs: facilitate SMEs' participation in public procurement and better use State aid possibilities for SMEs;
- Principle 6: facilitate SMEs' access to finance and develop a legal and business environment supportive to timely payments in commercial transactions;
- Principle 7: help SMEs to benefit more from the opportunities offered by the EU's single market;
- Principle 8: promote the upgrading of skills in SMEs and all forms of innovation;
- Principle 9: enable SMEs to turn environmental challenges into opportunities;
- Principle 10: encourage and support SMEs to benefit from the growth of markets.



The Small Business Act for Europe (SBA) plans to create a more favourable environment for small and medium-sized enterprises (SMEs) in the European Union (EU). The SBA promotes entrepreneurship, innovation, and the growth of SMEs, and it focuses on improving access to finance, markets, and skills. As a result, vocational education and training (VET) and higher VET students, institutions, and SMEs can benefit from the SBA through:

- Access to finance: The SBA provides a framework for improving SMEs' access to finance, including through financial instruments such as guarantees, loans, and equity financing.
- Support for entrepreneurship: The SBA promotes entrepreneurship as a key driver of economic growth, providing funding and support for SMEs and promoting entrepreneurship education and training.
- Access to markets: The SBA aims to reduce barriers to market access for SMEs, including by promoting e-commerce and simplifying regulatory procedures.
- Skills development: The SBA supports the development of SMEs' human resources, including through the provision of training and skills development programs.
- Innovation: The SBA promotes innovation and research and development in SMEs, including by providing funding and support for innovative projects and promoting collaboration between SMEs and research institutions.
- Access to a Database of good practices.
- The SBA provides a comprehensive framework for supporting the growth and development of SMEs in the EU, including VET and higher VET students and institutions.

By improving access to finance, markets, and skills, and promoting entrepreneurship and innovation, the SBA can help SMEs to thrive and contribute to the economic development of the EU.

The [Horizon Europe](#) programme aims to support research and innovation in Europe by providing funding for innovative projects and promoting cooperation between businesses, universities, and research institutions. The Horizon Europe programme is the European Union's research and innovation funding program for the years 2021-2027. It provides a wide range of opportunities for VET and higher VET students, institutions, and SMEs to benefit from its activities by:

- Funding opportunities: The programme provides a significant budget for research and innovation activities, offering funding opportunities for VET and higher VET institutions and SMEs to carry out research and innovation projects that can boost their competitiveness and contribute to economic growth.



- **Collaboration and networking:** The programme encourages collaboration and networking among different stakeholders, including VET and higher VET students, institutions, and SMEs. Participation in collaborative research and innovation projects can enable these stakeholders to access new knowledge, skills, and technologies, as well as to build new partnerships and networks that can support their future activities.
- **Innovation support services:** The programme provides support services to help VET and higher VET students, institutions, and SMEs to transform their research and innovation ideas into marketable products and services. This includes support for intellectual property management, technology transfer, and business development.
- **Skills development:** The programme provides opportunities for VET and higher VET students to gain hands-on experience in research and innovation activities, and to develop the skills and competencies that are essential for a successful career in the innovation sector. This can include opportunities for internships, training, and mobility.
- **Societal impact:** The programme is designed to have a significant societal impact, addressing global challenges such as climate change, health, and digital transformation. By participating in the program, VET and higher VET students, institutions, and SMEs can contribute to these important societal goals, while also benefiting from the knowledge and expertise of other stakeholders in the program.

The Horizon Europe programme provides a broad range of opportunities for VET and higher VET students, institutions, and SMEs to participate in research and innovation activities, access funding and support services, and develop the skills and competencies needed to succeed in the innovation sector.

[Next GenerationEU](#) (2021) is a European Union recovery plan, the largest stimulus package ever financed in Europe with a total of €2.018 trillion helping to rebuild a post-COVID-19 society that is greener, more digital, and more resilient; benefits for VET and higher education students, institutions, and SMEs can be seen in the following ways:

- **Funding for education and training:** The plan allocates a significant portion of its budget to support education and training, including VET and higher education, to ensure that students have access to quality education and training programs that can enhance their employability.
- **Investment in research and innovation:** The plan includes significant funding for research and innovation projects aimed at driving economic growth and improving competitiveness. This funding can benefit VET and higher education institutions, as well as SMEs, by providing access to new knowledge and technologies that can be applied to create new products and services.



- **Digital transformation:** The plan includes a significant focus on digital transformation, including funding for digital infrastructure and digital skills development. This can benefit VET and higher education students and institutions by providing access to modern digital tools and technologies that can enhance teaching and learning experiences. SMEs can also benefit from this investment by developing their digital capabilities and adopting new technologies to improve their productivity and competitiveness.
- **Support for entrepreneurship and SMEs:** The plan includes support for entrepreneurship and SMEs through funding for innovation and entrepreneurship programs, as well as financial support for SMEs affected by the pandemic. This can benefit VET and higher education students and institutions by providing access to entrepreneurship and innovation programs that can help them develop their skills and knowledge in these areas. SMEs can benefit from this support by accessing funding and other resources to help them grow and thrive.

[Recovery and Resilience Facility](#) (2021) is a key instrument of the European Union's Next Generation EU recovery plan aimed at helping EU countries recover from the COVID-19 pandemic and build a more resilient and sustainable economy; it will provide substantial funding for Member States to support reforms and investments that foster economic growth, job creation, and social cohesion. VET and higher VET students, institutions, and SMEs can benefit from the RRF in several ways:

- **Funding for education and training:** Member States can allocate funding from the RRF to support education and training initiatives, including VET and higher VET programs. This can help institutions to improve the quality of their programs and provide students with the skills and knowledge they need to succeed in the post-pandemic economy.
- **Support for digital transformation:** The RRF includes funding for digitalization initiatives, such as investments in digital infrastructure, digital skills training, and the development of digital services. This can help VET and higher VET institutions to modernize their operations and teaching methods and help SMEs to digitize their businesses and stay competitive.
- **Investment in green and sustainable initiatives:** The RRF also includes funding for green and sustainable initiatives, such as investments in renewable energy, energy efficiency, and sustainable transport. This can help institutions and SMEs to reduce their carbon footprint and contribute to the EU's goal of becoming climate-neutral by 2050.
- **Support for innovation and research:** The RRF includes funding for research and innovation initiatives, such as investments in R&D infrastructure, technology transfer, and support for startups and SMEs. This can help VET and higher VET institutions to



enhance their research capabilities and collaborate with industry partners and help SMEs to develop innovative products and services.

The RRF provides a significant opportunity for VET and higher VET students, institutions, and SMEs to benefit from EU funding and support for initiatives that can help them recover from the pandemic and build a more resilient and sustainable future.

[European Green Deal](#) (2019) focuses on creating a resource-efficient and competitive economy, supported by climate law and other measures to make the EU's climate, energy, transport, and taxation policies align with the reduction of net greenhouse gas emissions by at least 55% (compared to 1990 levels) by 2030. VET and higher education students, institutions, and SMEs can benefit from the European Green Deal in several ways:

- **Funding opportunities:** The European Green Deal provides funding opportunities for projects related to climate action, sustainable development, and green growth. VET and higher education institutions and SMEs can apply for funding to support research and innovation in areas such as renewable energy, sustainable transport, and circular economy.
- **Skills development:** The European Green Deal emphasizes the need for a skilled workforce to support the transition to a sustainable and green economy. VET and higher education institutions can play a crucial role in developing the skills and competencies needed to address the challenges of climate change and environmental sustainability.
- **Green jobs:** The European Green Deal aims to create new job opportunities in sectors such as renewable energy, energy efficiency, and sustainable agriculture. VET and higher education students can benefit from the opportunities created by the transition to a green economy, while SMEs can benefit from the growth of new markets and the development of innovative green products and services.
- **International cooperation:** The European Green Deal is a global initiative, and VET and higher education institutions and SMEs can benefit from international cooperation and collaboration in areas such as research, innovation, and skills development.
- The European Green Deal offers opportunities for VET and higher education students, institutions, and SMEs to contribute to the transition to a sustainable and green economy, while also benefiting from the growth and opportunities created by this transition.

[Shaping Europe's Digital Future](#) (2020) is a strategy that aims to ensure Europe is at the forefront of the digital transition by promoting digital skills, improving the use of technology, and fostering innovation. VET and higher VET students, as well as institutions, can benefit from this strategy through various initiatives and programs that support the development of digital skills and competencies. For example, the Digital Skills and Jobs Coalition is a multi-stakeholder



partnership that aims to improve digital skills and competencies among Europeans. It offers various training programs and certifications to help students and workers acquire the digital skills needed for the digital economy. SMEs can also benefit from the "Shaping Europe's Digital Future" strategy through various funding opportunities, such as the Digital Europe Programme, which provides financial support for the development and deployment of digital technologies and services. The program aims to strengthen the EU's digital sovereignty and support the digital transformation of businesses, including SMEs. Additionally, the strategy promotes the development of a Digital Single Market, which aims to remove barriers to cross-border e-commerce and promote the growth of digital businesses. This can provide SMEs with new opportunities to expand their market reach and increase their competitiveness.

[2030 Digital Compass: the European way for the Digital Decade](#) (2021) focuses on pursuing digital policies that empower people and businesses to seize a human centred, sustainable, and more prosperous digital future. The 2030 Digital Compass: the European way for the Digital Decade is a plan by the European Commission to set a direction for Europe's digital transformation for the next ten years. It aims to ensure that Europe's digital transformation is based on shared values and benefits all citizens and businesses, including those in the VET and higher education sectors, as well as SMEs. Some of the benefits for these groups include:

- VET and higher education students: The 2030 Digital Compass plan includes a Digital Education Action Plan to support the development of digital competencies among students and teachers in Europe. This will provide opportunities for VET and higher education students to acquire the digital skills necessary to succeed in the digital economy.
- VET and higher education institutions: The plan includes funding opportunities for digital innovation and research in higher education institutions. This funding can support the development of new technologies and digital infrastructure that can be used to enhance the quality of education and training in VET and higher education.
- SMEs: The 2030 Digital Compass includes initiatives to promote the digital transformation of SMEs, including the Digital Europe Programme, which provides funding for the development and deployment of digital technologies in businesses. This can help SMEs to improve their competitiveness and efficiency, as well as open up new opportunities for growth in the digital economy.
- The 2030 Digital Compass aims to ensure that Europe's digital transformation benefits all citizens and businesses, including those in the VET and higher education sectors and SMEs.



[Path to the Digital Decade](#) (2021) addresses the gaps in digital capacities, focusing on digital skills, digital infrastructure, digital business and digital public services. It is a set of policies and initiatives aimed at achieving the goals set out in the 2030 Digital Compass. VET and higher VET students, as well as institutions and SMEs, can benefit from this initiative through:

- Digital skills training: The initiative aims to promote digital skills training for all citizens, including VET and higher VET students. This will help them acquire the skills needed to work in a digital economy and adapt to the changing job market.
- Digital infrastructure: The initiative aims to improve digital infrastructure across Europe, including in rural and remote areas. This will benefit VET and higher VET institutions and SMEs by providing them with faster and more reliable internet connectivity and access to digital tools and platforms.
- Digital innovation: The initiative aims to support digital innovation across Europe, including in SMEs. This will help SMEs develop and adopt new digital technologies and business models, which can increase their competitiveness and productivity.
- Digital regulation: The initiative aims to create a clear and predictable regulatory environment for the digital economy in Europe. This will benefit VET and higher VET students and institutions by providing them with a stable and predictable business environment.

The [Path to the Digital Decade](#) initiative aims to promote digital transformation across Europe, which can benefit VET and higher VET students, institutions, and SMEs by providing them with the tools and skills needed to succeed in a digital economy.

[A New Industrial Strategy for Europe](#) (2020) outlines three drivers for industrial transformation (global competition, climate neutrality, and a digital future) offering new measures to accelerate the green and digital transitions, and responding to calls to identify and monitor the main indicators of economic competitiveness (internal market integration, productivity growth, international competitiveness, public and private investment and research and development investment). VET and higher VET students, institutions, and SMEs can benefit from A New Industrial Strategy for Europe in several ways:

- Education and Training: The strategy aims to support the development of skills and competences needed for the digital and green transitions, including through the upskilling and reskilling of the workforce. This can benefit VET and higher VET students who will be better equipped to enter the workforce with the necessary skills and knowledge, and VET institutions that can offer relevant training programs.



- **Innovation and Research:** The strategy aims to increase investment in research and innovation, including through the new European Innovation Council. This can benefit SMEs and higher VET institutions that engage in research and development activities and can access funding and support for innovation.
- **Digital Transformation:** The strategy aims to support the digital transformation of European businesses and industries, including through the creation of a European cloud infrastructure and the promotion of data sharing. This can benefit SMEs and higher VET institutions that are seeking to digitalize their operations and processes.
- **Green Transition:** The strategy aims to support the transition to a more sustainable and circular economy, including through the European Green Deal. This can benefit VET and higher VET students who can gain knowledge and skills related to sustainable development and environmental protection, as well as SMEs and higher VET institutions that are engaged in sustainable practices.

A New Industrial Strategy for Europe seeks to support the growth and competitiveness of European industries, including SMEs, and to ensure a sustainable and resilient economic recovery. VET and higher VET students, institutions, and SMEs can benefit from the various initiatives and measures proposed in the strategy.

The European Commission sees entrepreneurship as acting upon opportunities and ideas, transforming them into financial, cultural, or social value for others. Our entrepreneurship policy aims to support companies, in particular SMEs, throughout their life cycle, promoting entrepreneurial education at all levels, as well as reaching out and encouraging specific groups with entrepreneurial potential.

The European Commission's official website that focuses on [supporting entrepreneurship](#), particularly for small and medium-sized enterprises (SMEs), provides a wealth of information and resources for entrepreneurs, including information on funding opportunities, advice on how to start a business, and links to relevant EU policies and initiatives. One notable feature of the webpage is the section on EU funding for entrepreneurs. The European Commission offers various funding programs aimed at supporting SMEs and startups, such as the European Innovation Council (EIC) Accelerator and the European Investment Fund (EIF). The webpage also provides information on how to apply for these programs and what kinds of projects are eligible for funding. In addition to funding opportunities, the webpage also offers guidance on how to start and grow a business, with resources on topics such as business planning, market research, and intellectual property rights. There are also links to various EU initiatives and partnerships that aim to support entrepreneurship and SMEs, such as the European Small Business Act and the European Enterprise Network. Furthermore, the European Commission



provides information on its actions related to entrepreneurship education highlighting the importance of entrepreneurship education in equipping individuals with the necessary skills and mindset to become successful entrepreneurs and drive economic growth and job creation in the European Union. Those actions are:

- funding to European projects that will create reference models for further exploitation, through calls for proposals
- promoting exchanges of good practice and experiences at the EU level
- organising of workshops for policymakers and practitioners
- helping policymakers' and other stakeholders' networks
- publishing guidelines based on existing leading practices in Europe
- releasing studies, indicators, and data collection

The website provides an overview of the Commission's actions in this area, including funding for entrepreneurship education projects (such as the [Erasmus+](#) programme, [structural and investment funds](#) and [COSME](#) programme), the creation of policy recommendations and guidelines, and initiatives to promote cooperation between education institutions, businesses, and policymakers. It also includes examples of successful entrepreneurship education programs and initiatives across Europe, such as:

- [Entrepreneurship 2020 Action Plan](#) (2013);
- Communication '[Rethinking Education: Investing in skills for better socio-economic outcomes](#)';
- Communication '[Fostering entrepreneurial mind sets through education and learning](#)'.

Additionally, it provides information on projects and studies related to entrepreneurship education and studies on promoting entrepreneurship education in Europe, with detailed information on the various, objectives, partners, outcomes, links to reports, case studies, and other resources. The information provided is of interest to researchers, policymakers, and educators in entrepreneurship education and in promoting entrepreneurship and innovation. Main EU actions:

- To support education and training for teachers
 - [Guide for Educators](#) with a selection of examples of inspiring practices in training and supporting teachers for entrepreneurship education
 - The EU funded project TES created a virtual [Guide for Teachers](#)
 - Other EU funded projects aim at training educators in teaching entrepreneurship
 - The [European Entrepreneurship Colloquium](#) (EEC)
 - [The international network of universities](#) - CONEEECT



- The project Young Entrepreneurship developing in Action - YEDAC
- Two workshops on enabling teachers for entrepreneurship education were held in 2012
- A High-Level Symposium on 'Entrepreneurship Education: Teacher Education as critical success factor' took place in 2011
 - [The Budapest Agenda](#): Enabling Teachers for Entrepreneurship Education
 - [Enabling Teachers as a Critical Success Factor](#) (final report)
- To assess the entrepreneurial skills acquired by students and the impact of entrepreneurship education
 - Study 'Entrepreneurship Education: A road to success'
 - [Final report](#)
 - [Case studies](#)
- To promote better cooperation and the exchange of practices between EU countries on how to introduce systematic strategies in this area the final report of high-level reflection panels [Towards Greater Cooperation and Coherence in Entrepreneurship Education](#) (2010).
- To promote entrepreneurship in higher education
 - [HEInnovate](#): self-assessment tool for universities that aim to be entrepreneurial (under the responsibility of the Directorate-General Education and Culture)
 - Study: [Effects and impact of entrepreneurship programmes in higher education](#) (2012)
 - [Entrepreneurship in higher education, especially within non-business studies](#) (2008)
 - European survey on Higher Education Institutions (2008):
 - [Main results of the survey](#)
 - [Annex A: Tables](#)
 - [Annex B: Good Practice examples](#)
- To promote entrepreneurship in vocational education and training [Final Report of the Expert Group, 'Entrepreneurship in Vocational Education'](#) (2009)
- To step up progress in promoting entrepreneurial mindsets in society The [Oslo Agenda for Entrepreneurship Education in Europe](#) (2006)
- To improve the entrepreneurial capacity of European citizens and organizations by fostering entrepreneurial learning and the entrepreneurial mindset as promoted by the



European Entrepreneurship Competence Framework (EntreComp) as described below (see Figure X).

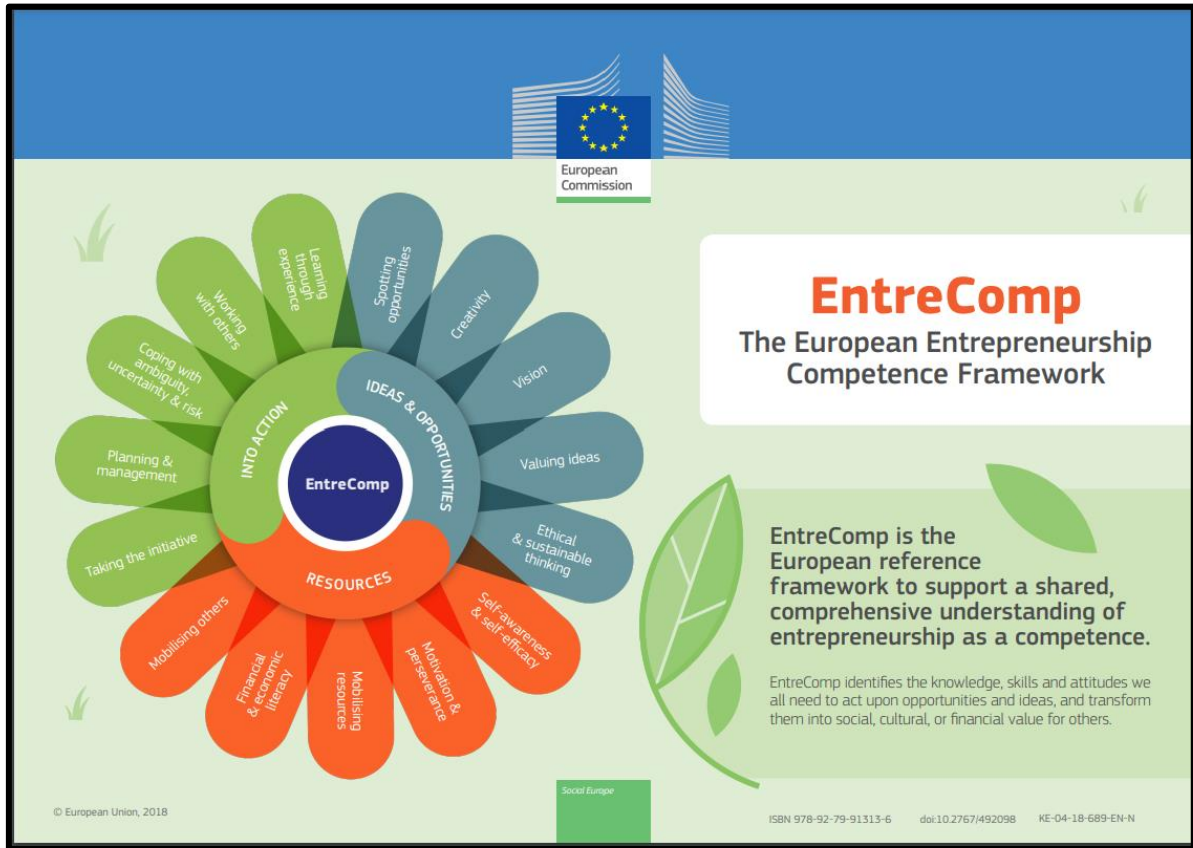


Figure 10: EntreComp: the European Entrepreneurship Competence Framework – factsheet

4.1.4.9 Entrepreneurship and VET

Entrepreneurship and vocational education and training have a close relationship. VET provides individuals with the necessary skills and knowledge to perform a specific trade or profession, while entrepreneurship involves starting and running a business. By developing entrepreneurial skills and mindset, VET students can be better prepared to become entrepreneurs or to contribute to the growth of small and medium-sized enterprises (SMEs).

Moreover, some vocational education and training programmes specifically focus on entrepreneurship. For example, in some European countries, vocational schools offer entrepreneurship training as part of their curriculum, providing students with the necessary skills and knowledge to start their own businesses. In addition, higher VET institutions often



collaborate with industry and SMEs, providing students with opportunities to gain practical experience and work on real-life projects.

Overall, the relationship between entrepreneurship and VET is significant and mutually beneficial, with VET providing individuals with the skills and knowledge necessary to become successful entrepreneurs or to contribute to the growth of SMEs.

Lengyel and Szász's (2021) literature review found that there is a positive relationship between entrepreneurship education in vocational education and training (VET) and higher VET and entrepreneurial intentions, attitudes, and self-efficacy of students. They also found evidence that entrepreneurship education can positively impact students' employability and readiness for the labour market. Specifically, the review found that VET and higher VET students who receive entrepreneurship education have higher levels of entrepreneurial intention, defined as the "intention to start a new venture, or to continue with an existing business, as a means of self-employment or becoming an entrepreneur" (p. 177). This is supported by several studies cited in the review, including a study by Fiet (2000) that found a positive correlation between entrepreneurship education and entrepreneurial intentions among undergraduate students (ibid). In addition, the review found that entrepreneurship education can positively impact students' attitudes towards entrepreneurship and self-efficacy, or their belief in their ability to successfully start and run a business. For example, a study by Kolvereid and Isaksen (2006) cited in the review found that entrepreneurship education positively impacted students' attitudes towards entrepreneurship and self-efficacy, which in turn increased their likelihood of starting a business (ibid). Finally, the review found that entrepreneurship education can positively impact students' employability and readiness for the labour market, as it can help students develop transferable skills such as creativity, innovation, and problem-solving that are valued by employers. This is supported by several studies cited in the review, including a study by Mustar and Wright (2010) that found that entrepreneurship education positively impacted graduates' employability and their ability to create new businesses (ibid). Overall, the literature review by Lengyel and Szász (2021) provides evidence that entrepreneurship education in VET and higher VET can have positive impacts on students' entrepreneurial intentions, attitudes, self-efficacy, employability, and readiness for the labour market (ibid).

Several studies have shown that vocational education and training can help to develop and foster entrepreneurship skills. For example, a report by the European Training Foundation (ETF, 2020) found that VET can provide an excellent basis for entrepreneurial learning and that vocational education and training institutions can play an important role in promoting entrepreneurship. Similarly, a report by the European Commission on the contribution of VET to entrepreneurship and SME competitiveness found that VET provides individuals with practical



skills, which are essential for starting and running a business. The report highlights the importance of entrepreneurship education in VET and higher VET as a means of developing the skills and attitudes necessary for entrepreneurship. According to the report, VET and higher VET institutions can play a significant role in promoting entrepreneurial attitudes and skills, particularly through the integration of entrepreneurship education into vocational curricula (ibid). The report emphasizes that entrepreneurship education can lead to a range of positive outcomes for VET and higher VET students, including improved employability, increased confidence and self-efficacy, and a greater likelihood of starting a business. It also notes that entrepreneurship education can benefit SMEs by providing them with a more skilled and entrepreneurial workforce, as well as fostering innovation and creativity within the workplace (ibid). In terms of challenges, the report identifies a lack of awareness and understanding of entrepreneurship among VET and higher VET students and teachers, as well as a lack of cooperation between VET and higher VET institutions and the business community. The report also notes the need for more effective training and support for VET and higher VET teachers in order to better integrate entrepreneurship education into vocational curricula (ibid). The report suggests that entrepreneurship education in VET and higher VET can contribute to the development of a more entrepreneurial culture in Europe, which in turn can lead to increased economic growth and job creation (ibid).

The report by the European Commission (2020) provides several key findings on the relationship between entrepreneurship and VET and higher VET, based on a literature review and survey of Member States:

- Entrepreneurship education is important in VET and higher VET, as it can enhance employability and create opportunities for self-employment and entrepreneurship.
- There is a need for a more structured approach to entrepreneurship education in VET and higher VET, with clearer objectives, guidance, and quality assurance mechanisms.
- Collaboration between VET and higher VET institutions and the business sector is important for promoting entrepreneurship, as it can help provide practical experience and relevant skills for entrepreneurship.
- Involving entrepreneurs in teaching and training activities can be beneficial, as they can provide valuable insights and real-world experience.
- Digital skills and the ability to use digital tools and platforms are becoming increasingly important for entrepreneurship, and VET and higher VET should reflect this in their curricula and training.

The report highlights the importance of entrepreneurship education in VET and higher VET and the need for a more structured and collaborative approach to promoting entrepreneurship.



It emphasizes the importance of practical experience, real-world insights, and digital skills for entrepreneurship success (ibid).

The UNESCO-UNEVOC (2019) report "Entrepreneurship in TVET: Providing opportunities, ensuring success" provides several case studies and examples of how vocational education and training (VET) can promote entrepreneurship. The report emphasizes the importance of fostering an entrepreneurial mindset and developing practical skills related to entrepreneurship within VET programs. It also highlights the potential of VET to provide support and resources for aspiring entrepreneurs, including access to networks and funding opportunities. One example from the report is a program in Kenya that provides entrepreneurship training and support to young people who have dropped out of formal education. Through a partnership between a local NGO and a vocational training centre, participants receive training in basic business skills and are connected with mentors and potential investors. The program has led to the creation of new businesses and improved livelihoods for many participants (ibid). Another example is a vocational training centre in Germany that incorporates entrepreneurship education into its programs for refugees. Participants receive training in business planning and management, as well as language and intercultural communication skills. The centre also provides access to funding opportunities and connects participants with local business networks. Many of the program's graduates have gone on to start successful businesses in Germany (ibid). The report presents a compelling argument for the potential of VET to promote entrepreneurship and support aspiring entrepreneurs (ibid).

The European Commission's guide for educators on entrepreneurship education in 2012 (European Commission. 2012) provided some examples of the positive impact of entrepreneurship education on VET and higher VET students. These examples include:

- A study in Finland found that students who participated in entrepreneurship education in VET were more likely to start their own business and have a positive attitude towards entrepreneurship.
- A survey of higher education institutions in Europe found that entrepreneurship education was associated with higher levels of entrepreneurship activity among students and graduates.
- An analysis of the impact of the EU's Erasmus for Young Entrepreneurs programme found that VET students who participated in the programme were more likely to start their own business, and that the programme had a positive impact on their personal and professional development.

The guide highlights several examples of the positive relationship between entrepreneurship education and VET and higher VET (ibid).



The Cedefop report "Entrepreneurship competence: An overview of existing concepts, policies and initiatives at EU and national levels" (Cedefop, 2018) provides an analysis of the relationship between entrepreneurship and VET. According to the report, entrepreneurship competence is increasingly seen as a key competence for VET graduates, as it can help them to become more employable and adaptable to changing labour market conditions. The report notes that there is a growing recognition of the importance of entrepreneurship education in VET, and many countries are now including entrepreneurship in their VET curricula (ibid). The report also highlights the need for VET teachers and trainers to have entrepreneurship competence themselves, in order to effectively teach entrepreneurship to their students. It notes that there is a lack of entrepreneurship training for VET teachers and trainers, and that this is a barrier to the development of entrepreneurship education in VET (ibid). Furthermore, the report discusses the importance of policy initiatives at the EU and national levels in promoting entrepreneurship in VET. It highlights a number of EU-level initiatives, such as the Erasmus+ program and the European Qualifications Framework, that aim to support the development of entrepreneurship competence in VET (ibid). Overall, the report suggests that there is a positive relationship between entrepreneurship and VET, with entrepreneurship education in VET having the potential to contribute to the development of a more entrepreneurial workforce (ibid).

