Project EASME/COSME/2014/014

An analysis of drivers, barriers and readiness factors of EU companies for adopting advanced manufacturing products and technologies

Deliverable 4 (based on WP3 – Tasks 3.1 and 3.2)

Policy Recommendations

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<th>Description</th>
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<td>ACTPHAST</td>
<td>Access Centre for Photonics Innovation Solutions and Technology Support</td>
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<tr>
<td>ADIttech</td>
<td>Advanced Innovation and Technology Corporation</td>
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<tr>
<td>AFIL</td>
<td>Associazione Fabbrica Intelligente Lombardia</td>
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<tr>
<td>AiF</td>
<td>Arbeitsgemeinschaft industrieller Forschungsvereinigungen</td>
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<tr>
<td>AMP</td>
<td>Advanced Manufacturing Park</td>
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<td>AMT</td>
<td>Advanced Manufacturing Technologies</td>
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<tr>
<td>AWS</td>
<td>Austria Wirtschaftsservice Gesellschaft</td>
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<tr>
<td>BIC</td>
<td>Business and Innovation Centre</td>
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<tr>
<td>BMBF</td>
<td>Bundesministerium für Bildung und Forschung</td>
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<tr>
<td>Bpifrance</td>
<td>Banque Publique d'Investissement France</td>
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<tr>
<td>CECIMO</td>
<td>European Association of the Machine Tool Industries</td>
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<tr>
<td>CEN</td>
<td>European Committee for Standardization</td>
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<tr>
<td>CENELEC</td>
<td>European Committee for Electrotechnical Standardization</td>
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<tr>
<td>Cetim</td>
<td>Technical Centre for Mechanical Industry</td>
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<tr>
<td>CFI</td>
<td>Cluster Fabbrica Intelligente</td>
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<tr>
<td>COSME</td>
<td>Competitiveness of Small and Medium-sized Enterprises</td>
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<tr>
<td>EFG</td>
<td>Equity Facility for Growth</td>
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<td>CPR</td>
<td>Common Provisions Regulation¹</td>
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<tr>
<td>CSA</td>
<td>Coordination and Support Action</td>
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<td>DAMRC</td>
<td>Danish Advanced Manufacturing Research Centre</td>
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<td>DHBW</td>
<td>Duale Hochschule Baden-Württemberg</td>
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<td>DIH</td>
<td>Digital Innovation Hub</td>
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<td>DoW</td>
<td>Description of Work</td>
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<tr>
<th>Abbreviation</th>
<th>Full Name</th>
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<tr>
<td>EACEA</td>
<td>European Education, Audio-visual and Culture Executive Agency</td>
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<td>EBN</td>
<td>European BIC Network</td>
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<td>EC</td>
<td>European Commission</td>
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<tr>
<td>ECCP</td>
<td>European Cluster Collaboration Platform</td>
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<td>ECEI</td>
<td>European Cluster Excellence Initiative</td>
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<tr>
<td>ECSEL</td>
<td>Electronic Components and Systems for European Leadership</td>
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<td>EEN</td>
<td>Enterprise Europe Network</td>
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<td>EFFRA</td>
<td>European Factories of the Future Research Association</td>
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<tr>
<td>EFSI</td>
<td>European Fund for Strategic Investments</td>
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<td>EIB</td>
<td>European Investment Bank</td>
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<td>EIF</td>
<td>European Investment Fund</td>
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<td>EIT</td>
<td>European Institute of Innovation &amp; Technology</td>
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<td>EMS</td>
<td>European Manufacturing Survey</td>
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<td>ERDF</td>
<td>European Regional Development Fund</td>
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<td>ERRIN</td>
<td>European Regions Research and Innovation Network</td>
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<td>ESCPs</td>
<td>European Strategic Cluster Partnerships</td>
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<td>ESIF</td>
<td>European Structural &amp; Investment Funds</td>
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<td>ESF</td>
<td>European Social Fund</td>
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<tr>
<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
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<tr>
<td>EU</td>
<td>European Union</td>
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<tr>
<td>EXPLORE</td>
<td>Extended Exploitation of European Research Projects’ Knowledge and Results</td>
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<tr>
<td>FabLab</td>
<td>‘Fabrication Laboratory’, a type of Makerspace</td>
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<tr>
<td>FHprofUnt</td>
<td>Forschung an Fachhochschulen mit Unternehmen</td>
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<tr>
<td>FoF</td>
<td>Factory of Future</td>
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<td>FTIPilot</td>
<td>Fast Track to Innovation Pilot</td>
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<td>H2020</td>
<td>Horizon 2020</td>
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<td>HPC</td>
<td>High-Performance Computing</td>
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<td>HPMT</td>
<td>High-Performance Manufacturing Technology</td>
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<td>HVM</td>
<td>High Value Manufacturing</td>
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I4MS  ICT Innovation for Manufacturing SMEs
IAF  Instituto Aragonés de Fomento
IBB  Investitionsbank Berlin
ICT  Information and Communication Technology
IGF  Industrielle Gemeinschaftsforschung
IMCP  Investing in Manufacturing Communities Partnership
IMI  Institute for Manufacturing Innovation
INFRADEV  Development and long-term sustainability of new pan-European research infrastructure
INFRAIA  Integrate and open research infrastructure of European interest
INNOSUP  Innovation support to SMEs in Europe
INNOVFIN  EU Finance for Innovators
INTERREG  European territorial cooperation
IPR  Intellectual Property Right
IRT  Institut de Recherche Technologique
KET  Key Enabling Technology
KfW  Kreditanstalt für Wiederaufbau
KIC  Knowledge and Innovation Community
KIC AVM  Knowledge and Innovation Community on Added-Value Manufacturing
KMU  Kleines und Mittleres Unternehmen
KTRM  Knowledge for Transfer of Rapid Manufacturing
LdV  Leonardo da Vinci
LEIT  Leadership in Enabling and Industrial Technologies
LLP  Lifelong Learning Programme
MADE  Manufacturing Academy of Denmark
MEP  Manufacturing Extension Partnership
MIMAN-T  Micro-Manufacturing Training System for SMEs
NFC  Near Field Communication
NNI  National Nanotechnology Initiative
<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tbody>
<tr>
<td>NNMI</td>
<td>National Network for Manufacturing Innovation</td>
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<tr>
<td>NPI</td>
<td>National Photonics Initiative</td>
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<td>NRI</td>
<td>National Robotics Initiative</td>
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<tr>
<td>NRW</td>
<td>North Rhine-Westphalia</td>
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<tr>
<td>PhD</td>
<td>Doctor of Philosophy</td>
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<tr>
<td>PPP</td>
<td>Public Private Partnership</td>
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<tr>
<td>PRI</td>
<td>Plateforme Régionale d’Innovation</td>
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<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>R&amp;I</td>
<td>Research and Innovation</td>
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<tr>
<td>RFID</td>
<td>Radio Frequency Identification</td>
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<tr>
<td>RIM</td>
<td>Regional Innovation Monitor</td>
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<td>RIS3</td>
<td>Research and Innovation Strategies for Smart Specialisation</td>
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<tr>
<td>ROI</td>
<td>Return on Investment</td>
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<tr>
<td>RTD</td>
<td>Research and Technology Development</td>
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<td>RTDI</td>
<td>Research, Technology Development and Innovation</td>
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<tr>
<td>RTO</td>
<td>Research and Technology Organisation</td>
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<tr>
<td>S2E</td>
<td>Stairways to Excellence</td>
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<tr>
<td>SBIR</td>
<td>Small Business Innovation Research Program (US)</td>
</tr>
<tr>
<td>SBRI</td>
<td>Small Business Research Initiative (UK)</td>
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<tr>
<td>SMACC</td>
<td>Smart Machines and Manufacturing Competence Centre</td>
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<tr>
<td>SME</td>
<td>Small and Medium-sized Enterprise</td>
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<td>SMEG</td>
<td>Small and Medium-sized Enterprise Guarantee Facility</td>
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<tr>
<td>SPIRE</td>
<td>Sustainable Process Industry through Resource and Energy Efficiency</td>
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<tr>
<td>SWMAS</td>
<td>South West Manufacturing Advisory Service</td>
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<tr>
<td>TREC</td>
<td>Towards EU Regional Economic Convergence</td>
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<tr>
<td>TRL</td>
<td>Technology Readiness Level</td>
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<tr>
<td>TTO Circle</td>
<td>European Technology Transfer Offices Circle</td>
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<tr>
<td>UK</td>
<td>United Kingdom</td>
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<td>US</td>
<td>United States</td>
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<td>Acronym</td>
<td>Description</td>
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<tr>
<td>VINCI</td>
<td>Vouchers in Creative Industries</td>
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<tr>
<td>VIS</td>
<td>Vlaamse Innovatiesamenwerkingsverbanden</td>
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<tr>
<td>WP</td>
<td>Work Package</td>
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<td>ZAB</td>
<td>ZukunftsAgentur Brandenburg</td>
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<td>ZIM</td>
<td>Zentrales Innovationsprogramm Mittelstand</td>
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Executive Summary

Based on the state of the art (WP1) and on the findings of the empirical analysis (WP2), this deliverable proposes recommendations for policy-makers on the one hand, and for service and AMT providers on the other, to address the main issues that limit the uptake of AMT by SMEs.

As a first step, the new knowledge acquired by the consortium partners through an empirical analysis was critically discussed and shared at an in-house workshop for the main purpose of agreeing on the main issues affecting the adoption of AMT by SMEs. Partners contributed to issue identification, also on the basis of their knowledge and experience of European and international policy processes. The issues identified represent significant drivers and barriers that can be addressed by means of specific actions by policy-makers and service/technology organisations.

In parallel, a desk analysis on the policy context and service offering systems for the uptake of AMT by SMEs was conducted at European, national and regional levels, as well as outside the EU. This analysis brought to light additional issues to those previously identified and identified a number of inspiring examples for addressing issues through proper recommendations.

The issues were then combined in a single framework including financial, funding, competence/skills, technology, supply chain cooperation, service offering and policy framework issues. Macro-areas for improvement (named improvement actions) were defined to address these issues: provide suitable resources for uptake; achieve better qualification for uptake; create new frameworks and infrastructure for cooperation in uptake; and create widespread, efficient service provision networks and improve the political framework for the uptake of AMT by SMEs.

Finally, detailed recommendations to address the improvement actions were developed for policy-makers and service/technology organisations, exploiting the whole body of knowledge gained in the course of the study (detailed drivers and barriers by type of technology or geographical area, inspiring examples, etc.). These draft recommendations were then validated during a policy workshop that took place in Brussels on 13 September 2016.
The recommendations can be summarised under four main headings:

I. Strengthening Capacity for SMEs

Many European firms still lack the capacities needed to adopt AMT. Shortcomings concern their know-how, human capital, organisational and managerial capacity, and funding. Without a better AMT ecosystem for SMEs to support them in building their capacities in all areas of advanced manufacturing, any further offers will be less effective. The detailed recommendations in this category are as follows:

Recommendation I.1. Improve and extend the “AMT ecosystem for SMEs” across all the EU
Recommendation I.2. Improve skills capacity for SMEs
Recommendation I.3. Provide adequate financial support for AMT diffusion

II. Promote High-end AMT Uptake

The uptake of most recent AMT at the frontier of technological development poses significant challenges even for companies that already possess basic innovation capacities. For the uptake of such technologies in more advanced industrial SMEs, high-quality demonstration environments and other suitable framework conditions need to be created to enable SMEs to pilot and uptake the most recent solutions and relevant research findings, in cooperation with research and technology organisations (RTOs) as well as with other relevant AMT firms. The detailed recommendations in this category are as follows:

Recommendation II.1. Promote the development of joint pilot plants and demonstrators
Recommendation II.2. Improve the exploitation of Horizon2020 research by SMEs
Recommendation II.3. Adapt standardisation and regulation to the diffusion of AMT

III. Improve the AMT Offer to manufacturing firms

Currently, many AMT providers still do not completely capture - and consequently meet - the needs of SMEs for the uptake of AMT. Such needs would demand the higher involvement of technology suppliers and customer businesses jointly participating in the uptake process, instead of the traditional customer-supplier relationship. To strengthen the uptake of AMT, new business models for technology providers and machine builders should be promoted that enable their SME clients to invest under conditions of uncertainty.