The report by the European Training Foundation titled "Entrepreneurial skills and attitudes in vocational education and training" (ETF, 2018) provides some data and analysis on the relationship between entrepreneurship and VET. According to the report, VET plays a crucial role in developing entrepreneurial skills and attitudes among young people. The report highlights that VET programs that provide hands-on experience and practical skills are particularly effective in developing entrepreneurial skills. Furthermore, VET students who participate in entrepreneurial activities tend to have higher levels of motivation, self-confidence, creativity, and problem-solving skills (ibid). The report also notes that while there is a growing interest in promoting entrepreneurship among VET students, there is still a need for more effective policies and strategies to support entrepreneurship education. The report recommends that policymakers and educators should prioritize the development of curricula that integrate entrepreneurial skills and attitudes into VET programs, as well as providing support and resources for VET teachers to deliver high-quality entrepreneurship education (ibid).

The article by Naude and Gries (2018) does not focus specifically on the relationship between entrepreneurship and VET or higher VET. Rather, it takes a broader perspective on the relationship between entrepreneurship and human development. The authors argue that entrepreneurship can contribute to human development by enhancing people's capabilities, or



their ability to pursue valuable goals and activities. The article includes a theoretical discussion of the capabilities approach to human development and its application to entrepreneurship.

4.1.4.9.1.1 The relationship between entrepreneurship and VET (higher VET) Curricula

The relationship between entrepreneurship and vocational education and training (VET) curricula and curricula development is bidirectional. On one hand, VET curricula can include entrepreneurship education as a means of developing entrepreneurial skills, competencies, and mindsets in learners. This can help learners become more entrepreneurial and better equipped to start their own businesses or engage in entrepreneurship in other ways. On the other hand, entrepreneurship education can also inform the development of VET curricula by providing insights into the skills and knowledge that are needed in the entrepreneurial workforce. This can help ensure that VET curricula are relevant and responsive to the needs of the labour market.

Moreover, the integration of entrepreneurship in VET curricula can also foster a more innovative and dynamic learning environment that encourages critical thinking, problem-solving, creativity, and collaboration. It can also help learners develop a more entrepreneurial mindset, which can be valuable in a range of contexts, including traditional employment, self-employment, and entrepreneurship.

The relationship between entrepreneurship and VET curricula and curricula development is mutually beneficial, as it can help both VET learners and the wider economy to develop the skills, competencies, and attitudes that are needed for entrepreneurial success.

The European Commission's guide for educators on entrepreneurship education (European Commission, 2012) emphasizes the importance of integrating entrepreneurship into the curricula of vocational education and training (VET) and higher education. The guide suggests that entrepreneurship education should be interdisciplinary and practical, involving real-life situations and challenges faced by entrepreneurs. It also recommends that entrepreneurship education should be delivered through experiential learning, such as project-based learning, and that it should be integrated into all phases of education, from primary school to higher education.

The guide also provides examples of good practices for integrating entrepreneurship education into VET and higher education curricula, such as the establishment of entrepreneurship centres, incubators, and mentorship programs. However, it does not provide specific quantitative data on the relationship between entrepreneurship and VET curricula development (ibid).



The European Training Foundation's report on "Entrepreneurial skills and attitudes in vocational education and training" (ETF, 2018) provides concrete data on the relationship between entrepreneurship and VET curricula and curricula development. Some of the key findings include:

- Many VET providers across Europe have included entrepreneurship education in their curricula in recent years, but there is still room for improvement.
- The extent and nature of entrepreneurship education in VET curricula vary greatly across countries and regions.
- Entrepreneurship education is most commonly integrated into vocational subjects such as business, management, and commerce, but there is also a growing trend to embed it into non-vocational subjects.
- There is a need for greater teacher training and professional development to ensure that VET teachers have the necessary skills and knowledge to effectively deliver entrepreneurship education.
- There is a need for greater collaboration between VET providers, businesses, and other stakeholders to ensure that entrepreneurship education meets the needs of the labour market and promotes innovation and growth.

The report also highlights successful initiatives and case studies from across Europe that demonstrate how VET providers can effectively integrate entrepreneurship education into their curricula and foster entrepreneurial attitudes and skills among their students (ibid). We list just a few:

- The Finnish education system has been highly successful in promoting entrepreneurship through its vocational education and training (VET) system. The system provides a range of courses and training programs that focus on entrepreneurship and offer students practical experience in starting and running a business. The Finnish government has also set up various initiatives and support systems for entrepreneurs, including mentoring and funding programs.
- The German Dual VET system is another successful initiative that integrates practical training with vocational education. The system provides students with hands-on experience in the workplace and combines this with classroom learning. The system has been credited with contributing to Germany's economic success and promoting entrepreneurship through the development of highly skilled and knowledgeable workers.
- The Netherlands has implemented several successful initiatives to promote entrepreneurship in vocational education and training. For example, the Dutch government has established the Dutch National Entrepreneurship Curriculum, which



provides a framework for the integration of entrepreneurship education across all levels of education. The government has also established various funding and support programs for entrepreneurs, including the Start-Up Visa program, which offers non-EU entrepreneurs the opportunity to start their own businesses in the Netherlands.

- In the United Kingdom, the Peter Jones Enterprise Academy is a successful initiative that offers vocational courses in entrepreneurship. The academy provides students with practical training and experience in starting and running their own businesses, as well as access to funding and mentoring programs. The academy has been credited with helping to increase the number of young entrepreneurs in the UK.

The UNESCO-UNEVOC (2019) report provides some examples of successful initiatives and case studies related to the integration of entrepreneurship into VET curricula and curricula development:

- Germany: The Dual Study Programme, which combines VET and higher education, has led to the creation of new small and medium-sized enterprises (SMEs) and has significantly contributed to the growth of the country's economy.
- Kenya: The KCB Foundation's 2jiajiri program has provided entrepreneurship training and mentorship to over 10,000 young people in Kenya, resulting in the creation of over 1,000 new enterprises.
- Mauritius: The National Institute of Cooperative Entrepreneurship has been successful in integrating entrepreneurship into the VET curriculum, resulting in the creation of over 400 new cooperative enterprises.
- Philippines: The Technical Education and Skills Development Authority (TESDA) has developed an entrepreneurship program that has been integrated into the VET curriculum and has led to the establishment of over 7,000 micro-enterprises.
- United Kingdom: The Enterprise for All program has been successful in embedding entrepreneurship education into VET curricula and has led to the creation of new enterprises and jobs.

The Cedefop (2018) report provides an overview of existing concepts, policies, and initiatives related to entrepreneurship competence in vocational education and training across EU member states. The report presents data on the following:

- The percentage of vocational education and training (VET) students who participated in entrepreneurship education in various EU member states.
- The proportion of VET programs that include entrepreneurship education.



- The types of entrepreneurship education provided in VET, such as classroom-based instruction, practical training, and experiential learning.
- The role of industry partnerships in promoting entrepreneurship education in VET.
- The policy frameworks and initiatives at the EU and national levels that support entrepreneurship education in VET.

The report also provides case studies of successful initiatives and programs related to entrepreneurship education in VET across the EU, including the European Entrepreneurship Competence Framework, the Danish Entrepreneurship Education Network, and the Start-up Your Future program in Italy (ibid). Here are a few examples of successful initiatives and programs related to entrepreneurship education in VET across the EU:

- Erasmus for Young Entrepreneurs: This initiative is a cross-border exchange program that allows new or aspiring entrepreneurs to learn from experienced entrepreneurs in other countries. It is funded by the European Union and has been successful in promoting entrepreneurship education in VET.
- European Entrepreneurship Education NETwork (EE-HUB): The EE-HUB is a network of stakeholders in entrepreneurship education from across the EU. It provides support and resources for educators, policy-makers, and entrepreneurs to promote entrepreneurship education in VET.
- Entrepreneurship Education at Haaga-Helia University of Applied Sciences in Finland: Haaga-Helia University of Applied Sciences in Finland has developed an entrepreneurship education program for its students that includes a variety of courses and extracurricular activities. The program has been successful in promoting entrepreneurship among students and has resulted in many successful start-ups.
- JA-YE Europe: JA-YE Europe is a non-profit organization that promotes entrepreneurship education among young people across Europe. The organization provides a range of entrepreneurship programs and activities for VET students and has been successful in fostering an entrepreneurial mindset among young people.
- VET Schools for the Future in Denmark: This initiative is a collaboration between vocational schools, businesses, and local authorities in Denmark to promote entrepreneurship education in VET. The initiative provides support and resources for VET teachers and students to develop entrepreneurial skills and has been successful in promoting entrepreneurship among young people in Denmark.

The article "Entrepreneurship and human development: A capability approach" by Naudé and Gries (2018) provides a theoretical analysis of the relationship between entrepreneurship and human development, based on the capability approach. The authors argue that



entrepreneurship can contribute to human development by creating opportunities for individuals to exercise their capabilities and improve their well-being.

While the article does not focus specifically on vocational education and training (VET), it highlights the importance of developing the capabilities and skills necessary for entrepreneurship. The authors suggest that education and training programs should aim to develop a range of capabilities, such as creativity, problem-solving, and risk-taking, that are essential for successful entrepreneurship (ibid).

Nevertheless, the article provides a review of existing literature on entrepreneurship and human development, including studies that have found a positive relationship between entrepreneurship and various indicators of human development, such as poverty reduction, employment creation, and gender empowerment. The article also discusses the role of institutions and policies in creating an enabling environment for entrepreneurship and human development (ibid).

The article suggests that entrepreneurship and VET can contribute to human development by providing individuals with the capabilities and skills necessary for successful entrepreneurship. However, it also highlights the importance of creating an enabling environment through supportive institutions and policies (ibid).

Lengyel and Szász (2021) conducted a review of the literature on entrepreneurship education in vocational education and training (VET) in order to identify the key characteristics and factors that contribute to its success. The study found that successful entrepreneurship education in VET includes the following elements:

- Practical, hands-on learning: VET programs that incorporate entrepreneurship education should provide students with opportunities to engage in practical, real-world learning experiences. This can include internships, work-based learning, and project-based assignments.
- Industry partnerships: Collaboration with industry partners can provide students with access to resources and expertise that can help them develop the skills and knowledge needed to succeed in entrepreneurship.
- Tailored curriculum: Effective entrepreneurship education in VET should be tailored to the needs and interests of the students. This can involve offering a range of courses and training programs that reflect the diversity of entrepreneurial activities.
- Supportive environment: Entrepreneurship education in VET should take place in a supportive environment that encourages students to take risks and learn from their



failures. This can involve providing mentorship and coaching, as well as fostering a culture of innovation and creativity.

- Integration with broader education goals: Entrepreneurship education in VET should be integrated with broader education goals, such as developing critical thinking skills, problem-solving abilities, and leadership qualities.

The study also identified several challenges associated with entrepreneurship education in VET, including a lack of resources and funding, a shortage of qualified teachers and trainers, and a need for better coordination between education providers and industry partners (ibid).

4.1.4.9.1.2 The relationship between entrepreneurship and VET (higher VET) incubators

Entrepreneurship and incubators have a close relationship. Incubators are facilities that support and nurture start-up companies by providing various resources, including office space, mentorship, networking opportunities, and access to funding. Incubators aim to help entrepreneurs succeed by providing them with an environment where they can learn, grow, and access resources that would be difficult or impossible to obtain on their own. Incubators can play a crucial role in the success of a start-up company. By providing access to resources and support, incubators can help entrepreneurs overcome common challenges that they may face, such as access to funding, marketing, and business development. Incubators can also help entrepreneurs develop their business ideas and strategies and provide a supportive network of peers. Research has shown that start-up companies participating in incubator programmes have a higher likelihood of success than those that do not. For example, a study by the National Business Incubation Association found that 87% of companies that graduated from an incubator program were still in business five years later, compared to only 44% of companies that did not participate in an incubator program. Overall, incubators can be an important resource for entrepreneurs, especially those who are just starting out. By providing access to resources, mentorship, and networking opportunities, incubators can help entrepreneurs succeed and overcome the challenges that come with starting a new business.

Aerts et al. (2007) conducted a study on European business incubators and found that these incubators play a critical role in supporting entrepreneurs and fostering their success. They identified several screening practices that incubators use to select the most promising entrepreneurial ventures, including evaluating the quality of the business plan, assessing the entrepreneurial team, and examining the market potential of the proposed product or service. The authors also noted that successful incubators tend to have strong networks and partnerships with other organizations in the local business ecosystem.



Audretsch and Belitski (2017) argue that successful entrepreneurial ecosystems in cities require supportive framework conditions, including access to resources, a skilled workforce, and effective governance structures. They note that incubators can play a crucial role in providing resources and support to entrepreneurs, particularly in the early stages of venture creation. The authors suggest that effective incubators should be linked to other components of the entrepreneurial ecosystem, such as universities, venture capitalists, and government agencies, in order to create a comprehensive network of support for entrepreneurs.

Etzkowitz & Klofsten (2005) also highlighted the role of universities in promoting knowledge-based regional development through the creation of incubators and technology transfer programs. These incubators can provide a supportive environment for entrepreneurs to develop their ideas and businesses, while also benefiting from the resources and expertise of the university. Therefore, it can be argued that there is a positive relationship between entrepreneurship and incubators in the context of knowledge-based regional development.

Hackett and Dilts (2004) conducted a systematic review of business incubation research and found that business incubators positively influence the survival and growth of start-ups, facilitate the acquisition of financial and human resources, and increase the likelihood of a successful exit strategy. They also found that incubators have a positive impact on job creation and economic development in the surrounding community.

Stam (2015) explores the concept of entrepreneurial ecosystems and regional policy, providing a critique of the concept and suggesting that while it can be useful in some contexts it has limitations and may not be appropriate in all cases. The paper highlights the importance of taking a nuanced and context-specific approach to entrepreneurship and regional policy.

Some examples of good practice incubators accelerating entrepreneurship:

STATION F

Station F - Located in Paris, France, Station F is the world's largest startup incubator. It provides startups with access to a vast network of investors, mentors, and partners. Reference: Station F. (n.d.). Home. Retrieved from <https://stationf.co/>





Y Combinator - Based in Mountain View, California, Y Combinator is one of the world's most well-known startup incubators. It provides startups with seed funding, mentorship, and access to its extensive network. Reference: Y Combinator. (n.d.). About YC. Retrieved from <https://www.ycombinator.com/about/>



Techstars - With locations all over the world, Techstars is a global startup accelerator that provides mentorship and resources to early-stage startups. It has helped launch successful companies such as SendGrid and DigitalOcean. Reference: Techstars. (n.d.). About Techstars. Retrieved from <https://www.techstars.com/about/>



1871 - Based in Chicago, Illinois, 1871 is a tech hub that offers coworking space, mentorship, and resources to startups. It has been instrumental in the growth of Chicago's tech community and has helped launch successful companies such as SpotHero and Braintree. Reference: 1871. (n.d.). About Us. Retrieved from <https://1871.com/about-us/>



Betahaus - With locations in several European cities, Betahaus is a coworking and startup incubator that provides startups with access to resources such as mentorship, networking events, and funding opportunities. Reference: Betahaus. (n.d.). About. Retrieved from <https://www.betahaus.com/>





IdeaSquare

IdeaSquare - Based in Geneva, Switzerland, IdeaSquare is an incubator run by CERN, the European Organization for Nuclear Research. It focuses on supporting startups that are working on innovative technologies. Reference: IdeaSquare. (n.d.). About IdeaSquare. Retrieved from <https://ideasquare.cern/about-ideasquare/>



Uptech - Based in Lviv, Ukraine, Uptech is an incubator that specializes in supporting startups in the technology industry. It offers mentorship, funding, and resources such as coworking space to its members. Reference: Uptech. (n.d.). About Us. Retrieved from <https://uptech.team/about-us/>

4.1.4.10 Case study: Advanced manufacturing entrepreneurial ecosystem in Spain, UPTEK

UPTEK, the Spanish Association of Startups and Technology-based Companies for Advanced Manufacturing, is the association that brings together and provides services to companies in the field that offer products or services for the world of manufacturing, as well as industrial companies and organizations that wish to connect with them.

UPTEK was created to provide shared spaces and bring open innovation and new talent to the industrial world, generating orderly visibility for these new companies, leveraging the resources of AFM Cluster (LCAMP partner) in its various areas (R&D projects, training, collaboration, internationalization, communication and marketing, etc.). AFM Cluster is the organisation that represents the interests of Advanced Manufacturing in Spain. Its mission is to:

- Group and represent startups and EBTs oriented to the industrial world, building a coherent, understandable and differentiated image of the sector and orienting it to the needs of the industry.
- Provide a forum for member companies to share information about market conditions and the development of new technologies and to collectively address issues of common interest.



- Foster business cooperation, creating networking opportunities among the different associates and with third parties.

UPTEK was created in 2019 and consists of 152 member companies, classified into 3 groups:

- Technology-based companies and startups with products and/or services for advanced manufacturing (COLLECTIVE 1).
- Industrial companies with interest in interacting with technology-based companies (COLLECTIVE 2)
- Other entities and related agents (COLLECTIVE 3)



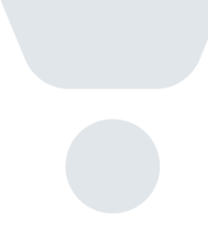
Figure 11: UPTK: Companies by group.

The analysis and segmentation of the market are of crucial importance when creating an entrepreneurship ecosystem in the field of advanced manufacturing.

Market analysis involves evaluating various factors such as customer needs, market size, competition, trends, and technological advancements. This analysis helps identify potential opportunities and challenges within the market, allowing entrepreneurs to make informed decisions and develop effective strategies.

Segmentation refers to dividing the market into distinct groups or segments based on similar characteristics, such as industry verticals, customer profiles, or geographic regions. This segmentation enables entrepreneurs to tailor their products, services, and marketing efforts to specific target segments, increasing their chances of success.





The importance of market analysis and segmentation in the creation of an entrepreneurship ecosystem in advanced manufacturing can be summarized as follows:

- **Identifying market gaps:** By conducting a thorough market analysis, entrepreneurs can identify untapped opportunities or underserved segments within the advanced manufacturing sector. This enables them to develop innovative solutions that meet specific market needs, filling the gaps in the market.
- **Targeting the right customers:** Market segmentation allows entrepreneurs to understand their target customers' characteristics, preferences, and pain points. By focusing their efforts on specific customer segments, entrepreneurs can create tailored solutions that effectively address customer needs, leading to higher customer satisfaction and market penetration.
- **Mitigating risks:** Market analysis helps entrepreneurs assess potential risks and challenges in the advanced manufacturing market. By understanding the competitive landscape, market dynamics, and potential barriers to entry, entrepreneurs can develop strategies to mitigate risks and navigate market challenges more effectively.
- **Enhancing competitiveness:** Through market analysis and segmentation, entrepreneurs gain insights into their competitors, industry trends, and customer expectations. This knowledge enables them to differentiate their offerings, identify unique value propositions, and position themselves strategically within the market, increasing their competitiveness.

In summary, market analysis and segmentation play a vital role in creating an entrepreneurship ecosystem for advanced manufacturing. They enable entrepreneurs to identify opportunities, understand customer needs, mitigate risks, and enhance their competitiveness, ultimately contributing to the success and growth of the ecosystem.

The following is a schematic presentation of the segmentation proposed by Uptek relating application processes to products and services:



SEGMENTACIÓN DE LOS MIEMBROS DE UPTEK

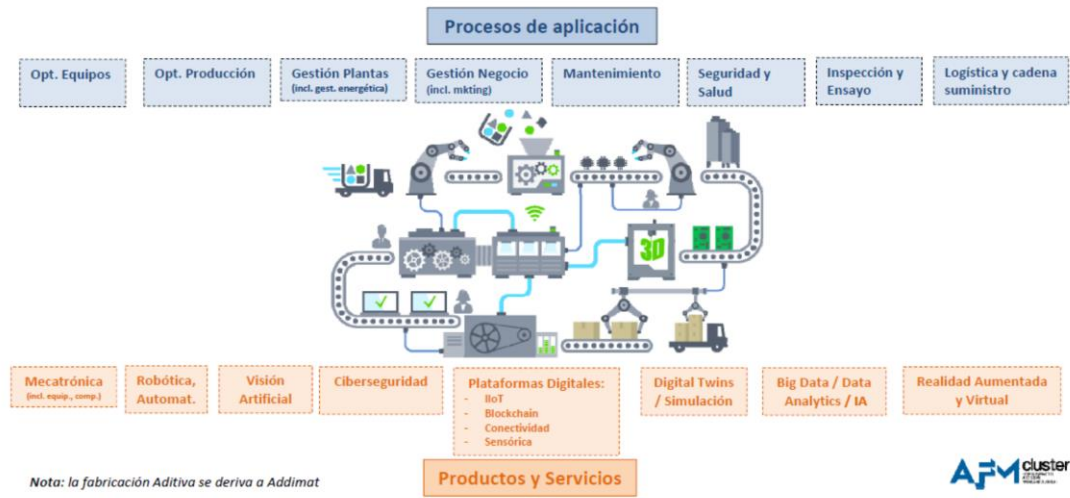


Figure 12: Segmentation of UPTEK members.

The Basque Country has been a hub for technological innovation and advanced manufacturing. It has fostered the growth of numerous startups in the field of advanced manufacturing, also known as Industry 4.0. These startups have leveraged cutting-edge technologies and disruptive ideas to transform the manufacturing landscape and contribute to the region's economic development.

Uptek defines the map of technology-based startups that respond to the main needs that companies in the field of advanced manufacturing require.



UPTEK PRODUCT AND APPLICATION SEGMENTATION

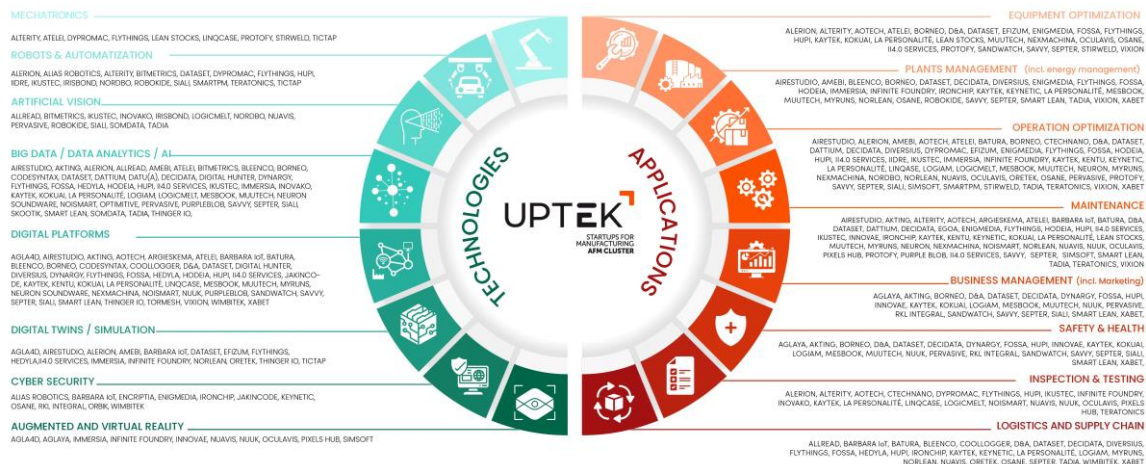


Figure 13: UPTEK product and application segmentation.

Defining the strategic lines of a startup association is of utmost importance for its success and development, and these are the ones defined by Uptek:

- To contact new potential partners and consolidate existing ones.
 - Identify companies that could be potential partners of UPTEK, especially of the group 1, contact them and present our value proposition.
 - Re-establish contact with those ex-associates who have ceased to be associates because they did not take advantage of the Association.
 - Inform and communicate to associates the initiatives carried out and planned, seek their participation and reinforce their sense of belonging.
- To turn UPTEK into the grouping of the solutions proposed for the field of manufacturing by the startups.
 - To know the capabilities/offer of the associated companies.
 - To have a classification by type of product/service they offer and by their applications.
 - To have an identification of proposals directly aimed at the manufacturing technology sector and success stories.
- To promote the activities of the Association and the Cluster that generate valuable services, proximity and contact.
 - Analyse the needs/interests of UPTEK members.
 - Disseminate and define initiatives and services that are of interest to them.

- Promote the proximity of the UPTEK team with the associates.
- To promote cooperation.

To achieve these objectives, it will be of vital importance to create institutional relationships such as public administrations and the different groups that make up the association, as well as traction in collaboration with external agents that enrich the ecosystem.

The goal is to promote B2B collaborations, and promote internationalization processes in the field of advanced manufacturing, disseminating initiatives among the different areas that make up the market to which UPTEK responds. It is important to know the needs and projects of the associates in the international area and to make visible internationalization aid programs that fit with UPTEK companies.

Finally, we would like to highlight the importance of attracting talent in the generation of the entrepreneurial ecosystem in such a specific field as advanced manufacturing.

That is why UPTEK is committed to a job portal (Joind) specializing in the skills needed to create a differential value in the market. Joind is the first employment platform for the industry that connects the best industrial companies with the best-qualified workers in this sector, the gateway to the best job opportunities in technological, innovative, digitized and highly internationalized companies.

4.1.4.11 (Regional) Smart Specialisation

The idea of Smart Specialisation emerged in the Knowledge for Growth expert group created by the European Commission to assess DG Research by analysing the causes of the lag of the European economy if compared to the United States. The concept was developed around 2008 (Hall 2011) and was very influential in European policymaking. Before smart specialisation strategies in the EU, regions engaged in Regional Innovation Strategies (RIS) and in parallel, Information Society Initiatives (RIS-I). As Hall (2011) states, smart specialisation was not accepted so easily because the prior innovation policy research and practices over the past few decades were often loathe to step outside of the box of usual practices. Before diving into understanding these two systems of regional innovation, particularly within the digital market, it is important to understand the particular form of innovation that smart specialisation strategies brought to the EU, and how they differ from their predecessors' models. There are two main features which distinguish smart specialisation strategies from RIS or RIS-I:



Before Smart Specialisation Strategies	Smart specialisation strategies
<p>Focused on remaining neutral in knowledge generation</p> <ul style="list-style-type: none"> - These strategies focused only on addressing market failures (Hall, 2011, p. 3) 	<p>Not neutral in knowledge generation</p> <ul style="list-style-type: none"> - Smart specialization generates knowledge that is not neutral because it tells us about the future economic value of a possible structural change (Hall, 2011, p. 8)
<p>Centralised planning procedures</p> <ul style="list-style-type: none"> - Technocratic and top-town planning as the main way to identify industrial development priorities 	<p>Bottom-up with a focus on Entrepreneurial Discovery Process (EDP)</p> <ul style="list-style-type: none"> - There is more focus on 'an interactive process in which market forces and the private sector are discovering and producing information about new activities and the government assesses the outcomes and empowers those actors most capable of realising the potential' (OECD, 2013, p. 11) - EDP - An approach that reveals what a region does best in terms of its scientific and technological endowments (Foray, David, Hall, 2011).

Table 6: Development in Smart Specialization strategies

As shown in the table above, the two distinguishing features of the smart specialisation strategy, as introduced in Europe from 2008 onwards, are the bottom-up knowledge generation approach and the focus on the entrepreneurial discovery process (EDP). However, the smart specialisation strategy did not appear out of thin air. Rather, it is the sum of a cumulative process of evaluating prior regional innovation strategies in Europe.

In 1994, the EU launched the **Regional Innovation Strategies (RIS)**, as part of the European Regional Development Fund (ERDF) initiatives. Each RIS cycle was co-financed by the European Commission and the region, lasted two years, and cost on average 500,000 euros (Landabaso, Oughton, & Morgan 2001). According to the same authors (2001: 11), you can define the purpose of RIS as:



[strategies] about establishing a socio-economic dynamic (social and institutional engineering) based on a bottom-up open discussion and consensus among the key innovation actors in a region about policy options and new ideas/projects in the field of innovation [...] A short definition of RISs might be 'an instrument to translate 'knowledge' into regional GDP

The main objective of RIS, funded under the European Regional Development Fund, was to "influence and improve European regional policy in order to make it more efficient in terms of its content and policy action" (Landabaso, Oughton, & Morgan 2001: 10). The innovative action was pinned on the "principle of helping regions to help themselves through initiatives designed to mobilise local knowledge in a process of collective social learning" (Henderson & Morgan: 1999).

RIS were brought in as an effort to put innovation at the core of regional policy. They were considered to be "the most active exercise in the promotion of R&D and innovation policies at the regional level with the aim of offering regional stakeholders a common platform to promote, design, implement, manage, and evaluate the region's R&D and innovation policy" (Zabala-Iturriagagoitia, Jiménez-Sáez, & Castro-Martínez 2008: 2). As Oughton et al. Assert (2002:105):

The idea is that by spending a small additional sum of money on innovation policy and networking key players, the RIS policy aims to increase the efficiency of industrial policy by ensuring that the structural funds are spent strategically and targeted at innovation

In order to achieve the mainstreaming of innovation into regional development policies, the RISs had six key methodological principles:

Principles
1. <i>RIS should be based on public-private partnership and consensus (the private sector and the key regional R&TDI players should be closely associated in the development of the strategy and its implementation).</i>
2. <i>RIS should be integrated and multidisciplinary: an effort should be made to link efforts and actions from the public sector (EU, national, regional, local) and the private sector towards a common goal</i>



<p>3. <i>RIS should be demand-led (focusing on firm's innovation needs, SMEs in particular) and bottom-up (with a broad involvement of R&TDI regional actors) in their elaboration. Innovation within RIS includes not only technology considerations but also issues regarding human capital, research and education, training, management, finance, marketing...as well as policy coordination among regional policy, technology policy, industrial policy, R&D and education policy and competition policy.</i></p>
<p>4. <i>RIS should be action oriented and it should include an action plan for implementation with clearly identified projects (at the end of the process new innovation projects in firms and/or new innovation policy schemes and interfirm networks should appear);</i></p>
<p>5. <i>Regions participating in RIS should exploit the European dimension through inter-regional cooperation and benchmarking of policies and methods.</i></p>
<p>6. <i>RIS should be incremental and cyclical: the exercise is dynamic in the form of a strategy and plan for action that has to be reviewed in the light of previous experience and on-going evaluation.</i></p>

Table 7:: Methodological principles of RISs. Original source: (Landabaso, Oughton, & Morgan, Learning regions in Europe: theory,policy and practice through the RIS experience, 2001)

Although RIS were considered a tool to close the innovation-gap across European regions, this theory was not without its flaws. (Landabaso, Oughton, & Morgan 1999: 6). The paradox, as the aforementioned authors suggested, implies that in less favoured regions there is greater need to spend in innovation. They listed 10 structural factors which affect Regional Innovation systems in less favoured regions (those regions with a lower capacity to absorb public funds to innovate). Among the structural factors listed and relevant to the purpose of this report are the following:



- Weak co-operation links between the public and private sectors, and the lack of an entrepreneurial culture prone to inter-firm co-operation (absence of economies of scale and business critical masses which may make profitable certain local innovation efforts).
- Little participation in international R&TDI networks, poorly developed communications networks, difficulties in attracting skilled labour and accessing external know-how.
- Few large (multinationals) firms undertaking R&D with poor links to the local economy.