Recommendation III. Support new service-based business models for the diffusion of AMT

IV. Strengthen policy coordination

While many pertinent support measures are already available in the EU, their coordination across different policy-making levels needs to be improved to reinforce synergies and complementarities, and to offer SMEs a more straightforward and coherent policy framework. This is particularly important in view of the introduction of new measures and tools in forthcoming policy programmes and initiatives.

Recommendation IV. Improve the alignment of EU, national and regional policies
1 Introduction and Methodology

Based on the findings of the empirical analysis on the survey and case studies conducted in D2 and D3, in terms of drivers, barriers and readiness factors for the adoption of AMT, this deliverable provides a number of policy measures and practical recommendations aimed at facilitating and accelerating the uptake of AMT by European SMEs. Draft recommendations were developed by the consortium members and validated at an experts’ policy workshop held on 13 September 2016 in Brussels, with the participation of over 20 policy-makers and experts from all over Europe.

The following four-step methodology was adopted to develop the policy recommendations.

1. Identification of issues based on the results of the empirical analysis
   The results of case studies and survey previously conducted in WP2, in terms of drivers, barriers and SME readiness factors, were critically analysed to pinpoint the most relevant issues affecting the adoption of AMT by SMEs. The results of the empirical analysis were further examined and discussed at a workshop held with the consortium partners at ITIA-CNR in Milan on 16 June 2016, and a set of issues was identified. These issues are either in the form of barriers to be overcome or drivers to be further exploited in policy recommendations to facilitate the uptake of AMT by SMEs. The issues identified suggest “improvement actions” for which detailed policy recommendations are provided.

2. Analysis of existing policy actions and service offerings, and identification of related issues
   A broad range of existing policy actions and service offerings was studied and critically analysed, mapping them at different geographical levels, including regional, national and EU levels, as well as outside Europe. The policy actions refer to programmes, initiatives, platforms, etc., triggered by policy makers to support SMEs in their uptake of AMT, while the service offerings concern various types of service, such as financial services, technology transfer, consulting services, IPRs, etc., that are offered to SMEs by various types of service provider, including financial organisations, clusters, research and technology organisations, universities and training companies. A critical analysis of the existing policy actions and service offerings revealed a set of policy-related issues in addition to those derived from the empirical analysis. Moreover, a number of good practices and initiatives were identified as inspiring examples to consider in the development of policy recommendations.
3. **Combination of the issues identified and definition of improvement actions**

All the issues identified were grouped and classified as “internal” or “external”: the former refer to issues that should be addressed mainly by service providers and companies; the latter should be addressed by policy makers to create a competitive framework suitable for companies. To address these issues, a set of general improvement actions was devised as a guideline for defining policy recommendations, also bearing in mind the general suggestions emerging from the results of the empirical analysis in terms of envisaged policy actions.

4. **Definition of policy recommendations**

A broad and comprehensive set of policy recommendations addressing all the issues identified was developed for the two separate targets, policy makers and service/AMT providers. Draft recommendations were then validated at a policy workshop with experts from different backgrounds. Feedback from the workshop was used to prepare the final version of the recommendations presented in this deliverable. Figure 1 illustrates the methodology adopted.

**Figure 1: Methodology for developing policy recommendations**

Source: own analysis
2 Issues emerging from the Empirical Analysis

The empirical analysis conducted in WP2 prepared the ground for gaining an empirical understanding of the drivers, barriers and readiness factors for the uptake of AMT by SMEs. This analysis included a qualitative case-study research phase focusing on in-depth mechanisms and significant cases, and a quantitative survey research phase providing generalisable insight on a number of items characterising the uptake process. To pinpoint the most relevant issues, the results of the empirical analysis were discussed at an internal project workshop held with the consortium members in Milan on 16 June 2016.

The knowledge gained by the various partners conducting the empirical analysis in their different regions was shared and the following main issues affecting the diffusion of AMT among SMEs were identified:

- Limited investment capacity against unclear benefits (especially for High-Performance Manufacturing Technologies);
- Costs and Revenues of new technologies are unclear and uptake risk is too high;
- Financial organisations’ lack of awareness of the potential of AMT and of the risk of their adoption;
- Private financial organisations’ lack of awareness of the potential of AMT and of their adoption risks;
- Fragmentation, complexity and bureaucracy of existing public funding instruments, that SMEs cannot afford;
- Lack of the interdisciplinary competence needed to understand new technologies and their benefits;
- Lack of the interdisciplinary competence needed to forecast the return on investment in AMT;
- Lack of skilled workforce for integrating, implementing and operating AMT;
- Lack of skills needed to identify and apply for suitable funding opportunities;
- Robustness and performance of AMT is not proven;
- Integration of AMT in existing processes is complex and generates a risk of declining performance and customer loss (especially for ICT);
- The conception of some AMT followed a pure technology-driven approach;
- Weak cooperation between RTOs and industry for the uptake of AMT;
- Imprecise knowledge of customers’ needs and limited marketing action by technology suppliers;
- Technology suppliers’ limited engagement in customer-supplier relationships;
- Lack of clear and qualified communication and diffusion concerning AMT;
- Lack of a clear map of service providers for SMEs;
• General lack of suitable SME-tailored contents and formats in offerings of AMT-related training and education services;
• Sustainable technologies are adopted mainly to comply with regulations;
• No standardised approach to the creation of extended value chains using ICT solutions.

Each issue corresponds to:
• a particular barrier/driver investigated by means of one or more questions in the survey questionnaire that proved particularly significant (e.g., “Uncertainty in ROI of AMT”, or “Uncertainty of maturity of AMT”), or
• a relevant concept emerging from the critical analysis of case studies (e.g., “general lack of suitable SME-tailored contents and formats in offerings of AMT-related training and education services”, or “fragmentation, complexity and bureaucracy of existing public funding instruments, that SMEs cannot afford”), or
• clusters of similar items emerging from the survey questionnaire and case studies (e.g., “High cost of investment to acquire AMT and lack of financial resources”, or “Difficulty of assessing AMT performance”, or “Lack of skilled workforce capable of adopting AMT”), or
• project partners’ knowledge and proposals presented during the in-house workshop based on the results of the empirical analysis (e.g., “no standardised approach to the creation of extended value chains using ICT solutions”).
3 Existing Policy Actions, Service Offerings and Issues

This section explains how additional input for policy recommendations was obtained from an extensive analysis of current policy actions and service offerings.