Analysing these structural factors, Landabaso, Oughton, & Morgan (1999) propose that the innovative capacity of a region is directly related to how well that region can "learn". In other words, learning and innovation are heavily linked, with innovation as the end goal and regional learning (that is dependent on strong inter-firm and public-private cooperation in a strong regional institutional framework) being the process.

Regional Information Society Initiatives (RIS-I) were first presented as an interest of the EU in 1994, through the action plan of "Europe's Way to the Information Society". The report was issued in the context of the EU's growing awareness of the significance of ICT in the development of not only the economy, but also entire societies (Olszak & Ziembra, 2009). It was decided that countries should implement the Information Society guidelines, with a focus on the regional level. The logic behind this was that:

regions and towns should start the initiatives for application of modern technologies. The regions [...] are often able to identify the needs and conditions for the development of the information society in a more accurate way than the central administration (Olszak & Ziembra, 2009, p. 215).

Within this context, in 1996 the European Commission formally established the Regional Information Society Initiative (RISI). The policy laid the foundations for each region to develop a "sound and sustainable organizational, conceptual and strategic base" for the development of a regional structure for an Information society (Stroetmann, 1998). The specific goals of the program were:

Goals of the RISI Initiative

1. increasing the awareness of inhabitants and businesses in the region in terms of ICT applications
2. carrying out the social exclusion prevention policy
3. strengthening the region's competitiveness and attractiveness



4. taking measures in order to improve labour market training and intensify actions related to education and innovativeness
5. including efforts aimed at the development of the information society into investment plans and structural changes in regions
6. promoting regional initiative of the information society, including pilot projects.

Table 8: Goals of the RISI Initiative. Original Source: (Olszak & Ziemba, 2009)

To achieve these goals, each RISI had to establish a "functioning Regional Information Society Unit" and a "committee Regional Steering Group" (Stroetmann, 1998). Each RISI initiative occurred in the context therefore of different regions, but also in different sectors. In the case of the Healthcare working group, for example, six regions of Europe participated in the initiative: Nord-Pas de Calais (France), North-West England (U.K.), Saxony, (Germany), Piemonte (Italy), Macedonia (Greece), Valencia Region (Spain). The objective of RIS-I in this case was the development of applications of new Information Technologies in the different fields of human activity, from teleworking to tele-education and telemedicine (Souf, Tiers, Donsez, & Beuscart, 1996).

Spurred on by the progression of the Regional Information Society Initiatives, on 30 January 1997, 24 European regions, meeting in Brussels, agreed to create a European "Association of Regional Information Society Initiatives". The principal objectives of the Association were:

- To shape ways to promote sustainable economic, social and cultural development of member regions in the forthcoming Information Society
- To create a common platform for the exchange of experience, know-how and projects among the regions. (CORDIS, 1997)

Most of the regions that joined the initiative were already supported by the Commission either through Structural Funds (Art.10 of the ERDF, Art.6 of the ESF) or already engaged in the IRISI pre-pilot action (Inter-Regional Information Society Initiative, the initiative that came before the Regional Information Society one).

On March 3, 2010, in a context of economic recession, the European Commission published the Europe 2020 strategy for smart, sustainable, and inclusive growth which defined three reinforcing priorities for Europe:

- Smart growth, with a strong knowledge and innovation component.
- Sustainable growth, with the support of a green and competitive economy.



- Inclusive growth, with high employment and social and territorial cohesion.

Investment in innovation, research, and entrepreneurship was a vital element of the European response to the recession. Among the responses defined in the strategy, one was the “Innovation Union” flagship initiative and, among other elements, it highlighted S3 as a vital element to achieve a smart, sustainable and inclusive growth. The “Digital Agenda for Europe” flagship initiative was also important in this regard as digital technologies are important in designing S3 (European Commission 2012).

E2020 priorities	Smart growth	Sustainable growth	Inclusive growth
E2020 flagship initiatives	Digital Agenda for Europe Innovation Union Youth on the move	Resource efficient Europe An industrial policy for the globalisation era	An agenda for new skills and jobs European platform against poverty

Table 9: E2020 reinforcing priorities. Based on European Commission 2012.

S3 became part of the 2020 innovation plan of Europe, the Europe Flagship Initiative on *Innovation Union: Transforming Europe for a post crisis world*. S3 became an ex-ante conditionality and every Member State must have a S3 to receive European Structural Fund support (European Commission 2012). The conditionality was embodied in two thematic objectives of the European Regional Development Fund (ERDF):

- Strengthening research, technological development and innovation (R&I target)
- Enhancing access to and use of quality of ICT (ICT target)



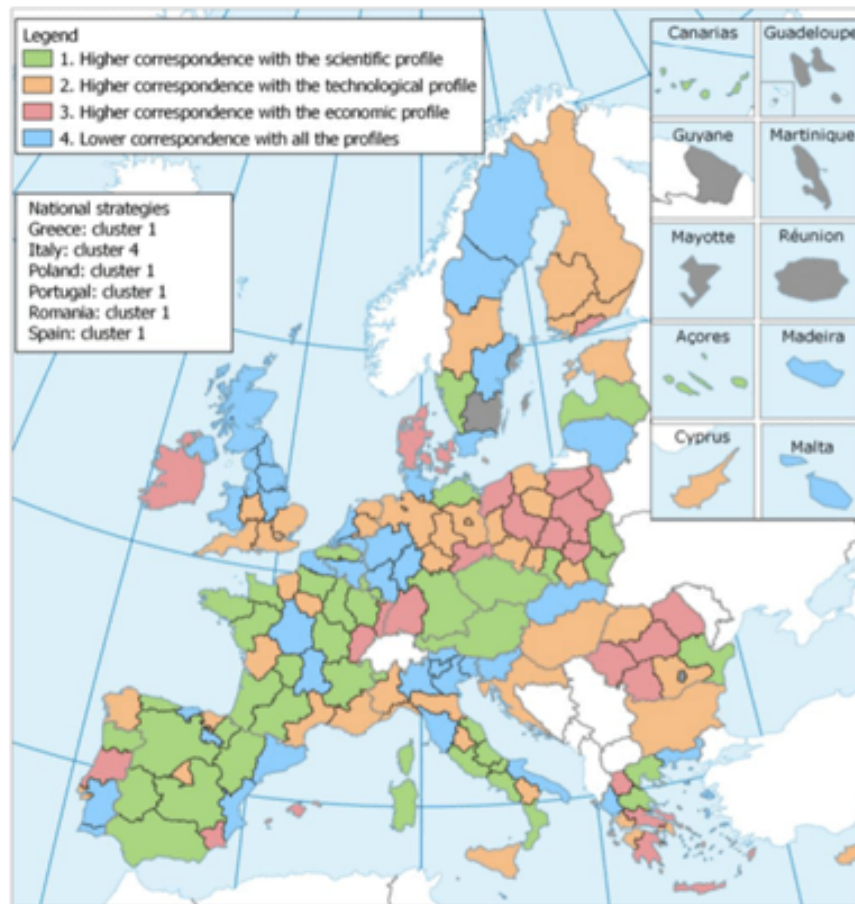


Figure 14: Groups of S3 strategies according to the correspondence of their S3 priority areas with the regional/national profiles. Source: Prognos / CSIL (2021).

From the above map, smart specialisation strategies can be summarised in four areas: a scientific profile, a technological profile, an economic profile, all of the above profiles. From this, one can suggest that currently smart specialisation strategies correspond strongly with their regional profiles. The EC also created a platform to support regions with S3; the Joint Research Centre of the European Commission coordinates the S3 platform.



Box 7: Why S3?

In the second decade of the 21st century the paradox of the results of two important European policies in terms of territorial cohesion and R&I performance came to light (Navarro EKONOMIAZ 83): the support for innovation and the development of poorer regions through structural funds, and the support for excellent science through the framework programmes. The problem was that the support for territorial cohesion through structural funds, aimed in theory to reduce inequalities among European regions, led to inefficiencies (multiple regions investing in the same or in similar things, duplication of efforts, lack of differentiation, etc.). The framework programmes led to an elitist system with many resources being concentrated in the best universities and in the most advanced Member States.

A period of austerity began as a consequence of the 2008-2009 economic recession. This period also meant the redesign of policies and the questioning of previous policies. The main challenge was how to combine territorial cohesion and scientific excellence. This is difficult and many thought it to be impossible.

The idea of Smart Specialisation is able to overcome this challenge. The underlying rationale behind the S3 concept is that by concentrating knowledge resources and linking them to a limited number of priority economic activities, countries and regions can become (and remain) competitive in the global economy. S3 can overcome some of the weaknesses of previous strategies (European Commission 2012):

- Considering the regional innovation system in isolation disconnected from the rest of the world and other European regions.
- Isolation from the region's productive fabric.
- Too much public investment in R&I, business' involvement was low.
- Lack of a sound analysis of the region's strengths.
- Ignoring the regional context and copying the best performing regions.

The main reason for Europe's backwardness was that the United States had been able to exploit the ICT technologies and Europe not. This is how ICT became the first General Purpose Technology (GPT) or, as we would refer to it now, Key Enabling Technology (KET).

S3 is defined as:

a place-based approach characterised by the identification of strategic areas for intervention based both on the analysis of the strengths and potential of the economy and on an Entrepreneurial Discovery Process (EDP) with wide stakeholder involvement.



It is outward-looking and embraces a broad view of innovation including but certainly not limited to technology-driven approaches, supported by effective monitoring mechanisms.

National/Regional research and innovation strategies for smart specialisation are integrated, place-based economic transformation agendas that do five important things:

- They focus policy support and investments on key national/ regional priorities, challenges and needs for knowledge-based development, including ICT-related measures;*
- They build on each country's/ region's strengths, competitive advantages and potential for excellence.*
- They support technological as well as practice-based innovation and aim to stimulate private sector investment.*
- They get stakeholders fully involved and encourage innovation and experimentation.*
- They are evidence-based and include sound monitoring and evaluation systems.*

The aims of S3 are (Foray EKONOMIAZ):

- Facilitating the emergence and growth of new activities that are potentially fertile in innovation and surpluses.
- Diversifying regional systems through the generation of new options.
- Generating critical mass, critical networks, and critical clusters within a diversified system.

Box 8: Spatially blind or spatially aware innovation policies?

Around the first decade of the 21st century, when S3 was being conceptualised, there was a debate between spatially blind and place-based strategies.

The World Bank proposed spatially blind strategies and the group of authors and organisations who worked with the European Commission were in favour of “spatially aware” or “place-based” strategies.

At the beginning, S3 was not necessarily related to a territory, but this changed quickly and has been in effect since the early 2000s. Important in this process was the “mirror group” for the [S3 platform](#) created by [DG Regio](#) of the European Commission. This group is behind the first S3 manual: [Guide on Research and Innovation Strategies for Smart Specialisation](#).



The first element of S3 is that it be a place-based policy. For that, every region should analyse its context and identify its innovation potential. Three key dimensions will be part of the regional analysis (European Commission 2012):

- Regional assets, such as technological infrastructures.
- Linkage with the rest of the world and the position of the region within the European and the global economy.
- Dynamics of the entrepreneurial environment in the region.

S3 seeks to identify priorities that follow a “diversified specialisation” approach and that are “vertical”. Diversified Specialisation means that regions should specialise to be competitive but not so much as to become vulnerable to changes (Navarro EKONOMIAZ). “Vertical” thematic priorities are understood in opposition to “horizontal priorities”. Regional Innovation strategies tended to be defined in terms of horizontal priorities and neutral policies aimed at improving conditions and capacities (good universities, human capital, intellectual property rights, etc.) but S3 advocates for a vertical, non-neutral and non-horizontal, style of intervention (Navarro EKONOMIAZ). It is an effective match between top-down broad objectives aligned to EU policies and bottom-up process to identify niches and domains of specialisation in the region. Foray argues that before S3 the traditional R&I investment strategies were:

- Politicians trying to satisfy everyone instead of prioritising what is important. This may function for political elections, but it is a rather poor way of allocating R&I resources.
- Do what others (especially the best performers) are doing with the hope of replicating their results (European Commission 2012). In any case, if it does not work, it will not work for many regions, and it will, therefore, be a shared failure.

According to Foray the relevant level to establish priorities is the medium granularity. If we go to a very high level we end up with a sectoral strategy, and if we go to a very concrete level we end up with a horizontal innovation policy that just funds specific projects. The relevant level is somewhere between sectors and micro-activities. The government will, therefore, not support a sector or a company, but the growth of a new activity. S3 priorities are activities in which innovative projects complement the existing production assets of the region (Foray EKONOMIAZ). It is important as well to highlight that priorities are not set forever, they change. When an activity is mature, it should abandon the S3 portfolio and leave its place to new opportunities.

The second key element is the “entrepreneurial discovery process” (Navarro XXX). To ensure the participation of the relevant stakeholders, Regions should go beyond the triple-helix,



use a governance scheme that allows for “collaborative leadership” and include “boundary spanners” (European Commission).

The third element is the “government as a platform”. Rather than the top-down public authority-led process for developing previous regional innovation strategies, the role of public authorities in S3 should be one of creating the right conditions for and then supporting the entrepreneurial discovery process. (Goddard, Kempton and Vallance EKONOMIAZ) (Foray 2009). Important here is to elaborate a clear vision, shared by all the stakeholders in the region, of where the region would like to be in the future. It is considered as a key element to keep stakeholders engaged in the process. (European Commission 2012). This requires an inclusive governance that enables targeted stakeholder interaction and policy coordination. Two things are important in the EDP (European Commission 2016):

- Ensure balance across competing interests and keep in check lobbying.
- Prevent capturing/hijacking of the EDP by incumbent agents.

Policy decisions are taken through an interaction in the quadruple helix, i. e., between policymakers, entrepreneurs, researchers and scientists, and the civil society in general (European Commission 2016).

The fourth key element is monitoring. It is an experimental policy (Foray EKONOMIAZ) and not all priorities selected by stakeholders will bear fruits. The European Commission (2012) suggests a six steps approach to design a S3:

- Step 1: Analysis of the regional context and potential for innovation.
- Step 2: Governance: ensuring participation and ownership.
- Step 3: Elaboration of an overall vision for the future of the region
- Step 4: Identification of priorities.
- Step 5: Definition of coherent policy mix, roadmaps and action plan.
- Step 6: Integration of monitoring and evaluation mechanisms.

One of the weaknesses of the academic literature of regional innovation systems and S3 is that it tends to overlook some elements that are very important for regional innovation where VET can be vital. The academic literature of regional innovation systems Navarro EKONOMIAZ:

- has emphasised knowledge generation over diffusion and exploitation.
- has prioritised the Science push model of innovation over other based on interaction, experience and collaboration (Lundvall’s DUI model for example) and, as a consequence, activities related to research have been prioritised over other types of activities that are important to innovation.



- has focused on high technology sectors and big companies and have ignored traditional, low technology, sectors and SMEs,
- has focused on universities, financial markets, and capital, and ignored labour force and labour market.
- has focused on a minority of people with very high qualification levels (PhDs., engineers, scientists, etc.) and ignored intermediate technical levels.
- has focused on regions and ignored the variety of local contexts that exist, or can exist, within a region.

With the growing importance of regional innovation efforts to address the specific goals of the European Green Deal, the Sustainable Development Goals, it has become more and more relevant to consider regional innovation strategies in a 'mission-oriented' approach (McCann & Soete, 2020). The 'mission' would essentially transform S3 strategies from focusing solely on a competitiveness logic, into focusing on regional society challenges. In this way, a paradigm shift from S3 to S4 is envisaged: S4+ means reinforcing the S3 mission-oriented policy viewpoint with non-neutrality, direction, and a system approach to engaging regions in European initiatives dealing with missions. The differences between S3 and S4 can be summarised in the following table (McCann & Soete, 2020):



Intervention logic	S3	S4
SWOT analysis	<p>Appraise endowments in assets</p> <p>Assess innovation potential in a territory</p> <p>Appraise entrepreneurial base and dynamics</p> <p>Identify international networks and value chains</p>	<p>Strengthen S3, and ...</p> <p>S4: Position the SWOT analysis in the ecological and digital transitions of the energy, manufacturing, agri-food, housing, and mobility systems.</p>
Governance	<p>Management structure in place</p> <p>Participation of stakeholders in quadruple helix</p> <p>Institutional and human resources capacity</p>	<p>Strengthen S3, and ...</p> <p>S4: Role of the state goes beyond being facilitator and catalyst to co-create system transformation. This requires management reforms and capacity building to work cross-domains, cross-departments, cross-sectors and cross-disciplines.</p>
Vision	<p>Shared vision on present and future innovation challenges</p> <p>Strategy medium-term</p>	<p>Strengthen S3, and ...</p> <p>S4: Vision goes beyond the R&I system. Could be a societal vision: "Which is the future we want – here?" or an industrial vision: "promising areas for the future". The vision should be linked to overall target(s) set in time (medium-term) which is understandable, measurable, ambitious but realistic.</p>



Prioritisation	Revision of previous priorities Identify areas of competitive advantage Verify critical mass of budget for achieving each priority	Strengthen S3, and ... S4: If the priorities are aligned or in the same overall direction as the overall EU-level investments (and regulatory changes), then the potential of reaching critical mass and of crowding-in of private investment and of EU funds increases.
Implementation	Broad definition of innovation Balance between focused and horizontal measures Upgrading existing industry using KETs and digital Experimentation in pilot actions Innovation ecosystems International collaboration search for value chains	Strengthen S3, and ... S4: The Implementation is driven by innovation but mobilises in synergy with other policy areas and investments, such as infrastructure, skills, etc. The scope is broader with systemic innovation and industrial transitions. Programmes create portfolio of projects and focus on development, testing or deployment of innovative solutions. Place-based experimentation and testbeds of local or foreign innovations are linked to user-driven innovation, economies of scope and public procurement. The strategy for positioning in value chains is proactive in new value chains emerging from the transitions and they create a local articulation of EU alliances. S4: The local framework conditions to innovation are now also European. When local entrepreneurs detect barriers or resistance to innovation for sustainability this can be channelled in "Green Deals" to the national and EU policy level. S4: Cooperation and mutual learning with other actors of change is facilitated by regional thematic network but the new network externalities are broader emerging from the reorientation of EU network of actors (European technological platforms, European partnerships, industrial alliances, EIT Knowledge and Innovation Communities, etc.) moving in the same direction.

Figure 15: S3 and S4. Source: McCann & Soete 2020.

Notably under 'implementation', S4 envisages "an implementation is driven by innovation but mobilises in synergy with other policy areas and investments, such as infrastructure, skills, etc." Particularly with relation to mobilisation through skills considerations, VET centres and CoVEs could have an important role to play.

The New European Agenda acknowledges the importance of smart specialisation strategies as they "play a central role in strengthening regional innovation ecosystems so that they are better equipped to stimulate and sustain economic growth." (European Commission, 2022). With this priority still in mind, the New European Innovation Strategy points to the European Institute



of Innovation and Technology (EIT) and the European Innovation Ecosystems (EIE) under Horizon Europe's Pillar III "Innovative Europe", which is laying the groundwork for a pan-European Innovation Ecosystem intertwining regional innovation ecosystems across the EU. The communication states that:

The EIT's Regional Innovation Scheme (RIS) focuses on developing innovation ecosystems in low-innovation performance regions across Europe and in linking these ecosystems to local and regional smart specialisation strategies. A new set of EIE projects will complement this by connecting well-developed regional innovation ecosystems with less developed ecosystems, ensuring cross-fertilisation.

In addition, in March 2023, the European Commission announced a flagship initiative, inviting Regions who are committed to better coordinating their research and innovation investments and policies and to collaborating on inter-regional innovation projects in the Regional Innovation Valleys. The areas of interest wherein the Commission seeks engagement are:

- Reducing the reliance on fossil fuels
- Increasing global food security
- Mastering the digital transformation
- Improving healthcare
- Achieving circularity
- Industrial competitiveness using deep tech innovation

This is in line with the priorities of the [European Research Area Policy Agenda](#) (2022-2024), which lists as a priority "Build Up Regional and National R&I Ecosystems to improve regions/national Excellence and Competitiveness". Within this goal, the European Commission, in collaboration with the Committee of Regions, the Member States and stakeholders, will conceptualise, pilot, and launch the ERA (European Research Area) Hubs across EU territory. ERA hubs are:



ERA Hubs

ERA Hubs is an initiative that builds on the existing capacities, such as the Digital Innovation Hubs and clusters, and links to the Enterprise Europe Network and StartUpEurope, to provide an interconnected knowledge space. This will facilitate collaboration and exchange of best practices, with the incentive to maximise the value of knowledge production, circulation and use. As the ERA Hubs initiative and the ERA Hubs represent a new approach, it is important that the implementation process focuses on a building up period to allow both co-design with the Member States and local knowledge ecosystems and their actors, as well as mutual learning of what works and what needs to be developed further to ensure that the initiative can eventually create the desired impact. This also includes a close collaboration with other EU programmes and initiative to ensure a clear complementarity and effective collaboration.

Figure 16 : ERA Hubs. Original source: KI0121450ENN.en_.pdf (apre.it)

Within this perspective, the EU is focusing on encouraging regional innovation that involves the maximum of stakeholder and knowledge collaboration. One such complementary activity could be the Partnerships for Regional Innovation Approach.

4.1.4.12 VET centres in Regional Smart Specialisation

The role of VET in S3 and in the regional innovation system is difficult to define in a “one size fits all” manner because, as it has been argued, European regions differ from each other and so do European VET systems. As the European motto goes, we are “united in diversity”.

The main stakeholders who are involved in the policy-making process surrounding smart specialisation strategies have traditionally been regional public authorities, together with private businesses, higher education institutions and civil society (Cohen, 2019) (Guzzo, 2021). As Moso-Diez, Atwell, Gessler, Nagele, & Nardi (2018: 340) put it:

the VET system practically has a low influence on design and development of the Smart Specialisation framework. In fact, the way it is conceptualised and structured does not take into account the VET system as part of the innovation governance system.

The following graphic illustrates the different level of participation in the RIS3 strategy in percentage:



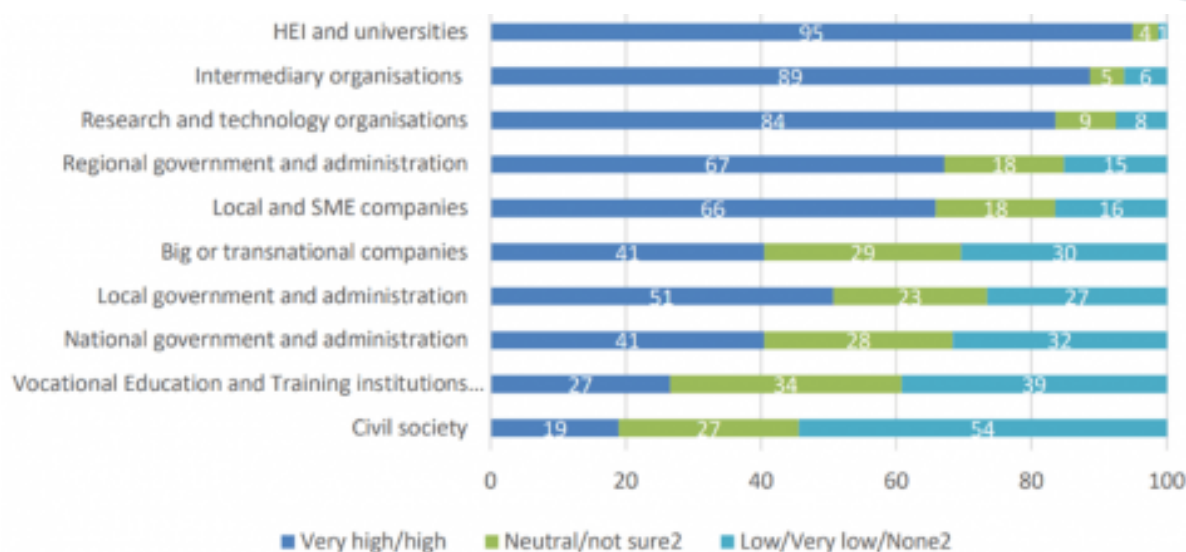


Figure 17: Level of Stakeholders' participation in the RIS3 strategy (in %). Source: JRC.

As can be seen from the above graph, Vocational Education and Training Institutions are the second to last group of stakeholders to be involved, by percentage, in RIS3 strategies. This implies they are an underutilised stakeholder in the governance of RIS3 strategies.

According to the proposal for a Council Recommendation on Vocational Education and Training for sustainable competitiveness, social fairness, and resilience (European Commission, 2020):

Centres of Vocational Excellence are intended to be world-class reference points for training in specific areas for both initial training of young people as well as for continuing up-skilling and re-skilling of adults, through flexible and timely offer of training for the skills needs of companies. They operate locally, being closely embedded in the local innovation ecosystems and clusters and bringing together a wide range of local partners, such as providers of vocational education and training, employers, research centres, development agencies, and employment services (among others), to develop "skills ecosystems" that contribute to regional, economic and social development, innovation, and smart specialisation strategies.

The prospects for VETs and CoVEs in regional innovation strategies may therefore be good, but the reality is that they are currently not considered as key stakeholders in the governance or decision-making processes of these strategies. Indeed, the literature on the perspective of VET systems as a catalyser of regional innovation, implanted within the smart specialisation strategy, is scarce. Despite this, Moso-Diez, Atwell, Gessler, Nagele, & Nardi (2018) find that increasingly VET centres are conceived as a type of regional innovation player, as different



regional case studies show their capability to develop strong interaction with micro-enterprises and SMES to support applied innovation, becoming a technology transfer catalyst for local innovation systems.

Intellectual Capital	System functions	Value contribution	Mechanisms
Human Learning assets	Vocational skills providers	Supply of young people with intermediate and higher technical qualifications required by businesses and strategic sectors	New agile, well-targeted curricula and qualifications
	Facilitators of lifelong learning	Reskilling of the active population to meet technology's rapid advance	Personalised education and training programmes
Structural Innovation assets	Technology service provider	Advisory and/or technical support services	Technology transfer projects
	Access to infrastructure	Specialist technology centres	Shared infrastructure
	Facilitator of new creative frames	Testing and trial services	Extended laboratory
		New collaborative discovery frameworks with apprentices	Challenge-based innovation projects
Relational Connectivity assets	Clustering and collaboration	Meeting place	Networking
		Collaborative space	Project nexus
		Local antenna	Information

Source: Adapted from Moso-Diez (2019)

Figure 18: VET and S3. Original source: (Moso-Diez, Atwell, Gessler, Nagele, & Nardi, 2018)

According to Moso-Diez (2019), VET centres have the ability to 'improve the human, structural, relational, and social capital of a country or region, adding value to the environment through a range of different mechanisms and instruments, especially in the face of the challenges of industry 4.0' (Moso-Diez, Atwell, Gessler, Nagele, & Nardi, 2018: 340).

Mikel Navarro pointed out some omissions in the literature about regional innovation systems, but he also noted that VET shows its full potential in the very parts ignored by studies. This is probably the reason why universities have been included as important agents of regional innovation and not VET:



Focuses of regional innovation literature (strengths of the university)	Omissions of regional innovation literature (strengths of VET)
Knowledge generation It has focused on universities, financial markets, and capital, and ignored labour force and labour market.	Knowledge diffusion and exploitation
Science push model of innovation	Innovation based on interaction, experience and collaboration (Lundvall's DUI model for example)
High technology sectors and big companies	Traditional, low technology, sectors and SMEs
Minority of people with very high qualification levels (PhDs., engineers, scientists, etc.)	Intermediate technical levels
The region	Varying local contexts within a region

Box 9: What happens with universities?

The 2021 edition of the OECD *Science, Technology and Innovation Outlook* pointed out some key challenges for academia (OECD 2021):

- Scientific research is increasingly being called upon to address complex societal challenges. In many situations, trans-disciplinary research (TDR), which combines different actors and sources of knowledge, is necessary. But TDR requires additional skills and approaches and generates additional outputs to those that are normally valued in academic research. TDR is not necessarily a good career choice for scientists wishing to establish themselves in academia. TDR is complicated, has a long lead-in time, and is often conducted in large teams with no single disciplinary champion. While scientific outputs and publications are important in TDR, a variety of other outputs are equally (if not more) important: policy reports, public communication documents, new multi-stakeholder networks, and changes in practice, all of which are clearly required in response situations like the recent global pandemic.



- Focusing on individual merit and disciplinary excellence has taken science a long way and should not be abandoned altogether. However, the way these qualities are assessed and measured no longer meets the broader societal expectations of science. Nor does it reflect the growing emphasis on open science and the increased tendency in many research areas to work in large, often distributed and diverse, teams. Individual career progression depends on assessment by peers, which itself is highly dependent on a researcher's publication record. Maintaining rigour and research excellence are critical for ensuring trust in science. However, there is a need to redefine what is meant by excellence in relation to all of the different expectations of science.
- The working conditions of academic researchers have been deteriorating in recent years. This is especially true for the growing number of postdoctoral researchers on fixed-term contracts and with limited continuous employment prospects. The precarity and insecurity of research careers is also a major obstacle to advancing gender equality and social diversity in the research workforce.
- International mobility in the global labour market for researchers can expand opportunities, but it can also increase precarity, especially for early career researchers and women.
- Mobility between academia and other sectors can help promote effective interaction between research, education, and innovation as well as opening up alternative career paths. However, it is not always clear how to facilitate exchange of early career researchers between sectors. Also, doctorate holders who have been trained in academia may need further training and skills to meet the needs of other sectors and they often face obstacles to returning to academic research. Training and experience that may be valued in other sectors are often not aligned with expectations for an academic career. Inter-sectoral mobility, especially at an early stage of one's career, can represent a one-way ticket out of academia, with little opportunity of returning. The result can be a permanent loss of talent in the academic scientific endeavour.



4.1.4.13 Open innovation: Wrap up

Throughout the various sub-sections above, we have opted for a systemic, interactive, and processual way of understanding innovation. We have also pointed out the close relationship between entrepreneurship and innovation and the importance of VET in the innovation ecosystem at local and regional levels.

Open innovation

Key messages

- An innovation is a new or improved product or process (or combination thereof) that differs significantly from the unit's previous products or processes and that has been made available to potential users (product) or brought into use by the unit (process). (OECD/EUROSTAT 2018). Innovation can be related to products, processes, organisational forms, and others. The last edition of the Oslo Manual (OECD/EUROSTAT 2018) only accepts product and process innovations.
- The degree of novelty of an innovation has been classified as radical or incremental. Incremental innovation is far more important than what is normally considered. Innovations do not happen in a single point in time, they are a process.
- Technological innovation is a source of wellbeing and competitiveness: There is a correlation between technological innovation and increases in GDP. The more innovative a country is, the more it grows in terms of GDP.
- For many businesses, innovation is not a choice but a necessity: if they are not able to implement technological innovations, they will die.
- Innovation is complex and it is wrong to analyse it in terms such as "good" or "bad". Technological innovations are supported and opposed by social groups with differing values. They affect employment and life choices. The main values behind the support for technological innovation are related to capitalism: efficiency, productivity, growth, etc. There is innovation outside of the markets, a fact that seems to be ignored (purposedly) by the main definitions and strategies behind innovation. It is difficult to say if the impact of an innovation has been good or bad in ethical terms; innovation affects GDP and makes our economies grow, but GDP may not be the only measure of social wellness.
- There have been different types of models to depict how innovation works. Some have emphasised the role of basic research, some focus on market needs, and some



have explained innovation as a system. Innovation is a complex process (not good or bad) that takes place in an environment and involves interactions between several actors.

- Firms cannot work in an isolated manner relying only on their own internal research and development to be innovative. They must connect with the context in which they operate. Users are also important in shaping new technologies; they are not passive consumers. So, apart from researchers, scientists, engineers, or managers, many other agents should interact with each other to promote innovation.
- S3 are place-based, they build on the strengths and resources of the region and they are aimed at the region.
- VET should play a more relevant role in S3.



4.1.5 Fifth Constituent: Community (of practices, of learning, of innovation)

This section explores the concept of community of practices (CoP). We will explore the origins of the concept, its meaning, how a community of practice can be built and some examples of such communities, in the following four sub-sections:

- Origins of the concept.
- What is a community of practice?
- How to build a Community of Practice.
- Examples of innovation communities.

The section closes summarising the key ideas in a wrap up.

4.1.5.1 *Origins of the concept*

The origin of the reflection about communities of practice (or for that reason, innovation) is in learning theory. The first use of the term is from Jean Lave and Etienne Wenger, cognitive anthropologists who coined the term when they were analysing apprenticeship, work based, types of learning in 1991. Since then, communities of practice have become popular in many organisations and the reflection about communities of practice has also grown.

Communities of practice have gained popularity in companies as a means of knowledge management. At the beginning, due to a simplistic understanding of knowledge as “information” (what we have referred to as “know-what”), companies started working with IT systems, but, considering the complexity of different types of knowledge, an IT system will not solve the knowledge management issue. We need a different type of interaction that allows for knowledge flows considering all the complexity and variety of types of knowledge.

Learning is, to a large extent, a social process that occurs in social settings. Taking into account our approach to different types of economically relevant knowledge (knowledge-what, knowledge-why, knowledge-how, knowledge-who), the social aspects will be very relevant to know how and know who. How do we learn how to do something? How do we get interesting contacts and networks? Working with others (Omidvar and Kislov 2014).

Communities of practice are a type of learning that can be labelled as situated in specific social configurations. Do not forget that innovation is ultimately about learning interactions between actors. In this sense, communities are important.



4.1.5.2 What is a community of practice?

Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly (Wenger-Trayner, 2015: 2).

Etienne Wenger (1998) conceives communities as social configurations in which shared enterprises are defined as worth pursuing and our participation is recognizable as competence. He argues we all belong to communities of practice, sometimes even without being aware of it. In most cases, these communities are not explicitly defined, do not have a name or any other kind of formal, labelled, membership sign. Furthermore, even if in many cases there is no formal membership mark, we know who belongs and who does not belong to a certain community. And we can distinguish communities by our degree of involvement in them: we can be core members or have what Wenger calls a “peripheral” form of membership”. Wenger also associates “community” with “practice” to build the expression “community of practice”. A community of practice, in this sense, has three dimensions (Wenger 1998: 73-85):

- **Mutual engagement:** community members are engaged in actions and there are relations of mutual engagement around these actions. A community is not the same as a network, a team, or a group in general. It is not just a matter of membership, but a matter of sharing practices in which members are mutually engaged. Mutual engagement is not to be understood as a synonym of homogeneity. Mutual engagement also implies that community members possess limited amount of knowledge and capacity and that they complement each other and the contributions of each member. The key idea is that community members share a practice and that they are mutually engaged as long as they share this practice. The ways in which participants involve with practice are complex.
- **Joint enterprise:** Having a joint enterprise should not be understood as agreement between community members, but as the result of a collective process of negotiation. A consequence of the collective process of negotiation is that defining a joint enterprise is a process, not a static agreement.
- **Shared repertoire:** “The repertoire of a community of practice includes routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice” (Wenger 1998:83).



He proposes a series of fourteen indicators (Wenger 1998: 125-126):

- *Sustained mutual relationships -harmonious and conflictual*
- *Shared ways of engaging in doing things together.*
- *The rapid flow of information and propagation of innovation.*
- *Absence of introductory preambles, as if conversations and interactions were merely the continuation of an ongoing process.*
- *Very quick setup of a problem to be discussed.*
- *Substantial overlap in participant's descriptions of who belongs.*
- *Knowing what others know, what they can do, and how they can contribute to an enterprise.*
- *Mutually defining identities.*
- *The ability to assess the appropriateness of actions and products.*
- *Specific tools, representations and other artifacts.*
- *Local lore, shared stories, inside jokes, knowing laughter.*
- *Jargon and shortcuts to communication as well as the ease of producing new ones.*
- *Certain styles recognized as displaying membership.*
- *A shared discourse reflecting a certain perspective on the world.*

In later publications (2002, 2015), Wenger-Trayner define three key characteristics that combine to constitute Communities of Practice:

- **Domain (instead of joint enterprise):** Community members are committed to a domain. Wenger-Trayner (2016) justify the use of “domain” instead of “joint enterprise” as follows: “One of the reasons I have not used the term ‘joint enterprise’ lately is precisely because when consulting with businesses, people always ask me: ‘What’s the difference between a community of practice and a team?’ And the notion of joint enterprise does not really clarify the distinction. So ‘domain’ is the term that I use now to define the area in which a community claims to have legitimacy to define competence. A team is defined by a joint task, something they have to accomplish together. It is a task-driven partnership, whereas a community of practice is a learning partnership related to a domain of practice. Members of a community of practice may engage in the same practice while working on different tasks in different teams. But they can still learn together. A learning partnership around a practice is a different structuring process than working on a joint task. So no, the notion of community of practice cannot be applied to any group. It refers to a specific structuring process, which is only a useful perspective in certain cases”.



- Community: in the pursuit of their domain, community members involve in a series of activities: help each other, share information, build the mutual relationships that enable learning to happen.
- Practice: Members of the community of practice not only share a common domain, but are involved in a practice, they are practitioners. The typical activities of a community of practice are summarised in the table:

Problem solving	"Can we work on this design and brainstorm some ideas; I'm stuck."
Requests for information	"Where can I find the code to connect to the server?"
Seeking experience	"Has anyone dealt with a customer in this situation?"
Reusing assets	"I have a proposal for a local area network I wrote for a client last year. I can send it to you and you can easily tweak it for this new client."
Coordination and synergy	"Can we combine our purchases of solvent to achieve bulk discounts?"
Building an argument	"How do people in other countries do this? Armed with this information it will be easier to convince my Ministry to make some changes."
Growing confidence	"Before I do it, I'll run it through my community first to see what they think."
Discussing developments	"What do you think of the new CAD system? Does it really help?"
Documenting projects	"We have faced this problem five times now. Let us write it down once and for all."
Visits	"Can we come and see your after-school program? We need to establish one in our city."
Identifying gaps in competence	"Who knows what, and what are we missing? What other groups should we connect with?"

Figure 19: Typical Community of Practice activities. Source: Wenger-Trayner 2015



Apart from these three characteristics, Wenger-Trayner suggest that communities are varied in terms of:

- Name: some of them are not referred to as communities.
- Size: some of them are big, some of them small, etc.
- Geographical coverage: global, local, regional, national, etc.
- Membership: from one organisation, from various organisations, individuals, etc.
- Recognition: some of them are formally established, others are quite informal.
- History: some are old, other new, etc.
- Type of interaction: there are communities which face-to-face, there are online communities.

The concept of communities of practice has been applied to various fields. There is a specific subsection below devoted to different examples of communities of practice. Wenger-Trayner (2015) identify the following contexts of application:

- Business.
- Government.
- Education.
- Professional and other types of associations.
- The civic domain.
- International development.
- Internet.



4.1.5.3 How to build a Community of Practice

As this document articulates the establishment of a community, it is not enough to reflect about the concept and to offer a summary of its main features, as we have done in the two sections above. We are creating a community. The Joint Research Centre of the European Commission (Catana et. al. 2021) published a “playbook” to set up, run and evaluate communities of practice in any type of organisation.

2.1. The Communities of Practice Success Wheel

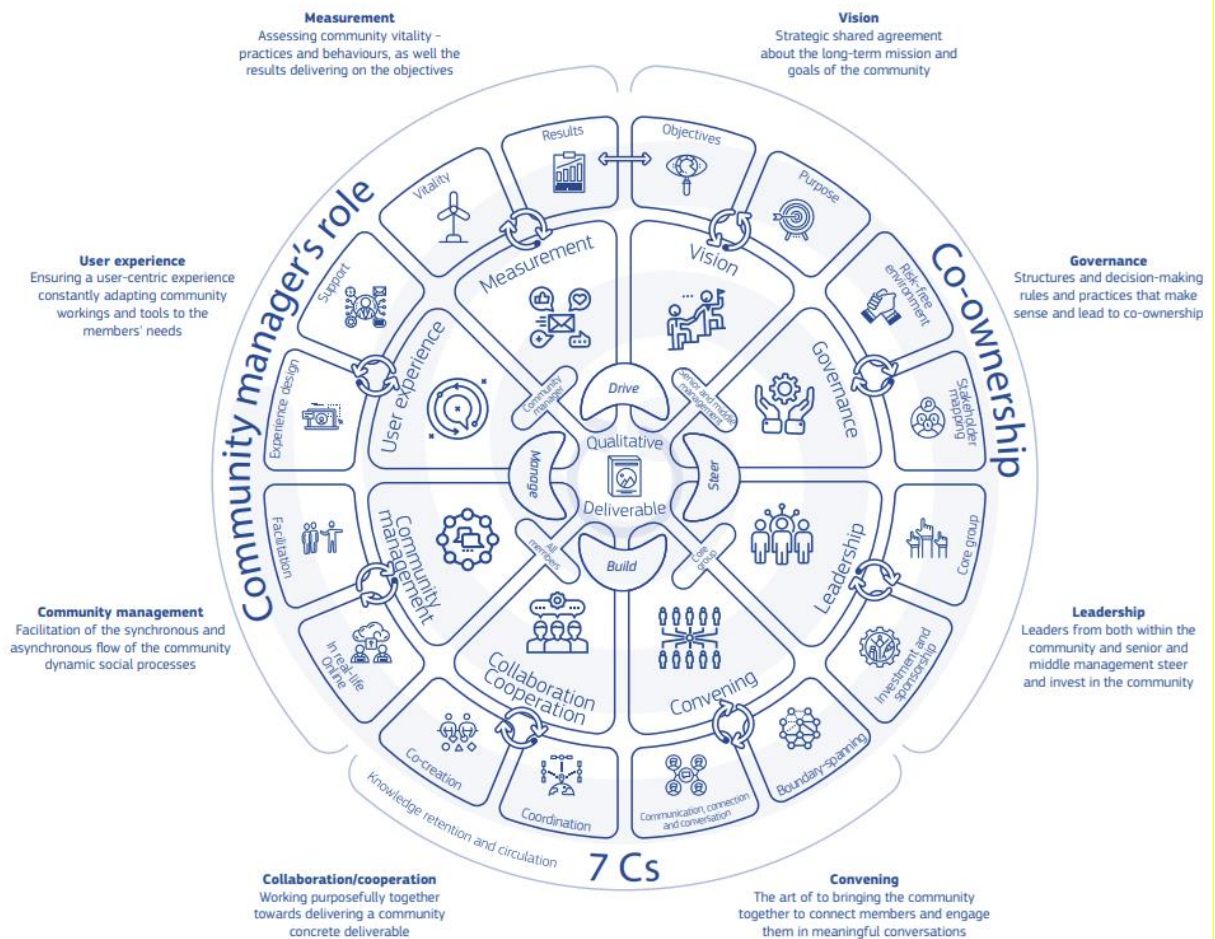


Figure 20: the communities of practice wheel of success. Source: Catana et. al. 2021.



4.1.5.4 Examples of innovation communities

At the European level, the most substantial and largest example of Innovation Communities is the **European Institute of Innovation and Technology (EIT)'s Knowledge Innovation Communities (KIC)**. In this subsection, we will be looking into the theory of the communities and the concrete example of the EIT KIC Manufacturing, as a relevant example to LCAMP's field of expertise.

The European Institute of Innovation and Technology (EIT) has nine Knowledge and Innovation Communities which, according to the EIT website (March 2023):

carry out activities that cover the entire innovation chain: training and education programs, reinforcing the journey from research to the market, innovation projects, as well as business incubators and accelerators. The EIT's role is to guide the process and set the strategies, but it's up to the Innovation Communities to put these into practice and provide results

Moreover, the EIT (EIT, Unknown) states that:

Through our Knowledge and Innovation Communities, we strengthen cooperation among businesses (including SMEs), higher education institutions and research organisations, form dynamic pan-European partnerships, and create favourable environments for creative thought processes and innovations to flourish.

The EIT has nine innovation communities:

- EIT Climate-KIC: Working to accelerate the transition to a zero-carbon economy;
- EIT Digital: Driving Europe's digital transformation;
- EIT Food: Leading a global revolution in food innovation and production ;
- EIT Health: Giving EU citizens greater opportunities to enjoy a healthy life;
- EIT InnoEnergy: Achieving a sustainable energy future for Europe;
- EIT Manufacturing: Strengthening and increasing the competitiveness of Europe's manufacturing industry;
- EIT Raw Materials: Developing raw materials into a major strength for Europe;
- EIT Urban Mobility: Smart, green and integrated transport;
- EIT Culture & Creativity: Transforming Europe's Cultural & Creative Sectors and Industries.

EIT manufacturing was established in 2019 with a vision that global manufacturing will continue to be led by Europe, contributing to make Europe and its manufacturing sector more



competitive and sustainable (EIT Manufacturing, 2023). The key stakeholders gathered in the EIT Manufacturing network are:

- Top-tier industrial partners
- Leading academic and research institutions from across regions
- Regional Innovation Schemes (RIS)
- Innovative start-ups and scaleups
- Innovative SMEs

Within these groups, the following specific stakeholders are identified:

Stakeholder Group	Specified
Entrepreneurs	Entrepreneurs, startup, scaleup
Businesses	Interested in the latest technologies, research and skills in manufacturing
SME	Looking to become more competitive
Researcher or Student	Researcher, students at BA, MA or PhD level

Table 10: Stakeholders targeted in the EIT Manufacturing KIC. Source EIT.

The EIT-Manufacturing KIC has four areas of activities (EIT Manufacturing website, 2023):

- Education
 - Running EIT labelled Master and PhD programmes and professional training to develop a high-value learning journey for students and professionals.
 - Reaching out to pupils, youngsters, society at large and other industries to create reciprocal awareness, attraction, and involvement in manufacturing by bringing information and knowledge to the general public.
 - Creating the infrastructures and learning experiences that enable individuals and organisations to network, skill, upskill and reskill within the Manufacturing Innovation Community. Offerings include short online units targeting the workforce and support for Teaching and Learning Factories.



- Innovation
 - Connect to the right partners within our ecosystem
 - Ensure adoption of innovations with manufacturers as end users
 - Improve market reach and robust scaleup
- Business Creation
 - Enable companies to grow quickly across Europe
 - Bring together the key manufacturing players
 - Commit to acting as strategic partner and investor
 - Facilitate deeper collaboration with EU institutions
- Regional Innovation Scheme (RIS)
 - Improve the innovation capacities of the local ecosystem via capacity building activities and closer interactions between local innovation actors (such as clusters, networks, regional public authorities, Higher Education Institutions (HEIs), research organisations, Vocational Education and Training (VET) institutions, or SMEs)
 - Help attract and facilitate the integration of potential new partners into the EIT KICs and link local innovation ecosystems to pan-European innovation ecosystems, including through the establishment of Co-Location Centres (CLCs) and RIS Hubs
 - Act as a bridge towards relevant Research and Innovation Smart Specialisation Strategies (RIS3s)
 - Leverage additional private and public funding, with particular attention to European Structural and Investment Funds (ESIF)

Tools within the EIT Manufacturing Knowledge Innovation Community:

Agora: The EIT Knowledge Innovation Community particularly targets entrepreneurs, start-ups, businesses, and scaleups launching a new manufacturing solution. The main tool offered for these target groups is the AGORA Digital Platform. It is a real-time collaboration tool, with an online networking and meeting place, acting as a 'one-stop-shop' for EITM news and teams (EIT Manufacturing, 2023).

Skills.move digital platform: The EIT Manufacturing community also works with SMEs looking to become more competitive by transforming operations, building new partnerships, and creating new models of customer collaboration. The main tool is the skills.move digital platform that helps the manufacturing industry to upskill and reskill its workforce by providing tailored learning experiences, thus avoiding big investments of time and money.



There are a few other research communities or open innovation communities that were found in the European context, but whose scope in terms of sector or stakeholders were not as relevant as the EIT's KICs. Noteworthy are:

Airbus Open Innovation Space, UK: A consortium of Airbus, KBR, Leidos UK, Northrop Grumman, and QinetiQ designed to bring new thinking to future space solutions. Open Innovation – Space will look to significantly raise SME engagement and accelerate regional recovery by broadening potential investment in novel solutions and ideas. More information available at: <https://securecommunications.airbus.com/en/landings/open-innovation-space>

Palfinger 21, WorldWide: Open Innovation within the Palfinger (an international technology and mechanical engineering company) sphere of influence. While this is not an Open Innovation as such, and is part of the Research and Development team within one business, the focus of the department is on open innovation. The areas of interest are: autonomous systems, alternative handling solutions, Palfinger as a service, and E3 (Emission Free, Efficiency and Electrification). More information available at: <https://www.palfinger.com/en/about-palfinger/palfinger-21st>

LGB Open Innovation in Science Centre, Flanders: As a centre, LGB conducts research on Open Innovation in Science, developing new OIS practices and offering OIS support services for researchers, organisations and projects. More information is available here: <https://ois.lbg.ac.at/>

Two examples of Open Innovation platforms which are often referenced in the European literature about innovation are Demola and High Tech Campus Eindhoven (Taken from the European Commission's Report: Open Innovation – A Vision for Europe, 2016. Available at: <http://www.openaccess.gr/sites/openaccess.gr/files/Openinnovation.pdf>).

The **Demola platform** (www.demola.net) is an international organization that facilitates co-creation projects between university students, companies and researchers, both locally and internationally. Demola is a co-creation concept that is geared to solving real challenges. Every project has an outcome – be it a new concept, a demo, or a prototype. If the partner company finds the outcome useful, the company can license or purchase the outcome, and take it for further development. Each partner has a clear role, and the work is guided by simple procedures. Contracts, intellectual property rights, licensing models, and other legal requirements are in place and meet international business standards and practices.

High Tech Campus Eindhoven (www.hightechcampus.com) in the Netherlands brings together more than 140 companies, startups, and institutes. Some 10,000 researchers, developers, and entrepreneurs are working on developing future technologies and products that





will affect the lives of billions of people. The ecosystem of open innovation helps Campus-based companies to accelerate innovation, by offering easy access to high tech facilities and international networks. Campus companies (including Philips, NXP, IBM and Intel) strategically decide what knowledge, skills, and R&D facilities they share in order to achieve faster, better, and more customer-oriented innovation in the fields of health, energy, and smart environments. High Tech Campus Eindhoven reports that Campus companies are responsible for nearly 40% of all Dutch patent applications.

Innovation campuses are a new phenomenon across Europe and their distinguishing characteristics are still ambiguous. An innovation campus can be defined as (Lowik, Alink, & Pulles, 2019):

a physical location on a large organization's premises, with high quality real estate and shared facilities, with the aim to actively foster open innovation practices among its residents

From this definition, it may be easy to see overlaps with the Innovation community or other regional innovation clusters. Indeed, the same authors summarise the key similarities and differences in these different innovation systems in the following table:



Dimension	Innovation community (open source)	Regional innovation cluster	Business & science park	Innovation campus	Incubator
Strong focal firm	√	X	0	√	√
Geographic proximity	X	0	√	√	√
Real estate orientation	X	0	√	√	√
Business development process orientation	X	0	0	√	√
(Shared) facilities	X	X	0	√	√
Active management	X	X	0	√	√
Knowledge diversity	√	√	√	0	√
Partner diversity	0	√	√	0	X

Table 1: Comparison of different innovation eco-systems. √ indicates that the dimension is present, 0 means that it is neutral, X indicates that it is absent.

Table 11: Innovation ecosystem comparison. Original source: (Lowik, Alink, & Pulles, 2019, p. 5)

In terms of partner diversity (the range of institutions involved from SMEs, start-ups, education and training institutes, and universities), regional clusters and business and science parks are much more diversified than open innovation communities or innovation campuses. However, Open Innovation Communities have greater knowledge diversity. As the authors mention:

since an innovation campus needs a clear identity and is centered around a focal firm, knowledge diversity is limited. Mostly, it is theme-driven, such as biotechnology, nanotechnology, chemistry, food & health. In contrast, business & science parks, regional innovation clusters and incubators can be more diverse.

While this table assumes a clear-cut differentiation between these innovation models, the reality may not be so distinguishable and little practical research exists on these campuses (ibid.).

Innovation Campus in Practice: GIANT, France Giant is an Alliance of eight French companies who are forging new links between higher education, research, and industry.



GIANT's approach to open innovation is built on diverse teams that include scientists, engineers, students, business developers, users, industrial R&D professionals, professors, and more. The overriding objective is to encourage co-creation across the innovation value chain. According to the GIANT-Grenoble website, 'Open innovation is a core component of GIANT's identity' (<https://www.giant-grenoble.org/en/innovation-collaborative>, 2023). In practice, each partner of GIANT has created their own spaces or methods to facilitate their open innovation. For example:

- Y.Spot, CEA's open innovation center, offers industrial R&D partners personalized product design and other services in line with their R&D strategies.
- A2I Grenoble INP offers a selection of training courses for a wide variety of learners on tech-related topics. The purpose is to facilitate cooperation to build the future of the industry.

GEM Labs develops and deploys its own unique teaching methods and can also offer custom-developed programs, specific use cases, and innovation barometers. MACI (located on the UGA main campus) supports new research, teaching, and partnership practices through social sciences and the arts. More information available here: <https://www.giant-grenoble.org/en/innovation-collaborative>

With this perspective in mind, Open Innovation Communities and Innovation Campuses may, in practice, share many similarities in the practical methodology and application of their findings.

4.1.5.5 *Wrap up*

'Community' generally describes groups of people (e.g., a town, a school) connected by a common interest who define their identities by the roles they play and the relationships they share in the group's activity. A community can exist over time despite a change of participants. It develops its own culture and communication methods as it matures. (Li, Grimshaw et. al. 2009). It is by no means a static construct.

The concept of community of practice is rather vague (perhaps purposefully so). It came into use in 1991 and its popularity has been growing since then. One reason behind the growing popularity is that many companies have become interested in it as an interesting knowledge management system. There are two main "academic" criticisms to the term:

- Birth: the term did not come as a result of a meticulous empirical study and its validity could be questioned since the very beginning.



- Vagueness and ambiguity: the use of the term has spread and there are many different uses of the concept as well as different concepts used to refer to similar things.

One of the creators of the concept, Etienne Wenger, in an interview where he was asked about the academic validity of the concept, answered (Omidvar & Kislov 2014):

I read that chapter in *Communities of Practice: Critical Perspectives* where Hughes (2007) makes that critique, that because of the variety of places where the concept has been adopted, it has become more and more academically useless as a concept because it means too many different things. I can see why an academic says that; and that's perhaps why I don't feel that I'm fully an academic, because I'm not so worried about that. For me, it's more like, "Does it make a difference in the world?" I'm a bit more interested in that than whether the concept is kept pure. The 1998 book was an academic book and it was critiqued by academics who wrote fairly critical reviews, in part saying: "this is just somebody's idea . . . "; "the empirical basis of this is very weak . . . "; "this is a guy who just spent a year in an office and wove a big theory that has thin anchoring in empirical facts . . ."—and I don't think that is an unfair critique, from that perspective. At that time, I was not so worried about those critiques because I was more interested in making a difference to people, like people in business who were adopting those ideas.

Be that as it may, the main takeaways are that:

- Learning is, especially when related with know-how and know who, a social process.
- Communities, as social structures, with shared practices, can foster learning and, thus, innovation.

Communities

Key messages

- Learning is a social process (especially in relation to know-how and know-who) and it occurs through involvement in communities (of practice).
- Communities of practice have been gaining more and more relevance as forms of inter- and intra-organisational learning.
- There are some potentially useful definitions, features, tools, and examples for building communities of practice.



4.1.6 Sixth Constituent: Collaborative space in the LCAMP Digital Platform

In this section we define the main features the open innovation community will need from the platform. We start by referring to what we agreed upon with regard to the platform in general and the online platform in particular. This occurred in two subsections of EXAM 4.0:

- On platforms. EXAM 4.0 recap.
- Online platforms. EXAM 4.0 recap.

The section closes summarising the key ideas in a wrap up.

4.1.6.1 *On platforms. EXAM 4.0 recap*

One of the goals of the LCAMP project is to create an online platform. Since their recognition as relevant economic players, platforms (especially online platforms) are an important topic for the European Commission (as well as other international organisations like the OECD, and national governments, regional governments, etc.). But what are online platforms? What is a platform in general? Our reflection about those issues started in the EXAM 4.0 project and continues in LCAMP with a concrete work package (WP8).

The meaning of the word “platform” is quite vague (Gillespie 2010). In general, we can find platforms:

- Online: on the internet. Most of us are users of more than one platform such as Youtube, Uber, Amazon, Facebook, etc. There are very different business models behind each platform, and the services they offer vary considerably.
- Offline: like the traditional city marketplaces. They gather buyers and sellers in a common place to facilitate contact.
- Hybrid: online and offline. Ecosystems (skills, entrepreneurship, innovation) are sometimes considered as platforms as well.

The Open Innovation Community we aim to define here, will collaborate and cooperate at both physical and online levels. At the physical face-to-face level, the open innovation community will be created inside the LCAMP alliance, as one of its internal communities, with a specific domain of work that will be defined in the synthetic part of this document. At online level, the community will be supported by a collaborative learning space within the online platform that will be created in work package 8.



There are several classifications of types of online platforms. The OECD (OECD 2019) differentiates between functional and structural typologies. But they recognise that “there simply is not one superior, one-size-fits-all way to categorise online platforms” (OECD 2019: 60). It may be impossible to find a satisfactory definition and typology of “online platform” because:

- Platforms could be studied from several disciplines like economics, sociology, informatics, history, etc. Each discipline tends to emphasize some aspects over others and give a rather biased vision of the term. They will provide satisfactory definitions in their fields, considering the focus on their research interest, but not satisfactory for all instances. For example, an economist may highlight the economic aspects of platforms, sociologists may be more concerned with their impact on society, philosophers with their ethical aspects, etc. All of them provide good information but are unsatisfactory when used outside of their fields.
- There is no such thing as a clearly defined research area on “platform studies”. Several people are engaging with the topic from different perspectives. It is an emerging field which is growing in extension and diversity. This means that the notion of “platform” will probably be enlarged to include things not considered up to now as platforms.
- The processes involved in platforms are complex and their structure is difficult to analyse. It is also difficult to differentiate the ontological question “what is X?” from other issues such as processes, services, users, or other aspects involved in platforms.