3.1 Mapping of existing policy actions and service offerings

A number of existing policy actions and service offerings intended to support SMEs in the uptake of AMT were analysed to obtain a general picture for identification of the relevant issues with a view to developing further policy recommendations and identifying potential shortcomings and best practices in the state of the art of policy actions and service offerings. The data collection process was completed focusing specifically on the adoption of AMT by SMEs, taking the main initiatives influencing the diffusion of AMT in SMEs in Europe into account. More than 120 sources were considered, including studies, reports, websites, presentations and papers published by various institutions and organisations such as the European Commission, European platforms, national and regional programmes, financial organisations, technical organisations, RTOs, clusters, training centres, science parks, etc.

In a next step, the programmes, initiatives and services offerings identified were divided into two main categories, namely policy actions and service offerings. The policy actions category includes the programmes, initiatives and other policy measures and instruments launched at various geographical levels (e.g., COSME, FOF, KIC AVM at EU level; MADE DIFFERENT and Catapult at national level; Innovation vouchers and Robotics loans at regional level; etc.). The service offerings category covers the existing services for supporting SMEs offered by service organisations (such as training, financial services, research services, etc.). This category includes financial service providers like the EIF, for instance, at European level, KfW at national level and Finlombarda at regional level. It also includes networks and platforms like the EEN, the EIT, the RI3S Platform for Industrial Modernisation, etc., which provide specific services in a structured and organised format. Other service providers such as technology parks (e.g., Lindholmen Science Park), technology service providers (e.g., SMACC), competence centres (e.g., Mittelstand 4.0 Competence Centre) and clusters (e.g., EMC2) are included in the category of service offerings too.

For both categories (policy actions and service offerings) a set of existing actions and services was identified at regional, national and European level, and also outside the EU. Tables 1, 2 and 3 illustrate the mapping of the existing policy actions and service offerings analysed.
Table 1: Mapping of policy actions and service offerings (Regions)

<table>
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<tr>
<th>Policy Actions</th>
<th>Service Offerings</th>
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<tbody>
<tr>
<td>Regional</td>
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<tr>
<td>• Creative voucher (Baden-Württemberg, Germany)</td>
<td>• Mittelstand 4.0 Competence Centre (Berlin, Lower Saxony, North Rhine-Westphalia, Hesse, Rhineland-Palatinate, Thuringia, Germany)</td>
</tr>
<tr>
<td>• Innovation Vouchers (Lombardy, Italy)</td>
<td>• IBB (Berlin, Germany)</td>
</tr>
<tr>
<td>• Innovation Vouchers (Limburg, the Netherlands)</td>
<td>• ZAB (Brandenburg, Germany)</td>
</tr>
<tr>
<td>• Creative Credits (Manchester City region, UK)</td>
<td>• L-Bank (Baden-Württemberg, Germany)</td>
</tr>
<tr>
<td>• Robotics loan (Pays-de-la-Loire, France)</td>
<td>• Innova creativity (Basque Country, Spain)</td>
</tr>
<tr>
<td>• VINCI (Salzburg, Austria)</td>
<td>• Finlombarda (Lombardy)</td>
</tr>
<tr>
<td>• Industry 4.0 training (Navarre, Spain)</td>
<td>• FinEmiglieromagne (Emilia Romagna, Italy)</td>
</tr>
<tr>
<td>• VIS (Flemish Region, Belgium)</td>
<td>• EMC2 (Pays-de-la-Loire, France)</td>
</tr>
<tr>
<td>• GLOBALmidt (Central Denmark, Denmark)</td>
<td>• Proxinnov /BPI (Pays-de-la-Loire France)</td>
</tr>
<tr>
<td>• Compétences 2020</td>
<td>• AFIL (Lombardy, Italy)</td>
</tr>
<tr>
<td>• (Pays-de-la-Loire, France)</td>
<td>• IAF (Aragon, Spain)</td>
</tr>
<tr>
<td>• Innovation Assistants (Saxony-Anhalt, Brandenburg, North Rhine-Westphalia, Germany; Kärnten, Austria)</td>
<td>• ITAinnova (Aragon, Spain)</td>
</tr>
<tr>
<td>• RENOVE Maquinaria (Basque Country, Spain)</td>
<td>• Chalmers Smart Industry Lab (West Sweden, Sweden)</td>
</tr>
<tr>
<td>• ClusterAgentur (Baden-Württemberg, Germany)</td>
<td>• DAMRC (Central Denmark, Denmark)</td>
</tr>
<tr>
<td>• Vanguard Initiative Actions (Several European Regions)</td>
<td>• Lindholmen Science Park (West Sweden, Sweden)</td>
</tr>
<tr>
<td>• VISEP</td>
<td>• Innovatum (Trollhättan, Sweden)</td>
</tr>
<tr>
<td>• AMBIS</td>
<td>• DHBW (Baden-Württemberg, Germany)</td>
</tr>
<tr>
<td>• ITA Exzellenz (South Yorkshire, UK)</td>
<td>• AMP (Baden-Württemberg, Germany)</td>
</tr>
<tr>
<td>• Allianz Industrie 4.0 (Baden-Württemberg, Germany)</td>
<td>• AdITech (Navarre, Spain)</td>
</tr>
<tr>
<td>• MecaTech (Wallonia, Belgium)</td>
<td>• Allianz Industrie 4.0 (Baden-Württemberg, Germany)</td>
</tr>
<tr>
<td>• MicroTECSüdwest e.V. (Freiburg, Germany)</td>
<td>• Cluster Exzellenz (Baden-Württemberg, Germany)</td>
</tr>
</tbody>
</table>

Source: own analysis
### Table 2: Mapping of policy actions and service offerings (Member States)