In EXAM 4.0, we agreed to follow the definition of the OECD (2019) and adapt it to our context so we begin with this definition (OECD 2019):

An online platform is a digital service that facilitates interactions between two or more distinct but interdependent sets of users (whether firms or individuals) who interact through the service via the internet.

From here we made some slight modifications to adapt the general definition of the OECD to the more specific aims of the EXAM 4.0 project:

PLATFORM of CoVEs in AM is a digital service that facilitates interactions between CoVEs and other agents of the Strategic Triangle in advanced manufacturing, who interact through the service via the Internet and these interactions do not involve economic gains for participants.

In LCAMP, as a scale up of the EXAM 4.0 project, we will stick to this definition and the (online) collaborative space for the open innovation community will be understood within these



constraints. But, in light of the previous discussion, we should already modify the reference to the “Strategic Triangle” because it is not completely in line with the systemic view of innovation described in the fourth constituent. We should clarify however that, with this definition, we are not aiming at any type of academic coherence or theoretical relevance. We rather need a valid and useful definition that serves our goals right now. This also means that we will be happy to revise and modify the definition at any moment:

Platforms of CoVEs in advanced manufacturing is a digital service that facilitates interactions between CoVEs and other actors who interact through the service via the internet and this interactions do not involve economic gains for participants.

Online platforms tend to have some features that make them special (European Commission 2016: 2):

- capacity to facilitate, and extract value, from direct interactions or transactions between users;
- ability to collect, use and process a large amount of personal and non-personal data in order to optimize, inter alia, the service and experience of each user. This data aggregation capacity (“economies of scope”) gives platforms an informational advantage over individual platform users and causes information asymmetry;
- capacity to build networks where any additional user will enhance the experience of all existing users -so-called “network effects”;
- ability to create and shape new markets into more efficient arrangements that bring benefits to users but may also disrupt traditional ones. The ability to organise new forms of civil participation based on collecting, processing, altering and editing information; and
- reliance on information technology as the means to achieve all of the above.

In platforms, users generate most of the value. There is a huge difference between traditional business models, where theoretically a supplier generates the value and the client buys it¹⁹, and platforms, where users create value for other users. (European Commission 2016: 4). When we talk about “value creation”, we should understand it in very general and abstract terms. Not necessarily meaning the provision of a service, product, etc. Platforms create what some economists call “network effects”, “the effect that one user of a good or service has on the value of that product to other people”. (European Commission 2016: 4). For example, the presence of more traders at an online marketplace increases the value of the online marketplace for shoppers. In that way, individual stores benefit indirectly by the addition of other stores due to

¹⁹ We know that this is not exactly so and there are a lot of studies on user innovation that contradict this traditional way of conceiving a business.



increased website traffic. This process is also reciprocal: the presence of more shoppers increases the value of joining for sellers. Consequently, shoppers benefit indirectly from the interest of other shoppers in the marketplace as the increased number of potential customers attracts more sellers resulting in wider choice for each shopper. Similarly, the presence of a wide selection of hotels on a travel marketplace, for example, attracts more accommodation seekers to the platform. This then increases the value of the platform for hotels and leads to even more hotels joining, thereby resulting in higher customer interest. (European Commission 2016: 4). Taking all this into account, it is clear that a platform needs a critical mass of users to survive.

The success in attracting users depends a lot on the platform's matching mechanisms: the efficiency of matching mechanisms determines to a great extent the benefits users obtain from the platform. All users should be able to find what they are looking for. Online platforms usually create an environment for interaction and offer its users matching mechanisms to find what they want. However, many platforms are not responsible for the quality of the services they offer. To minimise the risk, platforms create a kind of risk management through internal regulation "self-regulation based on community codes of conduct, user reviews, ex-ante control of suppliers' credentials, dispute resolution, insurance schemes, etc" (European Commission 2016: 7). Some platforms go further and "have already voluntarily put in place some proactive measures which go beyond their legal obligations. Measures range from (European Commission 2016: 7):

- various filtering technologies (e.g. PhotoDNA hashic technology for child abuse content or fingerprinting technology for music files in course of upload, with their own tools such as Youtube's ContentID or with commercial solutions such as Audible Magic),
- blocking (e.g. URL blocking based on black-list of Internet Watch Foundation),
- moderation of content by algorithms, staff or community (e.g. manual checking of algorithmically flagged comments in the discussion forums),
- enforcement of termination policy (e.g. toward users who repeatedly infringed rights),
- implementation of terms of service or of community guidelines (e.g. quality standards for customers),
- improved notice submission systems (e.g. by establishing "trusted flaggers" or by allowing direct removal of counterfeiting efforts).

Platforms are also becoming drivers of innovation. This type of "user innovation" has been analysed by some authors (Von Hippel 2005).

4.1.6.3 Collaborative space in the LCAMP platform: wrap up



Online collaborative spaces are common and they have been used both to support the work of communities or to host entire communities which do not have any physical entity. They are a cost efficient and comfortable way of interacting with other community members. The next part of the document, the synthesis, will specify what we expect from a collaborative space.



4.1.7 Seventh Constituent: Model

Model is the last element of analysis of the first part of the document. We are supposed to create an Open innovation community model. So, what is a model anyway? Models can refer to a representation of a specific thing under study or to a specific way or doing something. In this section, we discuss these two types of models, referred to as “scientific” and “managerial” models respectively. Whether we are thinking about scientific or managerial models, there is an immense number of models available for review and study. As we will see, the most relevant for our goals is the second. We will also share examples of such models to facilitate understanding. The discussion is organised in two subsections:

- Scientific models.
- Managerial models.

The section closes summarising the key ideas in a wrap up.

4.1.7.1 *Scientific Models*

Models are important in the natural and social sciences. Scientists devote a lot of effort to designing, developing, testing, interpreting, discussing, supporting, or arguing against various models (Frigg and Stephan 2020). We can find models in physics, chemistry, biology, economics, or sociology to name just a few disciplines. In general, we can understand models as representations, normally simplified representations, of the part (or parts) of the world under study.

In this sense, the first distinction we can draw is that between physical models, like Watson and Crick’s metal model of DNA or a miniature scale-model of a Ferrari Testarossa, or abstract objects in the minds of scientists, like Bohr’s atom model. Frigg and Stephan (2020) distinguish seven types of models:

- scale models: bigger or smaller copies of what they represent. These types of models are never completely faithful to their referent. For example, a scale-model of a car or an anatomic model of a skeleton, can be very good at copying the shape, the appearance, and the colour of the real object, but not so useful when it comes to the constituting material.
- analogical models: based on a similarity or analogy between the model and the part of the world they represent. Two examples can be a billiard model of gas or a hydraulic model to explain an economic system.



- idealised models: models that simplify the features of their referent to facilitate understanding. Examples of these type of models can be frictionless planes in physics, or markets in perfect equilibrium in economics.
- toy models: models that simplify so much and that they only take into account some causal connections, not all of them. An example of such a model is the Lotka Volterra model in population ecology.
- minimal models: highly simplified models or highly idealised models.
- phenomenological models: Frigg and Stephan (2021) distinguish two types of phenomenological models:
 - Phenomenological models that only represent observable properties and avoid including any hidden properties.
 - Phenomenological models that are independent of theories.
- Exploratory models: models that are useful as a beginning to further explore and to continue refining the model in several iterations.
- models of data: usually provided as an idealised model of raw data.

Models have interesting epistemological functions because they help us to learn about the world, but we will not delve deeper in this analysis because these are not the type of models we are looking for.

4.1.7.2 *Managerial Models*

Another sense of the word model can refer to a way of doing something, like business models, management models, marketing models, etc. These models go further than describing how a part of the world under study works by trying to say how something will work, and they define objectives, activities, vision, mission, revenue streams, and similar elements.

As a matter of fact, if we consider a business model, we will see that their main aim is to define a strategy (or plan) about how an organisation will make money (or create value in general). It is usually practice-oriented and it can be accompanied by specific tools and templates that make the application of the model to our own specific case notably easier. One such tool can be the business model Canvas, which concentrates in a one-page table all the relevant elements of the business:



Key partners	Key activities	Value proposition	Customer relationship	Customer segment
	Key resources		Channels	
Cost structure			Revenue streams	

Table 12: Business Model Canvas. Source: Ostwalder and Pigneur 2011.

There are some differences between the “models as representation of a part of the world being studied” (scientific models) and “models as specific ways of doing something” (managerial models).

Aspect of comparison	Scientific models	Managerial models
Assumptions	They are underpinned by a set of usually unstated assumptions	They are underpinned by a set of usually unstated assumptions
Aim	They are aimed at improving our knowledge or at being able	They are aimed at achieving something, be it efficient



	to explain some complex aspects of the world	management, more happiness in the company, a successful business, improving sales, etc.
Generality	They aim at becoming standards that are shared by a whole scientific community. Ideally there should only be one model	There are a lot of variants of models and they function as tools with which each user should work, adapt to its needs, and find the most suitable solution. For example, if we take a business model: a) there are different models of business models; and b) each entrepreneur will write a different business model, even if they are using the same model of business model.
Validity	They are valid as long as they are epistemologically useful	They are valid as long as they contribute to achieving specific aims.

Table 13: Types of models.

In LCAMP we are looking for a model, or better yet, we are looking at defining our own model in this second sense of “model as a way of doing something” or what we have come to call the “managerial model”.



4.1.7.3 Models: wrap up

In LCAMP, we are pursuing a model to define our main approach to innovation and create value at the regional level by being internationally connected. Whatever it might be, this type of model falls under what we have decided to call “managerial model”.

Models

Key messages

- There are two types of models:
 - Scientific models are aimed at knowledge and they usually consist of representations of a part of the world under study.
 - Managerial models are prospective and define how something will work by establishing objectives, vision, mission, and similar planning concepts. They also provide tools to facilitate their use.
- Since we are not seeking to know a specific part of the world, in LCAMP we refer to model in the second sense.



4.1.8 Summary of the analysis

Our analysis began contextualising the LCAMP project in terms of the European initiative for centres of vocational excellence, an initiative seeking to modernize VET systems in Europe that supports a model of multifunctional VET which collaborates with other actors at regional level and connects with similar centres at the international level through platforms. Centres of vocational excellence are part of the skills, innovation, and entrepreneurial systems in each region and connect with other centres of vocational excellence. The aim is to learn with each other, to improve the local by supporting each other internationally. In this sense, we have pointed out that LCAMP has a solid strategy based on principles, a shared vision and mission, a set of core values, and a series of fields of activity to create such an international alliance. The innovation community described in this document is part of the deployment of LCAMP's strategy.

We have seen that SMEs are important for the European economy and that they need to innovate. VET centres and SMEs should both innovate in digitalisation, organisational practices, and cutting-edge manufacturing technology implementation. Both need to modernise. We have suggested that, theoretically, there are arguments to consider a potential virtuous relationship between VET and SMEs to promote SME innovation and that, empirically, there are cases where we can find such a virtuous relationship, as is the case with applied research in Canadian colleges.

Then we have moved to analyse advanced manufacturing and we argued that it can be reinterpreted under the new European Commission's paradigm of Industry 5.0. We also argued that VET centres can fall under the same paradigm, and we described two tools to assist VET centres and SMEs working in manufacturing to make an "industry 5.0 transition": the collaborative learning factory and ADMA.

After that we have analysed innovation and concluded that innovation is the result of learning interactions between various actors in systems (local, regional, national) and that there are European policies to support innovation, such as the S3, in which VET should have a bigger role than the one it has now. We also inferred that the role of the innovator and the role of the entrepreneur are similar, and that in this sense, innovation and entrepreneurship support go hand-by-hand.

As learning is mostly a social process, especially with the types of knowledge which are more difficult to codify (know-how and know-who), building a community makes sense. Communities of practice have been researched since the 1990s and they have proven to be valuable for learning. This community will be defined in the next part of the book and will be supported by a digital tool in the platform LCAMP aims to create.



We have finalised by clarifying the sense in which we are employing the word “model” when we talk about an open innovation community model. This model, we have said, is a “managerial style” model.

The synthetic part of the document will explore how all these elements can come together into a community.



5 SYNTHETIC PART

After having analysed the main constituents of the LCAMP Open Innovation Community, we are ready to put them together in a model on innovation that can organise, hopefully in a successful way, the work of a community within the LCAMP alliance. If we draw an analogy with a food recipe, we have described the ingredients, and now we will move to the preparation. The next phase will be the test: between June 2023 and December 2025 we will carry out some projects within the community to see if it works.

Two sections make up this part: the community and the collaboration tool in the platform. The first one, based on the Community of Practices Playbook, will describe the main elements of our community. The second, the features we need from our collaborative space in the platform.



5.1.1 The community

In this subsection we follow JRCs playbook (Catana et. al. 2021) to define the main elements of our community. We will also make some references to Etienne Wenger-Trayner's work as the pioneer in the topic. Structure-wise, the section is composed of the subsections defined in the wheel of the playbook.

5.1.1.1 Features of the community

Communities of practice are groups of people who share a concern or a passion for something they do and learn how to do it better as they interact regularly (Wenger-Trayner, 2015: 2). Our Open innovation community is then:

A group of people who share a passion for technological innovation in line with the LCAMP collaborative learning factory model and the ADMA model and we aim to learn how to do it better as we interact regularly.

The LCAMP open innovation community is a social configuration which shares the enterprise of supporting and undergoing the Industry 5.0 transition, and the participation of members in the transition will be recognised as competence (Wenger 1998). Our community has the three characteristics of community coherence defined by Wenger (1998):

- Domain (joint enterprise): Joint enterprise as a result of a collective negotiation process. Having a joint enterprise should not be understood as agreement between community members. “the enterprise is joint not in that everybody believes the same thing or agrees with everything, but in that it is communally negotiated” (Wenger 1998: 79).
- Mutual engagement: the members of the LCAMP open innovation community are engaged in similar activities related to the collaborative learning factory and to ADMA, and there are relations of mutual engagement around these actions. Mutual engagement implies that community members are limited and complement each other and the contributions of each member.
- Practice: Members of the community of practice do not only share a common domain, but they are involved in a practice, they are practitioners. Some of the practices the open community will share are (Wenger-Trayner 2015):
 - Problem solving: every member will have the opportunity to request help from other community members, and other members will have the ethical responsibility of answering. This will give rise to shared projects, in some cases.



- Requests for information: members can contact other members to request information. Questions such as “how did you do X?” “I am having this problem; did you also experience it?”
- Seeking experience: members can get in contact with other community partners who have already done what they are trying to do, building on experience and avoiding repeating the same mistakes.
- Reusing assets: whenever a community member has developed something that can be useful for other members, they can share it.
- Coordination and synergy: community members can act together to get better prices when purchasing technologies, organise joint training, hiring experts only once for everyone, etc.
- Growing confidence: before trying something, members can share their ideas with the community and ask for advice.
- Discussing developments: community members can discuss and share their opinions about new software, specific machinery suppliers, etc. Questions like “what do you think about the new X-machine? Has anyone used it?”
- Documenting projects: the community can identify common errors and codify them in writing to share this knowledge for everyone, something like “after our experience in trying to do X in various ways, following methods Z and Y and using tools S and T, we conclude that it does not work”. This is knowledge generation at its best.
- Organising visits: this provides opportunities to learn together, building capacity collectively and collaboratively.
- Identifying (and maybe even addressing) competence gaps: Addressing questions like “we are missing knowledge to do X, can we contact someone who knows how to do it? Can someone teach us? Can we get involved in a project where this knowledge will be developed? Can we define a research project to generate this new knowledge and then share it with the rest of the alliance and with the rest of the world?”
- Shared repertoire: The third characteristic of community coherence is the development of a shared repertoire. “The repertoire of a community of practice includes routines, words, tools, ways of doing things, stories, gestures, symbols, genres, actions, or concepts that the community has produced or adopted in the course of its existence, and which have become part of its practice” (Wenger 1998:83). This will be developed as the community evolves.



5.1.1.2 The community of practice success wheel

In this subsection we follow JRCs playbook (Catana et. al. 2021) to define the main elements of our community. We will not follow it blindly because we find it rather artificial. It is hard for us to believe that any endeavour following a too systematic process will ever succeed. The document, though, provides useful guidance on the main issues to be addressed when defining a community.

The aim of the LCAMP open innovation community is to help VET centres and SMEs to innovate in manufacturing. As we have established when discussing advanced manufacturing in the analytic part, the common innovation challenge is the transition to Industry 5.0 in VET and in companies working in manufacturing sectors. There are two key elements to address: The collaborative learning factory model and the ADMA model.

But having a collaborative learning factory and the ADMA model does not in itself solve the innovation challenge of VET centres and SMEs. Implementing any of them is rather complex, and no matter how hard we try, there will always be obstacles. The aim of this community is to offer support to any VET centre or SME experimenting difficulties in the process, through a community of actors who share the common goal of either undergoing the transition to industry 5.0 or supporting other actors in the transition.

The community plays a vital role for the success of the LCAMP project because it combines other work packages and creates an appropriate learning interaction space to support mutual learning. It is difficult to envision a successful LCAMP project and alliance without the community.

This type of “informal” interaction works well in the sector (manufacturing) and with the actors involved (VET centres and SMEs). Innovation is related to what Pavitt calls a “knowledge base” of the company. In manufacturing we find what he and other authors refer to as “synthetic knowledge”:

A synthetic knowledge base prevails in industrial settings where innovation takes place mainly through the application or novel combination of existing knowledge. Often this occurs in response to the need to solve specific problems arising in the interaction with clients and suppliers. Industry examples include specialized industrial machinery, plant engineering, and shipbuilding. R&D is in general less important than in other sectors of the economy. When it occurs, it tends to take the form of applied research, but more often it involves incremental product or process development related to the solution of specific problems presented by customers. (...) Knowledge embodied in the respective technical solution or engineering work is at least partially codified. However, tacit knowledge seems to be more



important than in other types of activity, due to the fact that knowledge often results from experience gained at the workplace, and through learning by doing, using, and interacting. Compared to the second knowledge type (“analytical”) (...), more concrete know-how, craft and practical skill is required in the knowledge production and circulation process. These forms of knowledge are often provided by professional and polytechnical schools, or by on-the-job training. (Asheim and Gertler 2016: 295)

In this sense, we have strong reasons to think that VET centres and SMEs can work together in the Industry 5.0 transition and this is exactly what we envision or what we would like to happen with this community: VET centres and SMEs working together to support VET centres and SMEs transitioning to Industry 5.0. Interesting interactions can happen in terms of know-how about technology implementation, skills provision, and strengthening the networks. It is, as we see it, the ultimate realisation of the platforms of centres of vocational excellence as summarised in the motto “think global, act local”.

In the spirit of the initiative, LCAMP encourages manufacturing VET centres and SMEs to join our alliance, to implement the collaborative learning factory model, and to become ADMA TranS4MEs, but at the same time we offer them the option to support and be supported by others in the implementation of technologies through this community. The community is international, the projects are implemented at local level.

As a community of practitioners inside the LCAMP Alliance, we will be connected to other groups (or communities) of the alliance. The alliance will have a group working on technology and skills trends in what we have called the LCAMP Observatory, which corresponds to work package 3 of the project. There is also a group working on skill profiles for jobs, micro credentials, course databases, and development of new courses through work package 5. A group is working on the design and piloting of collaborative learning factories, within work package 6. Another group is working on ADMA for work package 7. Finally, a group is developing the digital platform, for work package 8. This is the internal environment in which the open innovation community will operate. The types of organisations working in the aforementioned groups are VET centres, universities, SMEs, company associations, research centres, IT developers, and an international network of regional and local governments.

Outside the alliance, the community will work affiliated organisation at local, regional or national levels. It is important to note, though, that these external relationships are organized and controlled by each member. The community will consist of members working with members, and then the members will work in their systems. Both things should be kept separate. A member can expect to find community support or to develop joint projects to tackle an issue coming from one of its technology implementations in its local, regional, or national system, but that member's



external partners will not enter the community. The communication will happen through the member.

In terms of membership, as a community inside the alliance, potentially all alliance members will have the opportunity of being open innovation community members as well. The only requirement will be:

Open Innovation Community members of the LCAMP Alliance must be about to implement, implementing, or have already finished an implementation, of technologies in line with the collaborative learning factory or ADMA models. We only want practitioners which can support other practitioners.

This means that we are not concerned about the type of partner, which can be: a VET centre, a university of applied sciences, a university, a technology centre, a company, an association, an individual engineer, a scientist, etc. Any LCAMP alliance member will be welcome to join the community as long as she is involved in technology implementation.

Principle 7 of the Strategy of the LCAMP Alliance states that we have a broad conception of technology and knowledge. We claimed that technology will mean for us (Bijker 1995):

- The knowledge required to handle a specific technology or artifact, or group of technologies or artifacts.
- The artifacts themselves, such as a computer, a robot, or a pencil.
- The reflection about the previous two, as in reflecting about I4.0, I5.0, digitalisation or advanced manufacturing.

In the case of the open innovation community, we are choosing only the first and the second potential meanings of technology. Community membership is about the knowledge needed to handle (implement, use, exploit, share, etc.) technologies and about the artifacts themselves. The community is not the place for the third meaning (reflection), which will find its place in the alliance generally, as well as in the observatory of trends and the work related to skills.

Other than that, we can only say that Open innovation community membership will be defined as a subset of LCAMP alliance membership. This membership will be rather informal, in the sense that we will not have a list of alliance members who are also open innovation community members, and varying over time, meaning that an organisation being an open innovation community member does not mean that it will become a member forever.

In terms of governance of community members, there should be a core group formed by three key coordinators (that as members of the community must also be practitioners



themselves). We can say that the community will be composed by three governance committees:

- The **collaborative learning factory committee**, coordinated by a leader of the collaborative learning factory model. During the project lifetime, until June 2026, this can be done by the leader of the corresponding work package: Miguel Altuna VET centre in the Basque Country.
- The **ADMA committee**, coordinated by a leader of ADMA. During the project lifetime, until June 2026, this can be done by the leader of the corresponding work package: AFM cluster in the Basque Country or AFIL in Italy.
- The **cohesion committee**, led by an organisation involved in ADMA and in the collaborative learning factory, which has a general interest in the success of the community. During the project lifetime, until June 2026, this can be done by the leader of the fourth work package: Tknika in the Basque Country.

These committees will have their internal working dynamics, very closely related to the corresponding work packages during the project lifetime and following their own rhythm after the end of the co-funding of the European Union. The cohesion committee leader will call a meeting every two months to talk to each other and to share the advances, pains, and successes of each committee. Once every year, on occasion of the LCAMP annual conference they will have a slot in the plenary to share whatever they deem appropriate and they will have a face-to-face meeting. The meeting agenda will be agreed by the three leaders of the three committees.

Twice every year, one virtually and the other one coinciding with the annual LCAMP conference, the community will meet with the rest of the groups (the observatory and the group working on skills) to track mutual progress. As many community members will be part of the other groups as well, these meetings will be held in a friendly and trustworthy atmosphere.

The core group of members who will steer the community will be the three committee representatives.

Convening consists of keeping members engaged in the discussion. As commented above, the JRC distinguishes three phases or stages in the lifecycle of a community of practice. We will assume that we, as new founded community, are in the first stage (Catana et. al. 2021: 61-67): an emerging community, which is still hub like community. In this stage communities need to discuss and communicate a lot and the community manager will have to act as a catalyst.

The convening effort will fall on the shoulders of the cohesion committee. At the beginning they will have to call meetings, to run tours the table, introduce new members and come up with



interesting facilitating techniques that allow for community building. The 3 c's of conversation, communication and connection are important for convening.

The community manager will either be the cohesion committee leader or any other person from the cohesion committee who is good at facilitating. The main role of the community manager will be to organise meetings, events, or whatever is necessary. Considering that it is a community which has collaborative learning factory and ADMA (from a technological point of view) as its domain of practices, it is compulsory for the community manager to be well versed in technological matters. It is important as well that the community manager is a good communicator. The LCAMP alliance has chosen English as its communication language, so, the community manager should have a good level of written as well as spoken English.

LCAMP open innovation community is ran by its members for its members. This means that the satisfaction of the members with the community must be high. Most likely, as the work of the community evolves, members' needs will also evolve. It will be important that they are able to meet them through various activities.

Measurement refers to the degree in which the community is achieving its objectives. The objectives of the community are related to new technology implementation through the collaborative learning factory and through ADMA, and can be quantitatively and qualitatively measured. During the project lifetime, the indicators are set by the project, as specified in the Detailed project description submitted to the European Commission in September 2021.

After the end of the project in 2026, the community will decide how, what, who, and how often they will measure. Without doubt, the experience during the project will be very valuable for the community to build a strong base from which it will continue working after the end of the cofounding of the European Union.

5.1.1.3 The collaborative space in the LCAMP platform

The open innovation community will need a collaborative space that fits its needs within the platform. The features of the space will, therefore, result from the needs of the community. There are, then, two questions to answer: what does the open innovation community need? What features can meet these needs?

From what we have said in the previous subsection, we can infer that community members will need to communicate both by written and orally; to launch open questions to the whole group; to share documents, pictures, videos or any other type or archive; and to measure the progress of their activities. And the features that can meet these needs can be the following:



- The need to communicate both by written and orally can be met by means of a forum, that can be organised by topics according to the needs of the members, and a videoconferencing option, that can be used to have spontaneous meetings between two, three or several open innovation community members or to organise whole group, more “formal”, meetings.
- The need to launch open questions can be addressed by a forum.
- The file sharing need can be met by means of a document sharing functionality.
- The measuring and monitoring need can be tackled by means of a business intelligence style tool.



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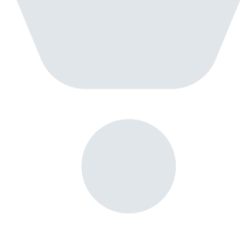
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10 ANNEXES

10.1.1 Composition of the LCAMP partnership

LCAMP brings together organisations with the expertise and competences needed to achieve the goals of the Alliance as laid out in this strategy. We have applied the following partner selection criteria to ensure that the best possible partnership is drawn:

- In-depth knowledge and expertise in the field of VET training design and delivery, skills intelligence, AM business understanding, development and use of training validation and recognition tools and EU-level training, education and employment policies,
- Complementarities with other partners: companies, VET/HVET providers, European networks, regional associations, governments, industrial associations and R&D centres.
- Accessibility to users (students and adult learners),
- Well established company partnerships,
- Organisational and financial capabilities, culture of innovation,
- Motivation, commitment and skills of staff involved,
- Experience of EU-level cooperation,
- Location and geographic coverage. LCAMP involves south European, Central European, North European and Eastern countries. It also involves Turkish partners and a Canadian partner. This ensures the geographical coverage of the partnership,
- Upward convergence by involving more developed and less developed regions.,
- Previous experience of working together at EU and national levels.

Under this light, LCAMP involves 18 partners from 8 EU member states, 2 partners from non-EU Member States, 1 Affiliate Partner, and 60 Associated Partners from all around the world.

In terms of complementarities, LCAMP brings together all the key stakeholders:

VET/HVET centres

- Curt Nicolin Gymnasiet (Sweden)
- DHBW (Germany)
- CMQ (France)
- Miguel Altuna (Spain)
- Da Vinci College (Netherlands)



- MADE competence center (Italy)
- TSCMB (Slovenia)
- GEBKIM (Turkey)
- Camosun College (Canada)

The institutions provide work-based learning and dual studies to about 50.000 students. Together they are partnering with more than 20.000 companies in their region.

Regional education bodies:

- Skupnost VSS (Slovenia)
- KPDoNE (Turkey)

The network will be engaged in the testing and development of new collaborations learning factories (CLF), how to implement the CLF model, and how to improve training provision of I4.0 technologies.

Companies:

- Simumatik (Sweden)
- KIC (Malta)
- FORCAM (Germany)

Together with other associated partners they build the network of IT experts and provide the IT solutions. KIC and his network is responsible for the platform development (WP9), the data management and building the six suites, the home-base of all services, data and tools for the different stakeholder groups.

Associations of companies:

- Mecanic Vallée (France)
- AFM (Spain)
- AFIL (Italy)
- GEBKIM Organized Industrial Zone (Turkey)

The associations represent 1000 Advanced Manufacturing companies in their regions. They will support the consortium in the surveys and provide sector-specific information and benchmarks in Industry 4.0.

European networks:

- EARLALL (based in Belgium)



EARLALL is comprised of 12 regional authorities which represent thousands of VET/HVET students in Europe and, in general, project partners are connected to large networks. This European-wide, even world-wide, connection brings high potential for impact in a great number of countries and various multiplier tools as far as dissemination is concerned.

R&D centres:

- TKNIKA (Spain)
- INVEMA (Spain)

TKNIKA carries out support services for Basque VET centres and coordinates entrepreneurial programmes, and company consultancy programmes in the Basque Country. TKNIKA is carrying out projects in fields related to Industry 4.0.

The variety of the partnership covers the whole Strategic Triangle of AM and VET/HVET.

Associate Partners

are partners that do not receive funding under the project but will still form part of the LCAMP Alliance. These partners are clustered in three main clusters:

- Teaching and learning: VET/HVET centres,
- Cooperation and partnerships: Companies, Associations of companies, R&D centres., and
- Governance and funding: Regional education bodies, Associations of companies, European networks

Descriptions

TKNIKA

TKNIKA is organically attached to the Vice ministry of VET. Department of Education of the Basque Government. Its nature is to provide applied research and innovation services and support to the VET centres and companies. To fulfil its functions, TKNIKA is structured in six areas: 1) technological innovation and innovation systems, 2) complexity management, 3) learning and high performance, 4) internationalisation, 5) applied innovation in strategic settings, 6) biosciences and sustainability.

CIFP Miguel Altuna

Public VETcentre created in 1928 whose activities involve IVET, CVET and applied innovation. Currently there are around 550 students and 84 staff members. Training activities are carried out in collaboration with industrial partners with more than 150 agreements related to WBL and



internships, innovation, collaborative projects, technical services, validation of trainings, and continuous training of workers.

AFM

The Spanish Advanced Manufacturing Cluster comprises: the Association of Manufacturers of Machine Tools (representing 90% of machine tool and advanced manufacturing technology companies in Spain), the association for industrial 3D printing and Additive Manufacturing, the association for metal cutting, forming and machining companies and the association for start-ups and new technology-based companies supporting the Advanced Manufacturing Industry. AFM comprises more than 450 companies plus 70 partners, represents more than 16.500 direct employees and a turnover more than 3.000 million €. AFM provides different services: International Promotion (Trade Shows, Missions, and Events), Technology, Industrial Safety, Environmental Issues, Quality Management, Fostering Cooperation, Institutional Relations, Training and Education, Studies and Statistics, Advice, Marketing and Communication.

INVEMA (technological unit of AFM cluster)

An active player in the European R&D&I ecosystem, INVEMA has participated in FP7 and Horizon programmes, has collaborated with major R&D centres (Fraunhofer, IMR, Polimi, Sirris, RISE, Profactor, SVUM, etc.). INVEMA belongs to CECIMO, the European Committee for Cooperation in the Machine Tool Industry. INVEMA promotes cooperation between international technology companies and networks through the organization of “Technical Missions”. Besides, INVEMA organizes various events related to technology transfer: congresses, seminars on BIEMH congresses, technical seminars and Webinars along the year. INVEMA has a deep knowledge of the main manufacturing actors.

DUALLE HOCHSCHULE BADEN WÜRTTEMBERG

Duale Hochschule Baden-Württemberg – DHBW (Baden-Wuerttemberg Cooperative State University) is the first higher education institution in Germany to integrate academic studies with workplace training within the curriculum. With around 34,000 enrolled students, over 9,000 partner companies and more than 145,000 graduates, DHBW is one of the largest HE institutions in the German Federal State of Baden-Württemberg. The success of the DHBW started with elevating Vocational Education and Training to the Higher Education level. All three schools of DHBW (Business, Engineering and Social Work) offer a broad range of accredited undergraduate and postgraduate programmes. With an increasingly international curriculum, DHBW promotes cooperation with companies, social institutions and universities all over the world.



FORCAM

FORCAM is one of the world's leading solution providers in the field of manufacturing control and optimization. More than 15 years ago, FORCAM brought the first Manufacturing Execution System (MES) to market maturity and has consistently developed since then. The MES is used by many companies. With the further development of the MES into an IIoT platform, a wide range of industries can now benefit from flexible machine connectivity and data analysis. FORCAM has developed initial principles and solution modules within research projects: "Innovations Allianz Green Car body Technologies" with the topic "Development of an energy management portal and components of an energy-sensitive production control system", "DaTeProMes" with the topic "MES Energy Dashboard for energy-optimized production controlling", In SmARPro - SmARt Assistance for Humans in Production Systems, basic components for process optimization were developed.

Association campus des métiers et des qualifications industrie du futur CMQE

CMQE brings together a network of secondary and higher education establishments, initial training centres (schools and apprenticeships) and continuing vocational training centres in the Lot and Aveyron for the fields of activity linked to Industry 4.0. The mission of the Campus is to provide solutions to the recruitment problems faced by the mechanical industries in the area, in terms of human resources and skills. The actions of the Campus are based on the following areas of work: a) Developing the attractiveness of training and the sector; b) Supporting companies in the digital transition, c) Adapting the training offer to the needs of companies, d) Training for the professions of tomorrow. CMQE aims to adapt training courses and create new training courses in line with the development of skills required by companies. It is involved in the creation of new professional licences, particularly in the field of the maintenance 4.0 and in the development of training courses for employees or job seekers. The setting up of complementary local initiative training, linked to new technologies, is also an important activity of the CMQ.

Mecanic Vallée

Is a cluster of manufacturers and federates an interregional network of prime manufacturers and subcontractors in the mechanical sector, on 3 major topics: aeronautics, spare parts for automotive, and machines tools. Founded and recognized as Cluster since 1998, once again One of the Best among French Clusters in 2010, "Mecanic Vallée" counted in 2021, 200 members, namely 160 companies and 40 organisms working on economic development or training (technological institutes, professional high school).



ROC DaVinci College

ROC Zuid - Holland - Zuid / Da Vinci College offers IVET and CVET programmes in Economics, Engineering and Technology, Information Technology, Health Care and Social Services. Trying to respond to the needs of society & the labour market DVC supports international activities, like mobility for students and staff, to help them to get prepared for / work at the international labour market and to be a responsible and contributing citizen. DVC has been cooperating with companies and institutions all over Europa for a long period. DVC received the 'Innovative VET provider Award' during the VET skills week 2018.

KIC

The Knowledge Innovation Centre (KIC) is a niche research and consultancy organisation with a mission to transform the ways we learn and work to give the opportunity to every person to reach their full potential. We take a systemic approach to change, focusing on improving education & skills policies and practices globally, via cooperation with governments, international organisations, universities and civil society. KIC is a global leader in the field of digital and micro-credentialing. The company was instrumental in the formulation of the European Union (EU) Approach to micro-credentials and designed the European Digital Credentials Infrastructure. We are active in the Europass and EQF Advisory Groups, the W3C Verifiable Credentials User Group and the European Blockchain Partnership. We have researched issues around unbundling and digital credentialing for well over ten years and assist clients with implementing business processes for micro-credentialing, as well as implementing technologies for digital credentialing across a variety of standards.

MADE

MADE is one of the Italian Competence Centers, acknowledged by Industria 4.0 National Plan. It aims at providing test and demonstration environment for Industry 4.0 in Italy. The MADE mission is to lead digital and sustainable transformation of companies applying oriented research and transfer of Industry 4.0 as well as to create an ecosystem. MADE provides a set of knowledge, methods, technical and managerial skills on digital technologies to support companies in their digital transformation towards Industry 4.0. In the large demo-center of over 2000 m², it provides an I4.0 – based pilot production facility for pioneering test, demonstration and development project realization. MADE is deploying Teaching Factory providers a real-life environment for students and research engineers to develop their skills and comprehend the challenges involved in everyday industrial practical methodologies to support reskilling of existing forces and upskilling of new jobs.



Associazione Fabbrica Intelligente Lombardia AFIL

AFIL is an Italian private non-profit association, recognized by Lombardy Region as the regional technological cluster for Advanced Manufacturing. AFIL is the outcome of a Lombardy-Region-led, process aiming to set-up a network of clusters interested in carrying out, at national and at international level, an integrated and sustainable system of infrastructures, competences and methodologies supporting research and innovation. It represents a network of companies, universities, public or private research institutions and entities (including financial ones) operating in the field of the intelligent factory (Advanced Manufacturing). AFIL operates as the private part of a public-private network with Regione Lombardia dedicated to advanced manufacturing and its members are located in different territorial areas and focused on specific application fields. The cluster aims at promoting and facilitating research and innovation as regards to best practices and enabling technologies for the manufacturing sector in order to support and develop the Lombard production system's leadership and competitiveness.

EARLALL

An international non-profit association registered in Belgium and established in 2001 under the initiative of regional authorities willing to build a solid cooperation in the field of lifelong learning. EARLALL counts on 12 full member regions, as well as on a group of observers (integrated by universities, public institutions, and sector-related entities), which represent over 100 million people across Europe. EARLALL's goals are cooperation and attention to raising the role and visibility of regional and local authorities in the field of lifelong learning at European and international level. EARLALL, with regional and local authorities from all around Europe as engaged and committed members, makes a natural dissemination partner and a one-of-a-kind platform for searching and sharing best practices. Given the associative nature of the organisation, the most sought activities among its members and other regional authorities are dissemination of project results, the share of best practices, and the update on policy measures.

Kocaeli Provincial Directorate of National Education

A public body supervising educational institutions and schools on behalf of Ministry of National Education in charge of all activities related to education and 72 VET centres. It supports principals, teachers and other staff with variety of in-service courses. It collaborates and co-operates with the other directorates and institutions in Kocaeli, in many National and International projects. In Kocaeli, being one of the industrial cities, VET is crucial. Kocaeli Provincial Directorate of National Education attaches special importance for planning and undertaking international activities. As an important transition corridor between Europe and Asia, Kocaeli is among the leading provinces contributing to the Turkish manufacturing industry's



production capacity. The city, which has a 13 percent share of the manufacturing industry, is also home to approximately 2,300 major industrial investments.

Gebkim VET

Established under the name of GEBKİM Chemistry Specialized Vocational and Technical Anatolian High School it is a leading VET centre in raising the qualified workforce needed in the field of Traditional Chemistry, Process and Petro-Chemistry and various chemical-related industries in Turkey and has been included in the Schools Implementing Special Projects by the decision of the Ministry of National Education of the Republic of Turkey. Gebkim VET has a pilot production area of 1170 m². In May 2021, Call: ERASMUS-EDU-2021-PEX-COVE EU Grants: Application form (ERASMUS BB and LS Type II): V1.0 – 25.02.2021 38 Gebkim VET accredited by Erasmus alongside with Gebkim NGO and Koruma Klor Alkali. The 2021 accreditation plan includes Gebkim VET's participation in Industry 4.0 projects in collaboration with Europe's leading industrial and academic actors, and study visits to Chemical focused companies.

GEBKIM Organized Industrial Zone

Based on the principles that industrialization should be harmonized in the context of "city-human environment" and "livable environment and sustainable development" it provides services in production and social areas. OIZ gives importance to the human factor within scope of the "city-human environment" principle within the framework of industrialization. To develop and improve the human factor, the Occupational Health and Safety Improvement Grant Program is implemented under the "Employment, Education, Social Policies" component of the Instrument for Pre-Accessions" developed within the scope of financial cooperation between Turkey and European Union. With the rapid spread and development of industry 4.0 and digitalization, a "Technology Development Center" is being established to adapt to the requirements of the time and not to fall behind.

Curt Nicolin High school

CNG is a non-profit, so-called free school situated in Finspång, Sweden. The school is owned by the industrial companies in Finspång (51%) and the Municipality of Finspång (49%). Curt Nicolin High school is a part of the Teknik College in Östergötland, which is an Association of Industrial and Technical Centres in the region.



Simumatik

Simumatik AB was born in 2018, and since then has been developing innovative software solutions that release the full potential of the cloud. To date, the company has grown to over 8 employees, made up of Programmers, Product Developers, Engineers and Marketing professionals. The team has deep knowledge and experience in core automation technologies and robotic applications. As a company, Simumatik has over 20 years of experience in developing virtual commissioning tools for industry and education. The headquarters are in the Science Park of Skövde, Sweden.

Technical School Center Maribor

Technical School Center Maribor has over 10 years of experience in cooperation with national and international projects. Our specific is that 40% of curricula is provided as in-company WBL and the teaching staff requirements demand up to date professional experience and knowledge from the field of work as well as pedagogical and andragogical competencies. In doing so we ensure up to date theoretical training at the institution facility and then monitored and guided in-company placements with certified and qualified mentors. The result is that our graduates are 99% employed and cherished by the employers as ready to work and act in contrast to their peer graduates from HE that are experiencing a growing number of young unemployment with the bachelor, master and even PhD. EQF level 5 is provided in our member institutions in various institutional synergies, some of them providing only EQF level 5, others also EQF levels 3 and 4 and then again some providing upgrades to EQF levels 6 and 7 and all that in public and private institutions.

Skupnost-vss Slovenia

A professional association of higher vocational colleges (HVCs) holds under its umbrella 47 members (94% of HVC institutions) all providing EQF level 5. They offer their programs (32) in 28 locations across Slovenia to 99% of the national EQF level 5 student population. HVC's mission is to promote the HVET in Slovenia and beyond its borders and to contribute to the progressive development of professional HVET research area. Our members provide HVET, contribute to the field of applied research and professional studies, and the development of local communities and regions. HVC is primarily focused on the development of policy and strategies in the field of EQF level 5. It organizes conferences, thematic seminars, roundtables and training programs and other events for its members and all stakeholders to collect and share relevant new knowledge and information and is focused on continuous development of leadership within our member institutions. It operates as a joint body for research and analytical work with focus to EQF level 5 and acts as its representative and voice on national and international level. It is



a link between its members, the world of work, students, authorities, national quality assurance agency etc.

Camosun College

A recognized leader in applied research, Indigenous education, trades and technology training, Camosun brings almost fifty years of experience to the partnership. In the area of trades and technology, Camosun has served its community through an ever-changing, ever-responsive series of offerings ranging from automotive service and carpentry to welding and virtual reality, with a clear dedication to sustainable building practices, ecologically responsible manufacturing, and equitable hiring and training practices for women, racial minorities, new immigrants, and Indigenous workers. Camosun brings expertise in the integration of active pedagogies, applied research, capstone experiences, design thinking, student-centered learning, just-in-time teaching, micro-credentials, and work integrated instruction. Camosun Innovates, the applied research unit for the college, provides access to Canada's network of Technology Access Centres, specializing in knowledge transfer from business and industry to the college sector, as well as the classroom and lab to the shop floor. Likewise, Camosun Innovates provides students with a venue for knowledge creation as they solve real-world research and development problems for local, regional, national, and international clients. The college serves as a conduit for understanding between the world of learning and the world of work, allowing for the constant sharing of ideas and innovations in support of vocational education and workplace excellence.



10.1.2 ADMA field research

10.1.2.1 *Why this Field Research is being carried out*

Advances in science and technology require the rapid development of new highly qualified professionals who respond to the needs of the productive environment. VET system, in its aim to respond to the needs of highly specialised professionals, prepared to adapt to the accelerated changes derived from the constant evolution of technological requirements, must have a teaching staff that permanently updates its scientific and technological competences and that continuously improves its capacity to transmit knowledge to its students, through different types of projects.

To this end, applied innovation learning activities will be carried out, aimed at fostering both a sense of initiative and innovative actions in the field of vocational training as a whole. These actions will aim to generate and increase the knowledge of the centres and of the people involved in such training, in new emerging areas and in advanced technologies and processes.

These activities will also promote specific contributions from VET to the value chain of SMEs, with the aim of optimising and improving their production processes and the products they manufacture, through collaboration in different projects between VET centers and SMEs, as well as boosting the acquisition of knowledge in the centres.

Regarding SMEs, in the digital era in which we live, technological innovation has become a fundamental factor for growth and survival. The ability to adapt to rapid market changes and to seize the opportunities offered by technology can make the difference between success and stagnation.

SMEs play a crucial role in the business fabric of any country, generating employment, fostering competition and stimulating the local economy. However, they often face unique challenges due to their limited size and resources. It is in this context that technological innovation takes on immense value.

It is important to note that technological innovation is not limited to large corporations or technology companies. SMEs have the ability to adapt quickly, be agile and take advantage of the opportunities offered by the constantly evolving technology landscape. The key is to identify the specific needs of each business and find technological solutions that fit their goals and resources.

Technological innovation is crucial to the growth and success of SMEs today. Embracing new technologies not only allows them to improve their operational efficiency and market reach, but also gives them the opportunity to be disruptive and make a significant impact on their



industries. It is time for SMEs to embrace the potential of technological innovation and position themselves at the forefront of the digital economy.

Therefore, in view of the need for innovation in SMEs and the need to continue to highly qualify vocational education and training teachers, it is necessary to use innovative tools and methodologies. Thus, after conducting a study on recent methodologies to help SMEs in their technological innovation process, it was found that the ADMA methodology could be suitable for vocational training teachers to be trained and could use this methodology to help SMEs in their environment on their way to technological innovation, providing knowledge both in the classroom and in companies.

To this end, it was necessary to carry out field research to see first-hand that the ADMA methodology was the right one to introduce in the LCAMP project.

10.1.2.2 Why the ADMA methodology has been chosen and its bases

The ADMA methodology is the most innovative methodology designed in Europe. This methodology is an innovative approach designed to help Small and Medium-sized Enterprises (SMEs) across Europe become Factories of the Future within the ADMA TranS4MErs project (running from 2021 to 2024). This project takes over from ADMA - European ADvanced MANufacturing Support Centre, which run from 2018 to 2021 and consisted of a three-step approach: the Scan, Transformation Plan and Implementation Plan. The previous methodology provided SMEs with assistance to develop a transformation plan for their company and guidance during the implementation phase to turn their company into a Factory of the Future. The transformation plans took an integrated approach to advanced manufacturing and addressed the innovativeness of processes and products, as well as the environmental and social sustainability of manufacturing.

The ADMA TranS4MErs methodology described in these chapter is based on an ADMA TranS4MErs deliverable from March 2023, that was made available by AFIL, a current member of that project consortium. The revised methodology still follows the three-step approach but emphasizes the transformation plan and its implementation. It introduces the TranS4MEr role, which is essential in this process as they assist SMEs throughout their transformation journey. TranS4MErs have a comprehensive understanding of the specific challenges that SMEs face and the most appropriate tools to use for their transformation. Together with the SME, the TranS4MEr co-creates the Transformation Plan (TP), which prioritizes implementation and



jump-starts the SME's transformation process. This is a crucial step where the SME establishes a relationship with the TranS4MEr and receives guidance on how to use the virtual xChange platform to seek out domain experts, toolkits, etc., to address their priority challenges listed in the ADMA TP. In the Revamp Phase, the SME receives tokens from the voucher system, which they can use to pay for education modules, tech tools, expert advice, and other resources. This provides SMEs with access to the necessary resources to implement their Transformation Plan and to become a Factory of the Future.



Figure 1: The ADMA TranS4MErs three-step approach

To meet the challenges of the modern digital, ecological and societal landscape, the ADMA TranS4MErs methodology introduces several new elements and improvements. These additions are designed to help SMEs overcome obstacles and become more competitive.

As stated before, the primary objective of ADMA TranS4MErs is to assist SMEs across Europe to become Factories of the Future. This means companies that can successfully navigate the digital, ecological and societal challenges and remain competitive. The process to reach that goal is called the Transformation Journey and SMEs often need support and guidance to make the right choices and stay on track. Therefore, to ensure that each SME receive the necessary assistance, each company will be matched with an ADMA TranS4MEr, who will be their contact throughout the transformation journey. The TranS4MErs will provide valuable assistance and guidance, ensuring they are well-equipped to face the challenges ahead.

The SME journey comprises various stages, including the link to the TranS4MEr match, voucher applications and service selections. These steps are described below:



1. The SME registers on the TranS4MEr platform.

2. The SME applies for the Design Voucher, which will enable the SME to be matched with a TranS4MEr and create a Transformation and Implementation Plan.

3. The SME will be matched with a TranS4MEr of their choice. The TranS4MEr is a trained person who will be the helping hand/trusted advisor and guide the SME throughout the journey. The TranS4MEr may even bring potential SMEs to the xChange platform and support them during the Scan process.

4. The SME takes the scan, which is a questionnaire that uncovers strengths and weaknesses in 7 areas related to advanced manufacturing.

The 7 areas are listed the following:

1. Advanced Manufacturing Technologies
2. Digital Factory
3. ECO Factory
4. End-to-end Customer Focussed Engineering
5. Human Centred Organisation
6. Smart Manufacturing
7. Value Chain Oriented Open Factory

5. After completing the scan, the SME has a debrief session with the TranS4MEr to go over the scan results and relate them to the SME's situation. During this, priorities are discussed and the TranS4MEr draft a Transformation Plan. This plan analyses the SMEs transformation maturity in the 7 areas, identifies opportunities for change and selects the one, or two areas, where the transformation journey should begin. It is discussed and reviewed with the SME to reach the final plan. Then the TranS4MEr drafts the Implementation section which goes into more detail about the selected areas. Based on the analysis of potential solutions and conclusions made to match specific objectives, the ADMA TranS4MEr guides the selection of Services, including training and expertise, that the SME may benefit from in its transformation journey and help set the KPIs. The draft is reviewed and finalized together with the SME.

6. The SME submits the Transformation and Implementation Plan for evaluation, which simultaneously serves as the application for a Revamp Voucher.

7. If the SME is granted the Voucher 2 (Revamp), the actual implementation will begin with confirming the services as reserved in the plan and then the services can be accessed. Ideally, while training and other actions are taking place, the TranS4MEr is on stand-by to hear about



the learnings and suggest the next step. After the implementation, KPIs are measured and included in the SME Progress tracking, which has two recipients: the SME to support its journey, and the Program Management to support the program development.

SMEs who do not wish to apply for vouchers can still embark on a transformation journey. After registering, they can bypass the voucher application process and proceed directly to taking the scan and perusing the service catalogue to select the services they wish to implement. They can then contact the service provider directly and make their own arrangements. If SMEs choose to follow the supported voucher-scheme journey, TranS4MErs will also assist them in collecting a success story that can inspire new users. The feedback obtained will help TranS4MErs, service providers, and program managers improve their services and processes. The SME will conclude the transformation journey within this framework, but the intention is for the journey to continue beyond that point.

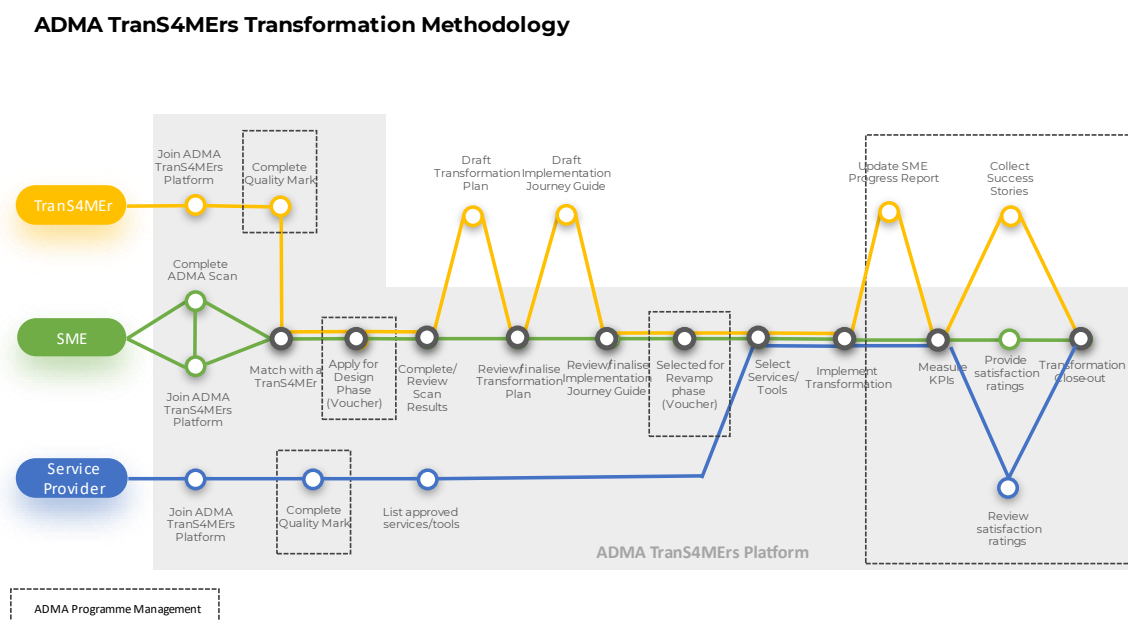


Figure 2: Journey map - a frame for the improved methodology.



The basis on which the people to be interviewed have been chosen.

Knowing the importance that the ADMA TranS4MErs project and its methodology of scanning SMEs implementing innovation could have, it was necessary to carry out field research on what is being done in the project and it was very interesting to conduct interviews and hold conversations with the TranS4MErs themselves who are already collaborating with companies. These actors have been the first in Europe to use this new innovative methodology and are already helping companies in their digital transformation.

So, first of all, a plan has been made to carry out this field research on ADMA in which all the members of the LCAMP project have participated.

Seeing which countries make up LCAMP and in which countries the ADMA methodology was being implemented, an analysis was made of which of the members needed to be interviewed.

Following this analysis, the relationship between ADMA TranS4MErs and LCAMP partners was established.

Previously, Irish Manufacturing Research (IMR), coordinator of ADMA TranS4MErs project, had already been involved in one of the face-to-face meetings held in the Basque Country on 7 and 8 September 2022, and the ideas and objectives of the two projects had already been made known, having agreed on the collaboration between them and defining the strategic lines to be followed in each project.

Therefore, after contacting IMR again, the agreement signed by ADMA TranS4MErs and LCAMP was transferred to all the TranS4MErs and they were informed about the working method of the LCAMP project, defining the lines to be followed in the field research carried out by LCAMP on the ADMA methodology.



What is the methodology designed to carry out the interviews?

After both sides of the projects saw interest in the field research, the LCAMP collaborators began to design the methodology to be used to carry out the field research. After several meetings and listening to the contributions of all parties, the working method and the document to be used in the interviews were defined.

1.- Firstly, it was defined who each LCAMP member was going to interview. For this, the proximity of the contacts was used and if it was the case, the knowledge that some partners of the project might have in some of the TranS4MEs contacts.

2.- So, after defining the contacts and their respective interviewers, prior to the interviews, we sent to the contacts the points to be discussed in the interviews. In this way it could be assumed that the interviews would be more fruitful and more information could be obtained from the TranS4MEs.

3.- Afterwards, the interviewer spent time documenting the interviews and sent the document back to the TranS4MEs interviewed, so that they could give their acceptance of what was discussed and the information obtained in the meeting.

4.- Finally, with the return of the document by each TranS4MEr, the methodology has been studied and conclusions have been drawn as to whether it is interesting to use the ADMA methodology in the LCAMP project to introduce it in vocational training as an innovation tool offered to SMEs.

Below are screenshots of the document used for the execution of the interviews as part of the ADMA field research methodology:



Name of the interviewer: Iñigo Mujika

Name of the interviewee:

Company:

Country:

Date:

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?
2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MERS?
3. Did you do any ADMA scan?
 - a. If the answer is yes continue with question number 4
 - b. If the answer is no continue with question number 12
4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?
6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.
7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)
8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?
9. Also based on the direct interaction with the SMEs (within ADMA TranS4MERS), what is your perception about the reasons why some companies haven't started their digital transformation before?
10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?
11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?
12. Which ADMA topics do you find more interesting for SME-s? Why?
13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

- ☐ YES
☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does

not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

- ☐ YES
☐ NO



FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Liher Errasti Gonzalez

Name of the interviewee: Peter Kopkas

Company: B I C Bratislava, spol. s r.o.

Country: Slovakia

Date: 22/05/2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

Basically yes, with support of services to be implemented.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

Probably yes, in our case we experience also from other consulting services and projects from the past.

3. Did you do any ADMA scan?

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

Yes

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

- Methodology already tested in previous project
- Possibility to benchmark the company
- Better knowledge for client, which areas could be supported
- Not really in depth
- Potential mismatch between needs of the client and services offered
- Clients financial participation in case of technology implementation



5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

Digital factory

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

More precise analysis of digitalisation potential.

Setting the transformation goals and services.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

Yes

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

Necessary information about transformation areas and a good knowledge of clients. Previous consulting activities are also welcome.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MEs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Lack of financial support.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

Not really.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?



Just to be from ADMA sector.

12. Which ADMA topics do you find more interesting for SME-s? Why?

New digital technologies and applications and support for its implementation.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

EDIH methodology, IMP3rove methodology

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Iñigo Mujika

Name of the interviewee: Lise-Ann Sheahan

Company: IMR

Country: Ireland

Date: 2023/05/24



1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

LA: Yes, it is very interesting and companies have been able to see that it is very interesting for working on future strategies and defining the path towards innovation.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

LA: It is not necessary to be an expert in any subject, I am an expert in fundings and I am an architect, which means that I do not have advanced technical manufacturing skills, but even so, companies have asked for my help and I have felt comfortable in this task of providing assistance to companies

3. Did you do any ADMA scan?

LA: Yes, in 4 companies

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

LA:

Strengths

1. The first ADMA scan is very quick
2. The digital tool (platform) is good enough to give a response

Weakness

1. The platform does not send a message to the ADMA transformer with the response of the company after full-filling the scan, which supposed a delay in the process
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

LA: ECO factory and Advanced Manufacturing Technologies are the most common transformation areas that I work on with the 4 companies. I have spent lot of time speaking about eco factory.

Iñigo Mujika asked LA about the size of the companies:

LA: Small companies, like more or less 20 staff. There are different people working in different areas, marketing with techniques...



6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

LA: They are really interested in future innovation. The scan helps us to make decisions and to identify the need of an expert to define the strategies (contacts are done). The usual situation is that they need help to define first steps. They normally know what area they want to invest on, but SMEs are not thinking of future and they need a guidance to help to know what steps to take to innovate in an orderly way in the company.

The company knows the future invest strategies but they do not know how to prioritise.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

LA: I think interesting for all manufacturing SMEs, but I have not tested with big companies. I think big companies have enough resource to make their own scan in another way using methodologies on which you have to pay for it because being the first ADMA methodology implementations free for companies, big ones think that if they don't pay, the service won't be good enough for them. Big companies use to make SMART INDUSTRY SIRI benchmark, on which they can pay 10.000 euro for an especial advice (series assessmentsàglobal benchmarking).