<table>
<thead>
<tr>
<th>National</th>
<th>Policy Actions</th>
<th>Service Offerings</th>
</tr>
</thead>
</table>
| Germany: | • Initiative Industrie 4.0  
• Digital agenda 2104-17  
• Central Innovation Programme for SMEs – ZIM  
• KMU-Innovativ  
• Industry 4.0 Research on the Shopfloor  
• Go innovative Innovation Management Vouchers  
• Forschungscampus – Public private Partnership for Innovation  
• FHproUnt  
• Autonomics for Industry 4.0 (Internet of Things) | • Steinbeis  
• Industrial Collective Research, AIF/IGF  
• KfW Development Bank  
• nanoValley  
• Festo teaching factory  
• Research for tomorrow’s production; intelligent networking in production |
| France:  | • RobotstartPME  
• Pôles de Competitivité | • IRT Jules Verne  
• BPI France  
• Cetim |
| UK:      | • Catapult  
• SBRI  
• Innovate UK | • Catapult HVM  
• SWMAS  
• Lloyds Bank Advanced Manufacturing Training Centre |
| Netherlands: | • Smart Industry | • SMACC  
• Nivala |
| Belgium: | • Made Different | • Agoria |
| Italy:   | • Progetto Bandiera “La Fabbrica del Futuro” | • Cluster Fabbrica Intelligente (CFI) |
| Denmark: | • MADE  
• Innovation assistant | |
### Table 3: Mapping of policy actions and service offerings (EU and outside the EU)

<table>
<thead>
<tr>
<th>Policy Actions</th>
<th>Service Offerings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>European</strong></td>
<td><strong>Outside the EU</strong></td>
</tr>
<tr>
<td>- European Fund for Strategic Investments – EFSI (and sub-programme EFSI SME Facility)</td>
<td>- RIS3 Platform for industrial modernisation</td>
</tr>
<tr>
<td>- European Structural and Investment Funds – ESIF</td>
<td>- Enterprise Europe Network (EEN)</td>
</tr>
<tr>
<td></td>
<td>- European investment fund (EIF)</td>
</tr>
<tr>
<td></td>
<td>- European Institute of Innovation &amp; Technology (EIT)</td>
</tr>
<tr>
<td></td>
<td>- EBN Innovation Network</td>
</tr>
<tr>
<td></td>
<td>- COSME EFG</td>
</tr>
<tr>
<td></td>
<td>- EFFRA (&amp; EFFRA Innovation Portal)</td>
</tr>
<tr>
<td><strong>H2020:</strong></td>
<td><strong>United States:</strong></td>
</tr>
<tr>
<td>- ActPhast</td>
<td>- National Network for Manufacturing Innovation (NNMI)</td>
</tr>
<tr>
<td>- I4MS</td>
<td>- AMTech</td>
</tr>
<tr>
<td>- LEIT</td>
<td>- National Robotics Initiative (NRI)</td>
</tr>
<tr>
<td>- FTIPilot</td>
<td>- National Photonics Initiative (NPI)</td>
</tr>
<tr>
<td>- INFRADEV / INFRAIA</td>
<td>- National Nanotechnology initiative (NNI)</td>
</tr>
<tr>
<td>- LLP (and sub-programmes such as LdV)</td>
<td>- Investing in Manufacturing Communities (IMCP)</td>
</tr>
<tr>
<td>- Industrial Leadership</td>
<td>- Small Business Innovation Research (SBIR)</td>
</tr>
<tr>
<td>- INNOSUP</td>
<td>- Small Business Technology Transfer – STTR</td>
</tr>
<tr>
<td>- KICs</td>
<td><strong>China:</strong></td>
</tr>
<tr>
<td>- KIC AVM</td>
<td>- Made in China 2025</td>
</tr>
<tr>
<td>- SPIRE PPP</td>
<td>- Internet Plus</td>
</tr>
<tr>
<td>- SME Instrument</td>
<td></td>
</tr>
<tr>
<td>- FOF PPP</td>
<td>- Manufacturing Extension Partnership (MEP)</td>
</tr>
<tr>
<td>- Robotics PPP</td>
<td></td>
</tr>
<tr>
<td>- Photonics PPP</td>
<td></td>
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<tr>
<td>- HPC PPP</td>
<td></td>
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<tr>
<td>- Eurostars Joint Programme</td>
<td></td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Other:</strong></td>
<td></td>
</tr>
<tr>
<td>- COSME (and sub-initiatives such as COSME EFG &amp; COSME LGF)</td>
<td></td>
</tr>
<tr>
<td>- European Cluster Excellence (ECEI)</td>
<td></td>
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<tr>
<td>- Stairways to Excellence (S2E)</td>
<td></td>
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<tr>
<td>- INTERREG</td>
<td></td>
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<tr>
<td>- TREC</td>
<td></td>
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<tr>
<td>- Vanguard Initiative</td>
<td></td>
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<tr>
<td>- TTO Circle</td>
<td></td>
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<tr>
<td>- InnovFin SMEG</td>
<td></td>
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<tr>
<td>- Blueprint for sectoral cooperation on skills</td>
<td></td>
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<tr>
<td>- ECSEL</td>
<td></td>
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<tr>
<td>- RIM Plus</td>
<td></td>
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<tr>
<td>- Joint initiative on standardisation</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- InvestHorizons</td>
</tr>
</tbody>
</table>

*Source: own analysis*
3.2 Mapping of policy actions

3.2.1 Policy actions at regional level

Several policy actions for the diffusion of AMT were promoted at regional level. An important policy measure at regional level concerns innovation and technology vouchers. Various regions in Europe implement this instrument to provide SMEs with partial funding. The vouchers are intended primarily to support the development and implementation of new products or production processes, or to improve existing ones. Examples are the innovation vouchers awarded in Baden-Württemberg (Germany), Lombardy (Italy) and Limburg (Netherlands).

Vouchers

- An evaluation of the “Dutch voucher system” revealed the important contribution of innovation vouchers to the collaboration between SMEs and knowledge providers such as technology centres and research institutions [1], [2].
- The assessment of the “Scottish innovation voucher” identified a positive impact of voucher systems on the set-up of an efficient and effective relationship and collaboration between SMEs and knowledge providers. The voucher was worth up to £5 000 per company [1], [3].
- An examination of the “creative credits programme” in the Manchester region in the UK showed that more than 80% of the SMEs that benefited from the vouchers considered it a positive driver for boosting their innovation capabilities and initiating innovative project ideas [4].

Technology voucher (Lombardy, Italy)

In Lombardy, Italy, there is a programme offering technology vouchers to SMEs that applied for European projects and passed the evaluation threshold, but then lacked the financial resources to fund their project.