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

LA: I think it is not necessary to have any other skills, the methodology is good enough.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

LA: They are so busy in their own business.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

LA: Huge, SMEs feel they do not have skills. They do not have qualified people to carry out the innovation in the company and that blocks them at the moment of carrying out the transformation as they need to subcontract these services. Besides that, what the SME wants to improve with this methodology is to increase the worker's capabilities and many implementation plans lead to that.



11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

LA: They do not need any background. They feel comfortable. The scans have been done by the SMEs without any help.

12. Which ADMA topics do you find more interesting for SME-s? Why?

LA: Best topic of ADMA: People's skills, re-skills. The worker is afraid of change and a barrier appears.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

LA: SIRI is one of them, but it is very expensive. ADMA is for free and very simple to do. You can get a grant to do others but they are very general and not specific for AM. There are different transformers, some more technical, others more "green". It would be grateful to have a specialisation group in order to have the option of expert advice and have the opportunity to see how other trans4mers work by looking and do best practice exercises.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO



FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Josu Riezu

Name of the interviewee: Daniel Moldovan

Company: BEIA GmbH

Country: Austria

Date: 30.05.2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

The short version is yes. The long version is that ADMA methodology is a slow process that seems distant and generic when it comes to scanning the SMEs. The options that are offered for selection require sometimes a lot of effort to imagine what it would mean in a real life situation.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

I think it is not enough to have just knowledge about ADMA methodology. Some prior experience in either interacting with SMEs or being a part of that mindset (either as an employee, manager or owner) is necessary. Most of the time, SMEs are interested in cutting costs and scaling up their business. Digitalisation is just a mean to these goals. This fact shall be kept in mind when explaining the pros and cons of the ADMA TranS4Mers. And the scans should put the focus on these two principles.

3. Did you do any ADMA scan?

Yes.

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths

- A holistic analysis of digitalization potential through the light of 7 transformation areas.
- The employment of a consultant (the TranS4Mer) that is helping the SMEs in this self-assessment process.
- The existence of the ADMA TranS4Mers xChange Platform.



Weaknesses

- The Scanning questions are formulated in a way that requires extra effort to grasp the meaning. Also, their topic is somewhat disconnected from the issues the SMEs are currently facing.
 - The structuring of the type of options the SME must choose from does not have a clear pattern. It is rather dispersed, and the SMEs get tired quite easily going through the selection process.
 - The focus of the SCAN is too much on the business plan and technology but not so much on the gains for the SME. Somehow, it fails to “bring home the story”. From my experience, the SMEs relate very superficially with the scan.
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

Digital Factory is the most chosen transformation area. As stated earlier, the SMEs need to cut costs. Digitalisation is the first step in this enablement process.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

As mentioned above, Digitalisation represents just the first step in an entire process that has as target (1) data collection, (2) optimisation of the manufacturing processes and (3) real time monitoring.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

I find ADMA methodology suitable for SMEs from the manufacturing sector regardless of the size of the company or location.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

TranS4Mers should act as a Consultant for the SMEs. As such, they should exhibit not only technical prowess but they have to be exposed also to the realities the SMEs are confronting in order to run a business.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?



Digital transformation requires specialized knowledge about software, computer networks, robotics, embedded computing. The lack of in-house know-how and sometimes the lack of funding for making the necessary investment contributed to the delay of such a transformation.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

The lack of skills can contribute to a certain extent to the postponement of digital transformation. However, the lack of funding for investment in technology to implement the digital transformation has a bigger weight in this decision.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

The ADMA scan is a first step in the process of assessing the need / opportunity for embarking on a digitalisation process. As such it requires a person that is familiar with both technical and business aspects of the SME.

12. Which ADMA topics do you find more interesting for SME-s? Why?

The SMEs will need to see that by introducing digital transformation their business will benefit financially. They need to have a grasp of the real cost of deploying a digital technology and also the impact it will bring in the production. As such, I find the “digital factory” the most interesting topic as it deals directly and in close proximity to the manufacturing process.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

Some other methodologies would involve employing dedicated service providers specialized on implementing digital twins for real time monitoring and data collection from the factory floor. This is a straight forward approach that gives the SME a clear picture of the cost and of what they will be able to achieve once the system will be implemented with the possibility of making prognosis for the ROI.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in



the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Josu Riezu, Leire Solaberrieta

Name of the interviewee: Risto Lehtinen

Company: DIMECC Oy

Country: Finland

Date: May 24, 2023

Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

RL: Yes, I think. It has the best potential with SMEs that have not yet started their journey, because the questions (and alternatives for answers) open new viewpoints to their operations.

Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

RL: No, I don't think it is enough. The ADMA methodology is a good and systematic framework for digital transformation in the manufacturing industry, but in order to be a good TranS4MEr, the person needs to have also subject-matter expertise. Without this expertise his/her suggestions for next steps will be too generic to be useful.

Did you do any ADMA scan?

RL: Yes, I have done the ADMA scan with two companies.

If the answer is yes continue with question number 4

If the answer is no continue with question number 12

Give us 3 strengths and 3 weaknesses of the ADMA methodology.



RL: Strengths:

1. It covers many aspects of a manufacturing SME's operations.
2. In ADMA scan the verbal answers are better than numeric values (1 ... 5), because they describe the current situation and give some insight to potential target state.
3. When a large number of SMEs has filled in the ADMA scan, the company can compare its results with a solid benchmark.

Weaknesses:

1. We did not have the ADMA scan questions and answers in local language (until I translated them myself).
2. Some of the answers are quite long, so it takes time to read them through and really understand their meaning.
3. Training for ADMA Trans4MEs is quite light, so their level of expertise and hence also quality of their suggestions may vary a lot.

After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

RL: With only 2 scans done it is impossible to draw this kind of conclusions.

Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

RL: I think it is useful. However, in the scope of the ADMA project, the next steps should be concrete and relatively small so that they can be completed in the given timeframe. In most cases this is a start for a long journey, and if the start is very difficult or time consuming, the company may give up.

Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

RL: For a very small company it may be a bit too heavy in relation to their ability to invest in digital transformation (machines, processes, etc.).

Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

RL: Subject-matter expertise is a definite must. Also, the ability to invest enough time is important, because already filling in the scan with the company can take up to 90 minutes. We have reserved 6-8 hours per company for filling in the scan and preparing the transformation plan. At least for the first scans this may be not enough.



Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

RL: Lack of time comes to mind first. Typically the companies already know what their hottest development areas are, but they do not have the time and resources to start their transformation activities. I hope that ADMA scan would offer to them an opportunity to stop and think.

How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

RL: Based on the two cases I have done, lack of skilled employees has not been a problem.

Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

RL: The need for change must come from the management: sense of urgency and willingness to change. Without these there will be no transformation.

Which ADMA topics do you find more interesting for SME-s? Why?

RL: With only 2 scans done it is impossible to draw this kind of conclusions.

Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

RL: In Finland, VTT has a digital maturity assessment tool (<https://digimaturity.vtt.fi/>). It can be used as a free-of-charge self-service web tool, which produces a basic visualisation of digimaturity. It gives a baseline of current digitalisation capabilities and maturities in six main dimensions, which can be used for recognising the most important and urgent development targets depending on nature of the business and size of the organisation. The 6 main dimensions of VTT's DigiMaturity tool include strategy, business model, customer interface, organisation and processes, people and culture, and information technology.

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☒ YES

☐ NO

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mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: CEM KILINÇ

Name of the interviewee: JIRI JANOSEK

Company: TECHNOLOGY CENTRE PRAGUE

Country: CZECH REPUBLIC

Date: 25.05.2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

The ADMA methodology is a framework that helps organizations assess their current digital maturity, design a roadmap for digital transformation, manage the implementation process, and automate various aspects of their operations. It can certainly be useful for SMEs undergoing digital transformation.

Interviewee thinks that the ADMA methodology is interesting and useful but in his opinion about ADMA is slightly more complicated than it is necessary to be.

Interviewee also has the opinion that the project should have been like slightly less complicated for the clients. It is unnecessarily complicated, as from the client's point of view it's necessary to register on one website then the data are transformed to another website. The transformation plan is made on this second website so he said if the whole methodology would be simplified it would be better both for the SME-s as clients of this project as well as for us as so-called Transformers.

ADMA Transformers project is more focused on staff training or transferring knowledge on digitalization. So, in overall it is evaluated to be useful for SMEs. Those trainings or those services are not only super specialized in how to implement robot in our manufacturing or how to optimized manufacturing line but there are also trainings focused on soft skills such as digital skills or improving skills of employees so if a company would like to train its staff in like digital marketing they could also find such trainings here. It's not only about super technical skills or



transformation of manufacturing into Super robotic Factory but it is also about like improving General skills.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

Interviewee is not an IT focused professional, he is someone who is dealing with a corporation with SME-s internalization of SME-s, with more focus on the business side. Interviewee's background is mechanical / automotive engineering. He thinks TranS4MErs does not need to have deep knowledge on digitalization, however it's necessary to have knowledge of the Project and ADMA methodology. It is enough to be a good Transformer to know what to offer, where, how does it work in the project and where to find information basically. So it's not necessary to be an expert on digitalization or robotics or on alike technologies. He said this is enough that in order to be a good Transformer, it is enough to know the project that would be his answer to this point.

From his point of view such background was satisfactory also his colleagues who have similar backgrounds are Transformers and so he thinks it's not necessary to be an engineer to be a Transformer. He thinks it really necessary to know the project.

Being University graduate with background of a years' experience and knowledge of the project should be fine.

3. Did you do any ADMA scan?

Jiří Janošec is a TranS4MErs who have completed the most transformation plans.

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

3 weakness:

- a. The methodology is unnecessarily complicated as the registration process and implementation are executed on different websites.
- b. The project progress is slow even though according to the timeline the project is halfway through.
- c. Interviewee is as a Transformer he basically doesn't have access to the registration of the client unless the client gives to him his or her email and password he is aware that this has something to do with the data protection. He sees small weakness of not having full access to the data of from clients.



3 strength:

- a. The digital scan its self is very easy it can be completed in 20 to 30 minutes.
 - b. The interviewee claimed that the catalogue of Service Providers and services is not yet fully appreciated. The registered customer can take advantage of free trainings worth up to EUR 5 000. The Consortium has 30 Partners so it's really huge Europe wide cooperation, covering most of Europe
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

Most desirable transformation area depends on the results of transfer of the digital scans which shows some indications where the company should improve.

The most common transformers area in my opinion in my experience so far it's T2 and T6 but it really depends on a client where he or she would like to improve its competitiveness so it's not so easy to really answer with one option.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

The question here is more on digital transformation so Interviewee split his answer into two. First reply would be like funding sources to provide the company where to find funding sources for its transformation. The second would be like identifying kind of providers if they really need to transform the manufacturing or installing robots or something like this this is not what Transformers can done. But Transformers can inform them. Here is the source of information and here is the list of companies who can do this for you. But then it is their responsibility and decision as Transformers don't get involved in this phase, the execution, Transformers is responsible for providing guidance.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

Interviewee said that right now as the ADMA methodology is applied as it focuses on manufacturing companies. Because the digital scan ask question about like manufacturing about data, processing in manufacturing so it is not suitable for companies which do not operating manufacturing lines or kind of assembly or something right now The methodology is suitable for companies which conduct manufacturing and have assembly or manufacturing lines. But if it would be like just sales company it doesn't work and as for activity sector from manufacturing again it's okay. Location is also not a major indicator. But the methodology is quite more efficient for manufacturing companies, it does not really suit for sales and / or trading



companies. There must be an element of assembly or manufacturing. Then the digital scan makes sense since questions with the focus on the digital ADMA scan how to replace old machines on the manufacturing line. In case the company doesn't have any machines then the scan doesn't make any sense.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

Interviewee said it would be nice if the person who would like to carry out the ADMA scan has some experience with for example the advisory / consulting companies, or know the area of maybe digitalization or at least the sector. So some experience would be necessary like at least get some knowledge of the sector and about the trends in the sector and trend of digitalization. So this could be learning by doing so if there will be a Transformer who is knowledgeable enough and have I would say junior Transformer or freshman in business then he or she could train him to be a good Transformer as well

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Interviewee thinks it has something to do about not having enough technical staff and there's also funding reasons as well. From the ADMA project point of view right now this is a project where companies through services can extend their knowledge and train the staff about digitalization e.g. digital marketing or how to process data from machines in the factory etc.. He thinks about it's a combination it's not just one single thing it differs company by company and it's combination of factors like not having enough people not having enough funding and maybe also they are afraid of change. So it's he thinks it's many factors which are unique to each company.

Interviewee thinks it also depends on the sector of the company. The company e.g. from food processing might not feel such necessity to digitalize its processes, while a company manufacturing some precise engineering components might require enhanced digitalisation. Interviewee said that some clients sometimes don't even know how they could use some data from manufacturing.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

Interviewee doesn't really think this will be an issue. Because mostly we are discussing digitalization ready company managers and decision makers and his perception is that there is shortage of technical staff. So skills are something which could be learned. He doesn't think it's a really huge issue. He thinks number one barrier in front of digital transformation for the companies would be shortage of staff, funding, time and then skills of employees would be much lower. So interviewee doesn't see it as a kind of issue.



11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

Any kind of requirement from the SME or the company just must be willing to cooperate with the ADMA Transformers. The rule of the project is that it must be a manufacturing company. So there is no special requirement from SME.

12. Which ADMA topics do you find more interesting for SME-s? Why?

This probably again will differ case by case by company. Some companies might find it more beneficial to connect their ERP to IoT components and it might be different for another company. From his experience so far topics in the transformation plans were more about enhancing the know-how. But not topics like how to implement a robot into our manufacturing or how to increase output from our manufacturing line. Topics we were used so far where more generally focused on increasing general knowledge about digital or what is digital marketing, how to process data, what can we do with data, how can we optimize production. etc. But again it's case by case.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

Interviewee split his answer to two parts. First is let's European commission tried to come up with kind of digital scan in PDF he can't remember the name of it but it possible to find it somewhere on commission website. But he thinks at the end they did not introduce it at all. But he thinks there was some kind of trial to conduct the methodology on a European level and in comparison with ADMA it was even more complicated. So that's the European level and on the country level of Czechia he is aware there are other digital methodologies but they are much more complicated than ADMA. One university has a testbed and they do digital audits mainly with larger companies and it takes up to 8 hours, it's really complicated and they ask for really strange questions. That's one example and the second of the second example would be the methodology that is applied by the Czech Association of Manufacturers. Association has also introduced their methodology like digital scan or digital questionnaire and also it's much more complicated and then time-consuming in comparison to ADMA. So in his opinion ADMA scan is very simple and very easy but the way how to get there the registration process is really complicated so to speak.

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☒ YES

☐ NO



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☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Jan Stenzel, jan.stenzel@heilbronn.dhbw.de

Name of the interviewee: Hanna Kim, hanna.kim1@kearney.com

Company/ IMP³ROVE Academy

Country: Germany

Date: 22.05.2023

1. Do you think that the ADMA methodology is useful in the digital transformation journey of SMEs?

Yes, I do think that the ADMA methodology is useful in the digital transformation journey of a SME, since there is:

- a comprehensive Benchmarking approach available accompanied by valuable services combining theory and hands-on approaches
- an Intended long-term cooperation with a qualified Transformer
- a ADMA Transformer who acts as an interface and as a competent advisor providing expertise and tailored services
- it helps the SME tackle the digital Transformation
- International service providers present competitive advantages and often more innovative approaches compared to those that are accessible in the SME's home country

2. Do you think a deep knowledge of the ADMA methodology is enough to be good Trans4MErs?

- No, I don't think this is enough to be a good transformer. As such you will need:
- analytical skills
- to respond individually to SME's needs
- a contextual understanding of the SME's current situation
- to prioritize and suggest specific recommendations



- to foresees and consider complex economic conditions, funding opportunities, and further (inter-)national support/funding strategies

3. Did you do any ADMA scan?

a. If the answer is yes continue with question number 4

YES

b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths:

- Individual report for each SME
- Questions are quick and easy to answer
- The 7 transformation areas cover all areas necessary to reach the transformational level of a “Factory of the Future”

Optimization needs:

- Transnational collaboration is difficult to implement, because of the language barrier, and digital environment, which can lead to
 - deterrence due to a large number of offers/services
 - The method itself steps/processes are many until matching occurs
 - High time expenditure for onboarding (SMEs, transformers, service providers)
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?
- ECO-Factory (Sustainability)
 - Value Chain orientated
6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.
- Yes, indeed, the action plan and the road map is one of the most crucial strategical phases to meet the transformation targets.



7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)
- The ADMA methodology seems less suitable to meet the needs of Start-Ups, since Start-Ups neither would consider the green and digital transformation as one of their priorities nor are they in a comfortable financial situation that would allow them to tackle the implementation of ADMA benchmarking results.
 - Lack of manpower, time, funding/budget
 - The degree of SME's digitization is crucial to the success of the ADMA methodology.
8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans? To perform as such you will need:
- analytical skills
 - to respond individually to SME's needs
 - a contextual understanding of the SME's current situation
 - to prioritize and suggest specific recommendations
 - to foresees and consider complex economic conditions, funding opportunities, and further (inter-)national support/funding strategies
9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?
- The exclusively digital access to the communications with ADMA Trans4mers via the platform can be a deterrent, as there is no personal contact (trust building therefore is more difficult).
 - Companies sometimes have no idea what the long-term benefits of a transformation to the Factory of the Future would be.
 - The topic of transformation is often not a priority.
 - Companies do not (yet) see the need for transformation as a given.
 - SMEs have less willingness to take risks and
 - They seldom have the considerable financial/human resources.
10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?
- I personally consider the lack of specific (digital) skills of employees not as decisive for tackling the digital transformation.



11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

- Yes, SMEs should meet such requirements:
- A sufficient degree of digitization
- The motivation/ambition to position itself for the future
- Sufficient financial resources and personnel to successfully realize innovations and their implementation

12. Which ADMA topics do you find more interesting for SME-s? Why?

Sustainability and green/circular economy

- Digitization of workflows and processes

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

- Yes, EDIH Services:
- Comprising even more comprehensive services as ADMA Trans4mers
- have easier access to SMEs
- do have a central matching point for contacts
- do have qualified EDIH coordinators

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☒ YES

☐ NO

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☒ YES

☐ NO



FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Iñigo Mujika

Name of the interviewee: Vilma Akelaitiene

Company: LITHUANIAN INNOVATION CENTRE

Country: Lithuania

Date: 2023-05-29

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

YES

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

Not enough, the expert must have knowledge of enterprises, know the trends of production innovations

3. Did you do any ADMA scan?

NO

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?
6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.
7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)
8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?
9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?



10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?
11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?
12. Which ADMA topics do you find more interesting for SME-s? Why?

The result of Scan

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

No , I don't know

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☒ YES

☐ NO

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☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Josu Riezu, Iñigo Muijka

Name of the interviewee: Asier Alonso Muñoz (Tecnalia), Iker Altuna (IMH)

Company: Tecnalia, IMH

Country: Spain (Basque Country)

Date: 2023-05-25



1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

IA: I have not diagnosed any company but some of my colleagues have done a scan. The methodology can be good, the structure is well thought out. The self-questionnaire is poor for someone to carry out without any help. Bureaucratically, the process is very well registered, but for companies it can be complicated: accreditation, entering the platform... companies may be put off.

AA: I have done two cases. It is difficult to reach the companies. It has been done with the people from IMH. The methodology is fine, it's not very different from what other consultancies use. To find out the priorities of companies and make a recommendation. The 7 areas are good, the material is well documented.

1. The downside is in the process of reaching the services. 5 hours of consultancy to get to the services is too few hours.

2. Biased starting point for doing the trans4mers scan because they may find it difficult to understand the questions because they may not have knowledge.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

IA: It is not only necessary to have knowledge of the ADMA methodology. For example, IMH tran4mers have needed help in advising companies. You need knowledge of the environment.

AA: In all consultancy processes you see that they depend a lot on the knowledge of the consultant. You need knowledge of the consultant and experience in the digital transformation process.

3. Did you do any ADMA scan?

AA: Yes, I have, 2 companies.

IA: I have done it with ADMA, but I have advised companies with other tools, and my colleagues have done it.

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

IA: The 7 areas cover the range of digital transformation but by assessing everything in the 5 possibilities, the conclusions may be weak. It is well focused on what is to be achieved. The company that really wants this transformation knows that the process is laborious and cannot be done in a few clicks, quickly.



AA: The results will depend on the consultant and not only on the methodology. It is good that there is a reference model in Europe, but it is scarce.

5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

IA: Advance manufacturing technologies, digital factory, smart manufacturing are the most interesting. Human centred organisation, ECO factory... as laws come in, they will use them, but they are not yet the most interesting.

AA: Area 2. Digital factory. It is a problem without a solution. The problem of digitalisation has not yet been solved or integrated in SMEs. I also agree with Iker with the area of Advance manufacturing technologies.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

IA: Needs as such are difficult to detect clearly. You have to work more with the company and then you can define future strategies or lines of innovation in the company.

AA: It helps you to identify lines of interest in the company. But it is not enough to identify projects, it is a long way away.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

IA: I would say no. Many companies find it difficult to do things differently. The CEO may be very aware but the other people in the company are not interested in change.

AA: Something that is universal is very difficult. SMEs in a very immature state will not understand the methodology and will not be able to self-diagnose. For SMEs that have started the process it will be unnecessary because they will have done the exercise before. It will be good for someone in between: they are familiar with things and will be able to see where they need to go. Geographically there seems to be no distinction.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

IA: It is necessary to have prior knowledge of the subject.

AA: Ditto

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MEs), what is your perception about the reasons why some companies haven't started their digital transformation before?



IA: They may not have felt the need to innovate, because if the results are positive they don't make changes. Until they feel the need to see that they are going to benefit from innovation, it is very difficult for them to make changes.

AA: Multiple cases. They don't know where to start. It is a broad transformation aspect that requires a prior exercise, without an external consultant, but an exercise in reflection. Many companies do not manage to do this and this can be a block to innovation. Manufacturing is not used to digital. It costs them a lot. It also has an economic cost, or the need for learning hours in the company. The company culture itself can be a blockage.

It is difficult to see the return on the investments you make in the company and so it is difficult to make investments.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

IA: The lack of knowledge of the workers has an impact on not innovating.

AA: They are afraid to implement certain innovations because the workforce does not know how to manage in a digital environment.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

IA: There would be companies that would not be able to do it, because they would find it difficult to understand the formulation of the question and the terminology used.

AA: They have to have prior knowledge. They need to have done some prior reflection on innovation. It is interesting that there is more than one person doing the ADMA scan.

12. Which ADMA topics do you find more interesting for SME-s? Why?

Response answered in the other questions by both interviewees.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

IA: Everyone has their own tool. I don't know Tecnia's, but I do know several diagnostics and they all revolve around the same environment. ADMA touches on more areas than the rest.

AA: I have implemented the Active 4.0 methodology: ADA self-questionnaire. At Tecnia they have their own model for identifying Industry 4.0 maturity. There are companies that have their own tool for this.

As a general model, the ADMA is more complete than some others, but the dedication to the company is small and the depth is very small.



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☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Hervé DANTON, MV France

Name of the interviewee: Alain DINIS

Company: SYSTEMATIC

Country: France

Date: 26/05/2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

Yes, it is useful, to open mind and knowledge and thoughts about ADMA, mostly for SME managers, always in operational level, rarely on strategy ways. It is widening bandwidth of SMEs managers.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

In theory, yes, but as ADMA methodology is clearly transverse, to know about digital processes and about ADMA technos could be a plus.



3. Did you do any ADMA scan?

Yes.

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths of the ADMA methodology are:

1. Scan is not an engaging process, so anybody can come just to see and discover interest of the ADMA methodology for its own SME.
2. Very good and visual restitution, so useful to inform SME manager in a 3D way
3. Good communications tools to be helpful to SMEs managers

Weaknesses of the ADMA methodology:

1. Other French offers in competition with Trans4mer ADMA methodology from Chambers of commerce or National/ regional agencies
2. Language barrier
3. Complexity of the ADMA Trans4mers Methodology, partially solved by first step (Scan step).

5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

It is mostly depending on SMEs' variety and typology. Difficult to answer, before several months and plenty of done scans.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

A clear presentation of the whole ADMA Trans4mers methodology is securing SMEs' managers before entering the process.



7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

ADMA Trans4mers methodology is clearly oriented on Manufacturing. But, this ADMA Trans4mers methodology is completely transferable on other sectors, as far as services activities.

8. Do you find necessary any kind of requirement from the trans4mer to carry out ADMA scans?

I have not all technological background as some engineers in ADMA have, but I can say I am able to do scans. We mostly need appetite for ADMA topics to follow and realise such kind of trans4mers scans.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Mainly, SME's managers lack time and bandwidth to enter digital transformation. They need more resources and time to enter. They need time to leave a time, operational activities to reach strategic ones.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

People, SME's managers need time, curiosity and appetite for digital transformation, to enter the process.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

To do an ADMA scan, no! If a SME manager knows it company, he/she will do without any problem.

12. Which ADMA topics do you find more interesting for SME-s? Why?



It is depending on kind of SMEs. ADMA methodology is fluidifying analyses.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

Smart industry around Paris is a regional offer :

CETIM offer is another one.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Samuel Nazzareno Monaco and Eda Ipek

Name of the interviewee: Daniela Georgieva

Company: ARC Fund (Applied Research and Communications Fund)

Country: Bulgaria

Date: 24-05-23

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?



Yes, the ADMA methodology is helpful for SMEs during their digital transformation journey. It allows companies to assess their current situation and to figure out how to improve. Some companies already know how to enhance their digital capabilities, but others may need guidance.

The ADMA methodology also provides a way to evaluate and rethink their strategies to digital transformation.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

It is very useful but when dealing with different SMEs from different fields, you need more than just ADMA knowledge. You must have additional skills and specific sector-related knowledge to be truly valuable and understand their processes, identify gaps, and make effective improvements.

3. Did you do any ADMA scan?

Yes

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths:

- The ADMA methodology provides companies with a clear result of their scan, making it easy for them to see where they currently stand and what areas they can improve. It helps them understand what steps they can take next.
- ADMA allows for better communication between the TranS4Mers and the company. This helps the company rethink their strategies and work together more effectively.

Weaknesses:

- Some companies might think that ADMA projects are a waste of time and struggle to understand the benefits they can get from the methodology. It can be challenging to convince them of the value and advantages of the approach
 - The ADMA journey can take a long time, requiring a significant investment of time and resources. This might lead to impatience, especially if companies want quick results or have tight timelines.
5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?
 - Advanced manufacturing Technologies
 - ECO factory
 - Value Chain Oriented Open Factory
 6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

Yes, it is indeed useful to identify the next steps in the digital transformation journey of SMEs. By doing so, SMEs can gain valuable insights and guidance to navigate their transformation



process effectively. Identifying the next steps involves not only providing technical services or implementations but also offering advice and free consultation.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

The ADMA methodology is more suitable for medium and large companies rather than micro and small enterprises. The ADMA scan may result in lower scores for micro and small companies due to their limited resources and capabilities. The size of the company is the primary factor that impacts the applicability of the ADMA methodology.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

It is necessary for the Trans4MEs to complete the scan themselves beforehand and be adequately prepared. This preparation includes having a comprehensive understanding of the ADMA methodology as well as in-depth knowledge about the company undergoing the digital transformation. By knowing everything about the company, including its goals, processes, challenges, and resources, the Trans4MEs can tailor the ADMA scan to the specific needs and characteristics of the company.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MEs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Based on direct interaction with SMEs within ADMA TranS4MEs, my perception is that some companies haven't started their digital transformation before due to two main reasons: lack of time and lack of perceived financial benefits.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

The impact of the lack of employee skills on the decision not to start a digital transformation can vary. Management may not consider it a significant factor, but employees may feel scared or uncertain about the changes involved.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

No, there are no specific requirements from the SME to carry out ADMA scans. The ADMA scan is the initial step of the project, and it is crucial for the SME to understand the methodology and its objectives.

12. Which ADMA topics do you find more interesting for SME-s? Why?

One of the most interesting topics was Smart Manufacturing and, additionally, I found interesting the fact that SMEs are often attracted to ADMA topics in order to access European funds. Many SMEs see the opportunity to secure funding from European initiatives as a way to support their digital transformation efforts.



13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

No.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Samuel Nazzareno Monaco and Eda Ipek

Name of the interviewee: Ioana Dragos

Company: North West Regional Development Organization

Country: Romania

Date: 23-05-23

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

The ADMA methodology can be considered useful as a first step in the digital transformation journey of SMEs. While it may not be sufficient on its own, it serves as a valuable tool for assisting companies in assessing their current stage and establishing a foundation. It helps companies prioritize their digital transformation initiatives by identifying the most relevant areas for improvement and evaluating their willingness and readiness to undertake them.



2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

At a first glance, having a deep knowledge of the ADMA methodology can be beneficial for being a good TranS4MEr, as it enables effective guidance through the digital transformation process. However, if the company desires a more comprehensive approach, additional knowledge and skills are necessary. While a strong understanding of ADMA is sufficient to guide the company through the process, going deeper into other related areas and acquiring additional expertise may be required to address complex technical issues and ensure a successful digital transformation journey.

3. Did you do any ADMA scan?

Yes.

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths:

- Provides a general framework for TranS4MErs, enabling them to act as true assistants to the company.
- Offers written materials that serve as reliable resources for guidance and reference.