Apart from vouchers, numerous instruments have been developed in the area of credit and loan schemes. For instance, the French region of Pays-de-la-Loire offers Robotics loans to SMEs with the support of the PRI Proxinnov (a regional innovation platform) and Bpifrance (a public investment bank) [5].
Moreover, a large number of credit options are available from national and regional support banks such as those in Germany (e.g., IBB, ZAB, L-Bank, N-Bank) and Italy (e.g., Finlombarda, Finemiliaromagna).

Some regional initiatives have also been launched to support SMEs in the region by creating opportunities to cooperate with other EU regions. An example is the GLOBALmidt initiative in central Denmark.

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**Pathway towards AMT for SMEs (Pays de la Loire, France)**

The French region of *Pays-de-la-Loire*, in collaboration with Bpifrance (French investment bank) and PRI Proxinnov (a regional innovation industry 4.0 platform), launched the “pathway towards advanced manufacturing for SMEs”. The programme aims to support SMEs in the region in their uptake of AMT with a total budget of €10 million over a two-year period. The activities include awareness-raising actions, funding of technological diagnostics and funding of collaborative R&D projects and demonstrators accessible to regional SMEs [5].

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**GLOBALmidt (Central Denmark)**

GLOBALmidt is a programme launched by a regional government in central Denmark to promote the international growth of Danish SMEs by setting up collaborations with other regions such as Northern Germany. The programme targets SMEs with a total budget of €2.6 million over a period of 18 months [6].

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Another policy action implemented at regional level is **Innovation Assistant**. The policy has been pursued in several regions of Germany, such as Saxony-Anhalt, Brandenburg, North Rhine-Westphalia, and in some Austrian regions, including Kärnten and Tyrol. This policy involves the regional authorities co-funding the employment of skilled graduates in regional SMEs to boost know-how transfer and innovation.

**Innovation assistant programme**  
*(North Rhine-Westphalia, Germany)*

The programme launched in the German region of North Rhine-Westphalia aims to strengthen the innovation capabilities of local SMEs through their recruitment of graduates, researchers and scientists. The ultimate aim of the programme is to improve and accelerate knowledge transfer to SMEs in order to boost innovation. To this end, the local SMEs receive a contribution to the cost of employing each graduate (up to €22 500 a year) [8].

Some policy actions at regional level target **training**, such as the **Industry 4.0 training programme** in the Navarre region in Spain. The programme is funded by Navarre’s government and the Association of Industrial Engineering Professionals. It aims to provide specialised training for SMEs within the scope of Industry 4.0 in the form of both theoretical and practical workshops [9].

**Industry 4.0 training programme (Navarre, Spain)**

In Spain, the regional government of Navarre has launched the “Industry 4.0 training” programme in collaboration with the Association of Industrial Engineering Professionals. The programme aims to spread theoretical and practical knowledge of Industry 4.0 topics amongst SMEs in the region. It addresses topics such as additive manufacturing, augmented reality, big data, cyber-physical systems and the Internet of things [9].

Another example at regional level is the **“Compétences 2020”** initiative in the French region of **Pays-de-la-Loire**, aiming to transform the region into a territory of excellence for AMT by developing and spreading the required skills among the local firms’ workforce [10]. The **Flemish Cooperative Innovation Networks - VIS** is a policy measure taken in the Flemish region of Belgium to support Flemish SMEs in terms of technological innovation by facilitating their access to the technological knowledge they need [11]. In Basque Country, the regional agency for business development has launched the **RENOVE Maquarina programme** to help SMEs modernise their production systems and adopt AMT [12].

Overall, largely with the exception of the EU’s leading economies, the majority of regional level actions are co-financed by the European Structural and Investment Funds (ESIF). They are therefore related to some extent to European-level policy coordination and they may be linked to European initiatives for networking and mutual learning, such as the RIS3 Platform for Industrial Modernisation.

3.2.2 Policy actions at national level

Policy actions at national level differ in terms of size and scope. Industrie 4.0\(^8\) in Germany is a notable example of a national strategic initiative to provide Germany’s manufacturing sector with AMT. There are other programmes too that focus mainly on SMEs. ZIM is the Central Innovation Programme for SMEs in Germany. It is a national funding programme targeting both SMEs and research centres they work with. It provides grants to SMEs operating in all sectors and technological areas for new product development, innovative production processes and services. The maximum cost of a project is €380 000 per company and €190 000 per research institute [13]. The programme has a budget of €543 million in 2016. The plan is for SMEs in new Ländere to receive at least 40% of the funding [14]. Another German initiative on a national scale is KMU-innovativ for high-tech SMEs. There are also vouchers offered as policy measures at national level in Germany. Two of the main examples are the “Go Innovative” and “Innovation Management” voucher schemes, according to which an SME can

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\(^8\) http://www.plattform-i40.de/i40/Navigation/EN/Home/home.html
apply for five innovation vouchers a year and receive a maximum total grant of €20 000 [15]. In France RobotStartPME is a national scheme to support SMEs in the uptake of robotics technology to improve their production processes. The programme co-funds 10% of an SME’s investment in a first robotics cell, as well as providing professional expert support in several phases of the uptake such as problem diagnostics, project definition, integration, implementation and monitoring [16].

### RobotstartPME (France)
When implementing AMT, French SMEs have the opportunity to benefit from the RobotstartPME programme, which has a total budget of €33 million and aims to provide financial support for SMEs investing in their first robotics cell (up to 10%). The programme also funds the phases of project definition, integration and monitoring [16].

In Italy, the Fabbrica del Futuro national programme helps Italian manufacturers to enhance their innovation capabilities by funding several research projects. The initiative was conceived to align Italian manufacturers with the main manufacturing priorities at European level [17].

In the UK, Catapult⁹ is a programme launched in 2010 to close the gap between innovation and commercialisation. The programme is designed to reach this objective by creating several Catapult centres across the country, which are technology and innovation organisations working to help enterprises, especially SMEs, to develop and adopt new technologies and products. Each Catapult centre specialises in a particular area and provides enterprises with specific services such as technology and consulting services. In the following sections, the High Value Manufacturing Catapult is mentioned among the existing service providers at national level. The programme aims to establish 30 Catapult centres in the UK by 2030 [18]. Moreover, the SBRI¹⁰ programme in the UK aims to connect solution providers and potential users in the framework of “competitions” based on strategic challenges defined by the government. In Belgium MADE DIFFERENT is a national initiative to provide a sustainable future for Belgian industrial R&D and manufacturing based on a vision of factories of the future. This initiative aims to enable Belgian manufacturing to excel in seven main areas of world-class technologies, simultaneous development, digital factories, human-centred production, networked factories, eco-production and smart production [19].

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⁹ [https://www.catapult.org.uk/](https://www.catapult.org.uk/)

¹⁰ [https://sbri.innovateuk.org/](https://sbri.innovateuk.org/)
In Germany the cooperative training programme (or dual-education programme) is a qualification system for training the skilled workforce at regional and national levels by establishing a close cooperation between local universities and SMEs. *FHprofUnt* is an example of a national-scale initiative in Germany that was launched by the Federal Ministry of Education and Research (BMBF). It supports application-oriented research through close collaboration between colleges and SMEs in order to facilitate a more effective knowledge and technology transfer to SMEs and provide training opportunities for students or researchers [20]. The *Forschungscampus* programme, also launched by the BMBF, is a public-private partnership that focuses on reinforcing the collaboration between SMEs and research and training centres.

**Research at Colleges with Enterprise /FHprofUnt (Germany)**

*FHprofUnt* is an initiative of the German Federal Ministry of Education and Research that aims to promote application-oriented research and development projects by connecting colleges with SMEs. This results in a more intensive knowledge and technology transfer to the firms and better research-oriented training opportunities for students and research staff. By 2015 the programme had funded several projects with a total outlay of €176 million [20].

**Universities of Applied Sciences (Germany)**

From the late 1960s onwards, a large number of universities of applied sciences were set up in Germany’s regions for the purpose of providing skilled graduates for the local SMEs. These universities are often located in less central areas, close to local SMEs. These universities have a very important role in improving the innovation capacity of SMEs and strengthening the local innovation ecosystem because they train the skilled workforce according to the firms’ needs. In many cases, the universities of applied science offer specific courses tailored to the particular technological profile of local firms and SMEs [21].
3.2.3 Policy actions at European level

The numerous policy actions at European level vary in size, target group and scope. Some of them are programmes focusing specifically on SMEs, and COSME is a significant example in this regard. With a planned budget of €2.3 billion, COSME aims to help SMEs gain access to financial resources and markets [23]. The programme runs from 2014 to 2020. **COSME Equity Facility for Growth (EFG)**\(^{11}\) is a financial instrument for supporting the growth and innovation of SMEs from the very early stage after their establishment to the growth stage. By means of this instrument, SMEs receive funds and investments to increase their competitiveness [24]. The **COSME Loan Guarantee Facility**\(^{12}\) (LGF) is another instrument that provides guarantees and counter-guarantees to enable selected financial intermediaries, such as banks and leasing companies, to expand their financial services to SMEs [25].

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**Forschungscampus (Germany)**

The Forschungscampus programme was launched by the German Federal Ministry of Education and Research in 2011 as a public-private partnership to boost cooperation in research and innovation. The programme is based on three main features: proximity, medium- to long-term research programmes and a compulsory public-private partnership. The initiative aims to combine a critical mass from science and business to pursue a future-oriented research approach [22].

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\(^{11}\) [http://www.eif.org/what_we_do/equity/single_eu_equity_instrument/cosme_efg/index.htm](http://www.eif.org/what_we_do/equity/single_eu_equity_instrument/cosme_efg/index.htm)

Horizon 2020\textsuperscript{13} (the EU Framework Programme for Research and Innovation) allocates substantial amounts of funding in favour of SMEs. The Leadership in Enabling and Industrial Technologies H2020 pillar aims at boosting research and innovation in terms of new technologies involving industrial partners, especially SMEs. In particular, the action focuses on public-private partnerships, cross-cutting KETs, R&I in SMEs, and raising ICT opportunities \cite{h2020}.

<table>
<thead>
<tr>
<th>Leadership in Enabling and Industrial Technologies (LEIT)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under H2020, Leadership in Enabling and industrial Technologies aims to increase the competitiveness of European companies, and SMEs especially, by focusing on advanced and innovative technologies and Key Enabling Technologies (KETs). The initiative thus plans concrete actions on public-private partnerships, R&amp;I, cross-cutting KETs, and identifying ICT opportunities, as well as seeking solutions to address societal challenges. The total budget is around €13.8 billion over the period 2014-2020 \cite{h2020}.</td>
</tr>
</tbody>
</table>

There are numerous initiatives and tools addressing innovation in manufacturing SMEs in the frame of the H2020.

For example:

- The SME Instrument is a tool with an overall funding of €2.8 billion dedicated exclusively to SMEs. It helps SMEs to develop and exploit breakthrough ideas for products, services and processes \cite{smi}.
- The SME Initiative is a financial instrument of the EC and EIB designed to facilitate SMEs in accessing finance by providing partial risk coverage. The initiative is co-funded by COSME and the EIB, and is currently operational in Bulgaria, Finland, Malta and Spain. In future it may be extended to other Member States as well \cite{sme}. The Fast Track to Innovation Pilot (FTI Pilot) aims to promote close-to-the-market innovation by applying a bottom-up approach. The initiative is specifically designed to boost the involvement of SMEs, reduce time to market and increase investment from the private sector in research and innovation activities. FTI Pilot runs over 2015-2016 with a total budget of €200 million \cite{fti}.

\textsuperscript{13}https://ec.europa.eu/programmes/horizon2020/
Some of the existing programmes and initiatives not only focus on SMEs, but also concentrate resources on specific technology areas. Examples of relevant actions include ActPhast and I4MS. I4MS is an initiative launched by the European Commission to support EU manufacturers, and specifically SMEs, in the adoption of ICT. To this end, the initiative is designed to make it easier for SMEs to access the infrastructure and technology they require as well as new markets [30]. ActPhast is another European programme with a specific focus on SMEs and on photonic technology. The programme aims to support SMEs in the field of photonics by providing funds for R&D projects with limited access to financial resources for investing in innovative technologies and in-house R&D [31].