Weaknesses:

- Lack of digital expertise: The ADMA methodology does not provide access to a dedicated digital expert who can offer specialized knowledge on how to effectively digitalize specific areas. It focuses more on capacity building and providing general knowledge, rather than tailored implementation strategies for individual companies.
- The knowledge gained through ADMA is often of a general nature, which can make it challenging to determine how to implement it effectively within a specific company's context. The methodology may not offer detailed guidance on the practical application of digital transformation in specific business processes.

5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

The most common transformation area found to have potential for improving SME competitiveness is implementing a digital factory, specifically since companies are interested in interconnecting machines.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

Of course, especially because after the scan, the next step is the Implementation Journey Review meeting and then the Transformation Plan. Having performed the ADMA scan together



with the company and having the related questions within the guide, we were able to discuss the next steps, otherwise it is just static information for the company. The next steps helps the company to prioritize and this is the added value of the TranS4MErs.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

It is suitable for any size of company in the manufacturing sector.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

One important consideration is that TranS4MErs need to provide assistance to the company during the scan, as there may be language barriers that obstacle their ability to complete the scan independently. Additionally, having technical competencies can be advantageous, although it is not a compulsory requirement.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

- Reluctance to change
- Uncertainty about where to start
- Cost concerns
- Lack of knowledge and skills

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

The lack of skills within the management board can have a significant impact on the decision not to start a digital transformation. If the board lacks the necessary skills and knowledge, they may be hesitant to initiate digital initiatives due to uncertainties or concerns about effectively implementing and managing the transformation process.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

No, specific requirements from the SMEs are not necessary to conduct ADMA scans. The questions used in ADMA scans are generally broad and applicable to various situations. However, it's important to note that some questions may pertain to connecting equipment, but they do not specifically address whether the equipment is digital or not. Therefore, the initial level of digitalization may not be fully assessed through these questions.

12. Which ADMA topics do you find more interesting for SME-s? Why?

SMEs generally find the "Digital factory" topic interesting because it directly relates to their operations. However, the connection between ADMA and the digital factory concept is limited. Other ADMA topics, such as "Human-centered organization," "End-to-end customer engineering," and "Value chain-oriented open factory," are more directly connected to the services offered in ADMA. These topics focus on process improvements and aligning with customer needs, making them particularly relevant and practical for SMEs.



13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

Another methodology to support the digital transformation of SMEs is the IMPROVE methodology. It offers a detailed analysis and recommendations but can be more static and time-consuming. ADMA, on the other hand, goes a step further by providing follow-up services and ongoing support.

Also the European tool DTA, adopted by the DIH, is used as a first step, but it lacks the follow-up aspect. To maximize effectiveness, there should be harmonization and synergy among different tools and methodologies.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

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☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Samuel Nazzareno Monaco and Eda Ipek

Name of the interviewee: Merete Nørby

Company: MADE

Country: Denmark

Date: 30-05-2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

Yes, the ADMA methodology is useful in the digital transformation journey of SMEs. It facilitates discussions about the company's needs and goals, providing a structured approach to stimulate



reflection on the company's broader aspects such as possibilities, weaknesses, and strengths. The ADMA questionnaire encourages SMEs to evaluate their current digital capabilities, customer engagement strategies, operational efficiency, and areas for improvement. This reflection helps identify gaps and areas where digital transformation efforts can have the most significant impact.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

No, having a deep knowledge of the ADMA methodology alone is not enough to be a good TranS4MEr. While the ADMA methodology is a valuable tool, it is meant to complement the existing knowledge and expertise of consultants in manufacturing companies. The methodology serves as a framework to structure and enhance the knowledge that is already present.

The ADMA methodology is specifically designed to build upon existing knowledge of production and manufacturing techniques. Without a solid understanding of these foundational concepts, it would be challenging to effectively utilize the methodology.

This combination of domain knowledge and methodology expertise enables consultants to effectively guide and support the digital transformation journey within manufacturing companies.

3. Did you do any ADMA scan?

Yes

- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

STRENGTHS:

1. Simplicity: The ADMA methodology provides a straightforward structure that allows users to navigate and answer questions without requiring a complete understanding of all aspects. This ease of use makes it accessible to a wide range of users.
2. Benchmarking: The methodology enables comparisons between companies within the same industry and across different countries.
3. Old yet Fundamental: The ADMA methodology has retained its relevance by providing a basic, foundational framework for digital transformation. Its simplicity makes it approachable and easy to implement, despite being an older tool that might differ from more recent advancements.

WEAKNESSES:

1. Limited Technological Scope: The ADMA methodology may not fully encompass all the latest advancements and emerging technologies.
2. Language Limitation: As the methodology is primarily available in English, it may pose a disadvantage for individuals or organizations that have a preference or requirement for using other languages.
3. Subjectivity and Consultant Influence: The conclusions drawn from the ADMA methodology can be influenced by the perspectives of the consultant involved. The interpretation of the results may vary depending on the expertise and approach of the TranS4MEr. This subjectivity can introduce variability in the outcomes obtained during the assessment process.



5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?
 - Digital Factory
 - Smart factory
 - Value Chain because it has so much to do with the survival of the SMEs in the longer run.
6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

Yes, it is useful to identify the next steps in the digital transformation journey of SMEs. Having another area or perspective to know what to do next is important. For example, in a longer perspective, if you don't consider the value chain, it could lead to potential risks. It is better to have a potential way forward rather than not having any direction at all.

7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

Yes, the ADMA methodology is suitable for manufacturing companies, including both SMEs and larger companies, but it is important to underline that its core focus and applicability lie within the manufacturing industry.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

Yes, it is necessary for the TranS4MEr to have certain requirements to carry out ADMA scans effectively. While it is important for the transformer to understand the methodology, it is also essential for the transformer to possess manufacturing knowledge. This adds value and quality to the dialogue during the ADMA scans. Having a solid understanding of manufacturing processes allows the TranS4MErs to have more meaningful discussions, provide relevant insights, and offer tailored recommendations for digital transformation within the manufacturing context.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?
 - Difficulty in Knowing Where to Start: Many companies struggle with understanding the initial steps and finding a clear starting point for their digital transformation journey.
 - Lack of Clarity on Advisory Support: Some companies express uncertainty about who to turn to for guidance and advice on how and where to start their digital transformation.
 - Time Constraints: Embarking on a digital transformation journey requires time and resources/daily operations.
10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?



Without digital skills, the process may appear more complicated, leading to uncertainty and hesitation. Conversely, employees with digital skills are more likely to have prior experience with digital journeys and approach transformation with confidence.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

One crucial requirement is the openness to acknowledge that the industry is vast and complex, and they don't need to understand everything. It is important for SMEs to recognize that embarking on a digital transformation journey can be challenging, but taking small steps is better than not taking any step at all.

12. Which ADMA topics do you find more interesting for SME-s? Why?

Eco factory, because its broad scope provides SMEs with flexibility and numerous opportunities.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

Yes, there are other methodologies available to support the digital transformation journey of SMEs. Two such methodologies are the Denmark regional officers' "Growth Wheel" and DIQ in Germany.

The "Growth Wheel" methodology, similar to ADMA, follows a structured approach and identifies various areas relevant to the digital transformation journey. However, it differs in that it contains more questions, which can sometimes lead to a reluctance to answer. On the positive side, the additional questions provide an opportunity to gain more knowledge and insights into specific areas, allowing for a more comprehensive analysis.

DIQ, on the other hand, acts as a link to guide SMEs towards their desired digital transformation goals. It provides a framework to define where the company wants to be in terms of digitalization. DIQ is a very large and extensive questionnaire that requires long time and many resource to fill out. If you want to invest a lot in investigating 'as is' you can also get better 'to be' suggestions – but it takes resources.

Ultimately, the important aspect is to take action and select a methodology that aligns with the company's goals, allowing them to progress and make tangible strides in their digital transformation journey.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.



☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Samuel Nazzareno Monaco and Eda Ipek

Name of the interviewee: Peter Lemcke Frederiksen

Company: Danish Technological Institute

Country: Denmark

Date: 22-05-2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SME-s?

Yes, it is useful. ADMA methodology provides a valuable tool and perspective for companies to determine resource allocation in their digital transformation journey. It is applicable and makes sense for all companies. However, it is important to note that not all companies require a comprehensive 360-degree overview, as many already have a clear understanding of where they want to focus their efforts. For some, a meeting and general discussion on improvement strategies may be more enough.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

Having a deep knowledge of the ADMA methodology is valuable in becoming a competent TranS4MEr, but it is not the sole requirement. While understanding the ADMA methodology is important, it is equally essential to have a general understanding of manufacturing in order to effectively engage with manufacturing companies. It is necessary to possess basic knowledge and be familiar with the common challenges faced by these companies. Additionally, having a general overview of the potential obstacles that these companies could encounter in the future can further enhance your ability to support them in their digital transformation journey.

3. Did you do any ADMA scan?

Yes.



- a. If the answer is yes continue with question number 4
- b. If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths:

- The ADMA methodology has a specific focus on manufacturing, making it highly relevant and tailored to the needs of manufacturing companies.
- The Transformation Plan (TP) generation process is efficient and not complicated. The platform simplifies the collection of both the answers and the scans.
- The ADMA methodology offers a comprehensive overview of the seven different transformation areas, allowing companies to gain a holistic view of their operations and identify improvement opportunities.

Weaknesses:

- The voucher system provided by ADMA for funding digital transformation initiatives is often considered inadequate by many companies. The voucher amounts are small, and the application process can be time-consuming, leading companies to explore alternative funding opportunities at the national level.
- Most of the companies prefer to have a local partner to assist them in their transformation journey, which may not always be readily available within the ADMA framework.
- It can be challenging for Trans4MEs to identify and address areas that require improvement within the company. Each company has unique needs and requirements, and finding a suitable match between the company and the service provider can be a complex task. Direct communication and collaboration between the company and the service provider are necessary to ensure a good fit.
- The terminology used in the ADMA methodology could be simplified to improve clarity and ease of understanding.

5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

- Digital factory
- Smart manufacturing
- Eco factory

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

Yes, it is highly beneficial to identify the next steps in the digital transformation journey of SMEs. Creating a lightweight roadmap for the company helps prioritize actions and initiatives. This roadmap can also assist SMEs in applying for national funds and securing financial support for their digital transformation efforts.



7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

The ADMA methodology it is not suitable for every SMEs, but only manufacturing SMEs.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

In order to carry out ADMA scans effectively, it is necessary for the transformer to meet certain requirements, such as:

- Manufacturing expertise
- Knowledge of the ADMA framework:
- Experience as a consultant in the manufacturing sector

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

There are various reasons why some companies have not embarked on their digital transformation journey. One common reason is the limited availability of resources, both in terms of finances and personnel. Additionally, there may be a lack of knowledge about the potential benefits and opportunities that digital transformation can bring. Another one is the lack of skilled labor. In fact, skilled labor often seeks opportunities to work with the latest technologies.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

The impact of employees' lack of skills on the decision not to start a digital transformation can be significant. Skilled workers play a crucial role as they possess the expertise to recognize the practical benefits and opportunities associated with specific digital processes, since they search the emerging trends. They can see the concrete opportunities in embracing digital transformations.

11. Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

In order to carry out ADMA scans, it is essential to have someone with the necessary knowledge and understanding of the business processes within the SME. It is not just anyone who can fill out the questionnaire effectively; ideally, it should be someone like the CEO or production manager who possesses the requisite expertise and insights into the company's operations.

12. Which ADMA topics do you find more interesting for SME-s? Why?



For SMEs, the ADMA topics that are often found more interesting are Digital Transformation, Smart Manufacturing, and Eco Factory. These topics are particularly appealing because their terminology is relatively easier to comprehend compared to the others.

13. Do you know any other methodology to support the digital transformation journey of SME-s? Give us advantages and disadvantages comparing with ADMA.

There are indeed other national methodologies available. These include both very specific tools and more general methodologies. The ADMA Methodology is a good compromised when it comes to the Manufacturing sector since it is not too specific nor too general.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Samuel Nazzareno Monaco and Eda Ipek

Name of the interviewee: Chiara Lazzaroni

Company: Quantra S.r.l.

Country: Italy

Date: 23-05-23



1. Do you think that ADMA methodology is useful in the digital transformation journey of SMEs?

Yes, because the ADMA methodology serves as an initial step in a company's digital transformation journey. It acts as a starting point by creating awareness of the company's current status, which is crucial for determining future goals. ADMA is designed to facilitate continuous improvement throughout the transformation process.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good Trans4MEs?

It is a necessary condition to successfully support the company in completing it, but it is not a sufficient condition. A fundamental contribution we can make is when we provide concrete examples. Merely reading the theory is not enough; it is not sufficient. However, presenting practical examples helps companies to relate and understand better.

3. Did you do any ADMA scan?

6 (in 2019 other 8)

- If the answer is yes continue with question number 4
- If the answer is no continue with question number 12

4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Strengths:

Structure: The ADMA methodology is organized into levels, allowing companies to understand their current position and potential for growth.

Qualitative significance: Each level is accompanied by a description that helps companies grasp the implications of being at that particular level, giving qualitative meaning to the quantitative aspects.



Standardization: By creating a standardized methodology, ADMA enables companies to compare themselves with other European SMEs, fostering benchmarking and knowledge exchange.

Weaknesses:

Compatibility challenges: Some sub-themes within the ADMA methodology may be difficult to apply in certain business contexts, particularly in operational departments, such as how people are organized within the company.

External support required: Completing the ADMA questionnaire without external support can be challenging, indicating a need for assistance or guidance.

5. After doing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SME?

Undoubtedly, the digital factory transformation is one of the most commonly chosen areas by companies as a priority. This is likely because it is a topic that companies genuinely recognize as important, and the Italian workforce has focused on it in recent years, particularly with the advent of Industry 4.0 and related incentives.

In terms of identifying common areas for improvement in competitiveness for SMEs, one notable area is the integration of their company with external stakeholders, particularly within the supply chain. Although seen as a valuable enhancement that would lead to increased competitiveness for both individual companies and the entire supply chain, it remains a challenging step to undertake.

6. Is it useful to identify next steps in the digital transformation journey of SME-s? (For example, applied research, technical services or implementations required by the SME). Give us examples of implementations. Describe difficulties.

It is definitely useful as it allows SMEs to have a concrete and tangible understanding of the path they need to take, both in terms of resource efforts and financial efforts. I have often encountered companies with clear objectives but with a strong difficulty in outlining the steps to be taken (such as activities to be carried out, involvement of external resources, and adoption of technologies) to achieve those objectives.



7. Do you find ADMA methodology suitable for any kind of SME? (Size of the company, activity sector, location...)

The ADMA methodology can be implemented in any manufacturing SME, regardless of the company's size, geographical location, or industry. However, the application of the methodology can sometimes be challenging for SMEs with poorly structured processes and organization. This difficulty is particularly pronounced for companies that provide manufacturing services for others, as they may lack their own designs and control over the T4 level.

8. Do you find necessary any kind of requirement from the transformer to carry out ADMA scans?

I believe there are three fundamental requirements to successfully support SMEs in completing the scan:

An excellent understanding of the scan itself, in order to explain the structure and how it should be filled out efficiently and effectively for the benefit of the company.

The ability to provide concrete and suitable examples for each level, tailored to the SME being analyzed, in order to assist them in evaluating themselves in the best possible way.

Critical thinking, which involves analyzing and reasoning about the given responses to ensure they align with the company's reality. It also includes verifying that the person completing the questionnaire truly understands the questions, as without a good comprehension of the inquiries, it is impossible to provide accurate answers for their own company.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MEs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Among the main reasons, there are:

Limited availability of internal resources that could dedicate themselves to the digital transformation project, resulting in difficulty in allocating time from regular activities to extraordinary ones.

Difficulty in defining priorities to sequence an improvement plan in a logical and feasible manner.



Desire to handle everything internally (in sporadic and discontinuous ways) without relying on external resources due to a lack of trust and/or financial resources.

Difficulty in determining the cost-benefit of certain improvement actions and consequently obtaining approval from top management.

Lack of confidence in the people within certain business functions compared to others.

10.How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

It can be a determining factor, but in my opinion, the aversion to change is even more significant. Skills can be learned, whereas changing a culture rooted in tradition and a reluctance to change habits and step out of one's comfort zone is more challenging. In my view, the lack of skills can instead contribute to the failure of the transformation journey.

11.Do you find necessary any kind of requirement from the SME to carry out ADMA scans?

Transparency and honesty in the response. The desire to truly understand where one stands, without being afraid of the final evaluation that will emerge, but with the awareness that whatever the level of maturity, it is only the real starting point from which to begin improving.

12.Which ADMA topics do you find more interesting for SME-s? Why?

It is difficult to provide a general and non-specific answer, as each situation is unique, and each topic is more or less relevant to the company's business, its level of maturity, and its current and future objectives. Among the supported SMEs, the topics that have generated the most interest are:

The digital factory (T2) and the open factory integrated in the supply chain (T7), for the reasons mentioned earlier.

The smart factory (T6), especially regarding production planning. In a rapidly changing world, production planning and flexibility in managing change are key factors for successful companies.



13. Do you know any other methodology to support the digital transformation journey of SMEs? Give us advantages and disadvantages comparing with ADMA.

No, I am not familiar with another one in detail to be able to make comparisons.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

When the interview is finished, the information collected will be sent to the interviewee by email and the interviewee will have to give his/her consent for this information to be used in the report that will be created in the LCAMP project. If the interviewee does not reply to the e-mail within a maximum of 10 working days after the e-mail has been sent, the interviewee will be considered to have agreed to the information collected in the interview.

☒ YES

☐ NO

FIELD RESEARCH ON ADMA METHODOLOGY - INTERVIEW

Name of the interviewer: Volkan Alparslan Kılıç

Name of the interviewee: Ints Viksna

Company: Latvian Technological Center

Country: Latvia

Date: 07/06/2023

1. Do you think that ADMA methodology is useful in the digital transformation journey of SMEs?

Partly, why I am saying that it is partly because it's very hard to say that methodology is just exactly what is needed for digital transformation of SMEs, because this digital transformation can take different shapes. And currently we are mainly concentrating on manufacturing digital transformation shape. But inside the company, there are a lot of other digital transformations



possible, not only in the manufacturing part, that is mainly ADMA, because ADMA is advanced manufacturing. So from this point of view, this is partly this methodology is useful in digital transformation journey of SMEs. Besides manufacturing SMEs, there are also a lot of other SMEs like service SMEs. For example. For them, this can be applied, this Admin methodology, but with very strong limitations and with very strong bordering. So that's why I'm answering the question.

2. Do you think a deep knowledge of the ADMA methodology is enough to be good TranS4MErs?

Also partly because none of the projects can work and cover 100% of methodology, ADMA provides the basics or up to medium level of this knowledge for these transformers. And still transformers need to have their own experience, how to adapt in specific cases, how to make translations in specific cases, and how to service the companies that might have manufacturing something like as a part of all their process. So this is that I'm saying that we cannot say that admitted is 100 methodologies that is good for transformers, it is good, but you have to have also your in house knowledge and experience.

3. Did you perform any ADMA scan?
 - a. If the answer is yes, please continue with question number 4 YES
 - b. If the answer is no, please continue with question number 12
4. Give us 3 strengths and 3 weaknesses of the ADMA methodology.

Methodology regarding ADMA SCAN.

Because the sad question was about the Admascan. So I assume that it is related somehow to the Admascan. Regarding the Sad muscan, it is one strength. Definitely. It is that it is already based on existing scan methodology that was tested well before this ADMA project was started. This is a strength definitely. Because there was no need to develop it from the scratch. Then the second strength of this Admascan, it is that it can be performed by SMEs independently. So they don't need to have ADMA experts sitting behind them or besides them. So this structure of this ADMASCAN it is quite nice and it's quite understandable. The sad strength is that despite this atmosphere let's say it is rather short questionnaire, short scan. But it can provide a basic overview of all this digitalization process inside the company.

Basing on all these priorities. That is definitely also the scan. The weakness of this admission scan three weaknesses. Maybe I will not say three weaknesses. Maybe there are two weaknesses. One weakness is that the formulation of these answers is a bit complex. And then in this case, the companies prefer to have them in their national languages. Because not all of them understand so well English. That is the weakness of ADMA SCAN. But it can actually be solved making translation of this ADMA SCAN in native languages. This is as a weakness. Then the second weakness is what I already mentioned under point one is that as a project it is more concentrated towards advanced manufacturing. It means manufacturing



companies. So in this case, the companies where this manufacturing process is not so deeply integrated in their main business they are something between manufacturing and services.

For them, this ADMA SCAN it is quite complicated to be applied. But still there is also options. So if it is a weakness but it is not a huge weakness. Regarding the third weakness, I cannot say. I can identify only two of them.

5. After performing the scans, what is the most common transformation area that you found is needed to be tackled or has a good potential for the improvement of competitiveness of the SMEs?

Transformation area. You mean from these priorities. What is transformation area? There are priorities eight priority axis in that methodology.

Yeah. Regarding this is about this transformation animals. For us it is the main was this I have to check it now in the documents. I can't remember exactly. But for us it was this advanced manufacturer just a second. I will take out some papers. What? I have some notes already. Just a minute.

I hope it is working. But yeah, it was this advanced manufacturing eco factory. And what was the sad one? Smart manufacturing, I guess. Yeah, that was the sad one. Where we have these priorities where we have most of all interest coming from companies and also this transformation of plants lies most of all in these three areas. Then what else I can add? Well, that's it.

6. Is it useful to identify next steps in the digital transformation journey of SMEs? (for example, applied research, technical services or implementations required by the companies). Give us examples of implementations. Describe difficulties.

Yes, it is. But actually we have to look on this a bit from other perspective and we have to look it not only that it is 100 sure that Cow company will implement this transformation and implementation plan, but we have to look it from other perspective. And this perspective is that the company has to start thinking about transformations, about the digital transformations. And actually if they have already agreed to be part of this admit, means that they have already started thinking that they need or might need these digital transformations. The question is of course to what stage they are and are they ready for these digital transformations? That is a very good question. And usually the companies have these problems with this readiness and why do they have these problems?

Because, you know, everything depends on financial resources of the company and that is obviously logically. And if these resources are not so many, then yes, digitalization it is interesting process. Yes, we want to have it. Can we afford it? No, we cannot afford it. And then there is a place where we can step in as the ADMA transformers with our services and then we can help them provide these services, let's say for free. This is one position and the



next position for these next steps. It is also a good thing to discuss is for example, there are two SMEs. One is SME where is working, let's say four or five people. And all this, let's say client management they are doing on the paper with the pen and pencil. And then there is company where is working more than 200 people.

They have robots, cobots they have all these digital solutions and so on. And then comes the question where this ADMA transformation plan and transformation journey is most useful for this small SME where four people are working. And for them, let's say they will be trained or taught to use the Excel or access. It doesn't matter at this moment what program. I'm just saying to see these levels for them, this training for usage of Excel or Access or for this huge one medium sized company who will buy the next robot. Definitely from the digitalization point of view, the most valuable impact will be in a small company where they will be just teaching Excel because they will have for them it will be like a built robot factory from scratch.

They was not using it and now they can use it and they can become more efficient, they can become more competitive in the market. Maybe they can even find some new solutions. Or maybe they will be able to offer new services that they was not able to offer before because they were lacking of the stuff. Not enough people working and they cannot afford to contract more. So this is a question and this is the next tech steps that should be also identified in this transformation journey by admit transformer experts when they are preparing this plan and implementation plan. This is my point of view. Maybe it is wrong, but this is what we have noticed.

7. Do you find ADMA methodology suitable for any kind of SME? (size of the company, activity sector, location...)

For any kind. Okay, let's from this question I will split it of course about the size of company. Yes for every size of company depends for which size of companies there will be more benefits for which size of companies there will be less benefits. Because for smaller micro companies, definitely yes for medium size and of course for large companies where they have a lot of resources. Could be. But they have all other potential possibilities that they can utilize for the development. Regarding activity sector, again depends manufacturing yes, practically I would like to say no, yes, maybe, but even all manufacturing sectors at this moment we have not identified any of these sectors where this methodology could not be implemented.

But regarding this, let's say service sector, if the company is working, it is complicated, then you have to work and then adopt this methodology according to company type. And you have to make something like a bridging by understanding what is this one can be called as manufacturing. For example, laboratories, they are taking some samples, they are doing some it is like a service, but it is some manufacturing because they produce the results.

Volkan: Okay, so shortly we can say it's hard to generalization of Admin methodology for every SME it depends on size of company or which sector it depends on. But you think still suitable?

Yes, it is suitable. Let's say if we're looking from one to ten, one is totally unsuitable. Ten is suitable. That I would like to say eight to nine.



8. Do you find necessary any kind of requirement from the TranS4MEr to carry out ADMA scans?

Yes, I think and then we have also implemented it not only on our company level, but it is also in the project level also.

For example, the same quality mark, for example.

9. Also based on the direct interaction with the SMEs (within ADMA TranS4MErs), what is your perception about the reasons why some companies haven't started their digital transformation before?

Practically I already partly answered this question. They don't need it and they are not thinking about it till the moment when the operation of the company fully satisfies the revenues and incomes of the company owners. And so why do they need to implement and new technologies methodologies? Why do they need to buy new machinery? They are happy with this one. If they have this plan, yes, then they have this development plan and then they are going according to this plan and this is somehow also answered on this question.

10. How much do you think the lack of skills of employees has an impact on the decision of not starting a digital transformation?

I would like to say that the skills of employees, I think definitely do not have any impact on decision-making decisions. Of course, if it is not something like Gila project management or democracy or whatever in the company, everybody has his own opinion and nothing is happening. But the development of the company is usually normal companies. It is the decision of the senior management CEO and also this related level. And then according to the decisions, the company is going for digitalization or not digitalization, and then the rest, the medium level of management and lower medium of management and just staff members, have to do what is requested by the company owners and by the company operation. So if the staff is lacking some knowledge or competence, the staff can be trained at any moment.

And if the staff is not willing to do it, then we can get rid of the stuff. That's easy.

11. Do you find necessary any kind of requirement from the SMEs to carry out ADMA scans?

Yeah, they have before the admission is performed, they have to think a bit about what is happening in their company, how it is organized, and how is the process currently organized. And also somehow they have to think about what do they want to have as a goal of this transformation and this admission, what do they want to understand, and how they will make interpretations of this ADMASCAN? This is one thing, and the second thing is that it may be



my message to all of them who want to do something like that is that this admission should not be taken like it is. God said that it is so. No, it is just one of the tools where you can see maybe some weaknesses, maybe some opportunities in the future. And based on that point of view, you have to build the next transformation implementation plan.

12. Which ADMA topics do you find more interesting for SMEs? Why?

Smart manufacturing and advanced manufacturing. These are the top ones.

13. Do you know any other methodology to support the digital transformation journey of SMEs? Give us advantages and disadvantages comparing with ADMA.

Well, there are quite many of them. I will not be able to list them. For example, our company by ourselves, we have also our digital transformation journey methodology, which we have developed practically in parallel with ADMA. We have also adopted something from the ADMA. At the same time we have also adopted something from such is there such innovative audit tool that was developed by World Bank and it is called the Korean method. We have this, let's say, new digitalization transformation methodology developed by ourselves. But as far as I know, the addicts have their own also the methodology for digital transformations. Because these addicts currently have these funding possibilities and due to this, they have their own scanned before the project is accepted.

And then the second scan after the project is accepted and implemented, and only after that, they provide this grant and vouchers to the company. So yeah, there are several.

I acknowledge that my name may appear in the report on the ADMA methodology of the LCAMP project and I consent to its use.

☒ YES

☐ NO

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☒ YES

☐ NO



10.1.2.5 Conclusions of the Filed Research on ADMA

From these interviews, a deep insight into the reality and impact of ADMA in enterprises has been gained, which has led to the decision to use this methodology in the LCAMP project. In particular, the focus will be on the implementation of ADMA in vocational schools, where teachers will play a key role on the road to technological innovation in SMEs.

Key learnings from the interviews

During the interviews with ADMA experts, essential knowledge has been gained about the principles, applications and benefits of this methodology. It has been understood how ADMA is based on the use of advanced technologies in manufacturing processes, such as automation, robotics, data analysis and artificial intelligence among others. Furthermore, it has been identified how ADMA can help SMEs improve the efficiency, productivity and quality of their manufacturing processes.

The interviews revealed that ADMA is having a significant impact on companies in the manufacturing sector. The implementation of advanced technologies, such as robotics and automation, has enabled organisations to improve the speed and accuracy of their manufacturing processes. In addition, data analytics and artificial intelligence have facilitated decision-making based on real-time information, which is leading to greater efficiency and optimisation of resources. The use of ADMA has driven product innovation and enabled companies to adapt quickly to market changes.

Based on the learnings from the interviews, the decision to use the ADMA methodology in the LCAMP project has been taken. This project aims to boost technological innovation in VET, and it is considered that ADMA will play a key role in this process. Teachers in these schools will play a key role in educating students about advanced manufacturing technologies and in collaborating with companies to implement innovative solutions in their production processes. Through the use of ADMA, teachers will be able to teach students the skills necessary to adapt to industry demands and promote business competitiveness.

In conclusion, interviews with ADMA experts have provided a deep understanding of the ADMA methodology and its impact on SMEs. Based on these learnings, the decision has been taken to use ADMA in the LCAMP project, focusing on its application in VET. It is considered that teachers will play a crucial role in educating students about advanced manufacturing technologies and in collaborating with companies to implement innovative solutions in their production processes. In turn, through the use of ADMA, as teachers will increase their technological skills and better understand the surrounding business ecosystem, students can



be taught the skills necessary to adapt to the demands of industry and promote business competitiveness.





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