**ActPhast**

ActPhast is an EU programme with a budget of €10 million that funds SMEs' projects and investments in innovative technologies and in-house R&D in the particular field of photonics. According to the project statistics, 92% of the companies supported are SMEs of various size (37% micro enterprises, 46% small enterprises, 9% medium-sized enterprises), and 63% of the companies supported are “photonic” companies [31].

**I4MS**

I4MS is an EU initiative supporting manufacturing SMEs in the uptake of “robotics, HPC cloud-based simulation services, laser-based applications and intelligent sensor-based equipment.” Out of the €110 million for funding I4MS in phases 1 and 2, around 42% has been used to provide financial support for SMEs and 25% for services to SMEs delivered by competence centres. In 2016 a special call dedicated to establishing Digital Innovation Hubs in different EU regions was announced under the I4MS initiative [30].

From a thematic point of view, in the ICT domain, it is worth noting that the European Commission proposed concrete measures and initiatives concerning, amongst others, the set-up of priority standards, the cloud and the Internet of Things, in its communication entitled "Digitising European Industry: Reaping the full benefits of a Digital Single Market" released in April 2016 [32]. From the sustainability perspective, the European Commission published a report in March 2014 entitled "Advancing Manufacturing - Advancing Europe" written by the Task Force on Advanced Manufacturing for Clean Production. This report made proposals on how to commercialise new advanced manufacturing technologies more quickly [33].
Some of the European initiatives focus on the development of infrastructure as a strategic asset to boost European research and innovation. Several important projects were launched under FP7 and H2020, such as **EXPLORE**\(^{14}\) (a CSA addressing cross-fertilization of AMT among different sectors and the identification of supporting European pilot lines and demonstrators) and the **Multi-KETs**\(^{15}\) pilot lines project (for developing a concept for European pilot lines integrating multiple KETs). **INFRADERV**\(^{16}\) is a programme focusing on research infrastructure, and existing initiatives for developing **European Digital Innovation Hubs and Competence Centres**\(^{17}\) in the advanced manufacturing domain are specifically targeting the uptake of AMT by companies.

The **Vanguard initiative**\(^{18}\) is another significant measure focusing particularly on innovation for SMEs, since its object is to set up a European network of interlinked regional pilot plants accessible to SMEs for the uptake of new technologies.

The initiative is “driven by a political commitment made by regions to use their smart specialisation strategy to boost new growth through bottom-up entrepreneurial innovation and industrial renewal in European priority areas” [7].

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**Vanguard Initiative**

The “Vanguard Initiative – New Growth Through Smart Specialisation”, launched in January 2014, aims to set up a European network of interlinked regional pilot plants accessible to SMEs for the uptake of new technologies. There are now 18 European regions forming part of the Vanguard Initiative to “build the synergies and complementarities in smart specialisation strategies to boost world-class clusters and cluster networks, in particular through pilots and large-scale demonstrators”. The initiative has a strategic political nature and it is currently identifying a suitable public-private funding strategy [7].

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\(^{14}\) http://explore-fp7.eu/

\(^{15}\) http://www.mkpl.eu/home/


\(^{18}\) http://www.s3vanguardinitiative.eu/
Other measures focus on skills and competence for manufacturing. A significant example in this regard was the “Lifelong Learning Programme (LLP)” with a total budget of €7 billion over the period 2007-2013 [34].

**Lifelong Learning Programme (LLP)**

The European “Long-Life-Learning - Leonardo Da Vinci” programme has funded several projects for the purpose of implementing new learning systems particularly suitable for the uptake of AMT by SMEs (e.g., KTRM and MIMAN-t).

In this framework, some projects targeted the specific needs of SMEs to improve the skills required for the uptake of AMT (such as KTRM and MIMAN-t), which developed training schemes in the additive manufacturing and micro-manufacturing domains, respectively) [35], [36]. Another example of EU-funded projects targeting the teaching factories approach to meet SME training needs is KNOW-FACT to develop a knowledge partnership for the definition and launch of the European teaching factory paradigm in manufacturing education [37].

Other policy initiatives focusing on competence and skills for manufacturing SMEs are the Sector Skills Alliance and the Blueprint for Sectorial Cooperation on Skills. The Sector Skills Alliance is an action operating under the European Education, Audio-visual and Culture Executive Agency (EACEA) aiming to reinforce skills across the Member States by identifying the new skills required for new markets and sectors [38]. The Blueprint for Sectorial Cooperation on Skills is one of the actions in the New Skills Agenda launched in June 2016.

**Blueprint for Sectorial Cooperation on Skills**

The Blueprint for Sectorial Cooperation on Skills is one of the actions on the New Skills Agenda launched in June 2016 by the European Commission to boost human capital, competitiveness and employability. The initiative aims to broaden individuals’ skills and knowledge, especially in some specific sectors such as the automotive industry, by providing education and training based on appropriate strategies and instruments [39].

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19 www.rapidmanufacturing-training.eu

20 http://www.miman-t.eu/
From a geographical diffusion perspective, the H2020 Spreading Excellence and Widening Participation is a strategic policy action at European level under H2020 that aims to strengthen research and innovation performance, and to improve homogeneity among the Member States by targeting those with a poor performance in R&I [40].

The Eurostars Joint Programme is an initiative under H2020 for reinforcing the trans-national collaboration of European SMEs in terms of research and innovation. The programme provides funding to SMEs to help them develop innovative products, processes and services through transnational collaboration schemes [41].

**Eurostars Joint Programme**

Under H2020, Eurostars provides funding to SMEs to boost their competitiveness in terms of innovative product and process development, and expertise sharing through transnational collaborations. The programme is co-funded by the European Commission and national budgets of 36 Eurostars participating states. The programme has a total public budget of €1.14 billion over 2014-2020. So far, the programme has funded 472 projects with €290 million and an average success rate of 30% [41].

Horizon 2020 INNOSUP calls for proposals and tenders are another example of EU policy measures to create opportunities for collaboration in different Member States. INTERREG is another programme launched by the European Commission to boost inter-regional collaboration in Europe.

**INNOSUP (EU)**

Horizon 2020 INNOSUP calls for proposals and tenders are an example of EU policy actions to expand the EU innovation ecosystem and develop a pan-European ecosystem where all Member States have access to existing service offerings by creating opportunities for collaboration, peer-learning and the uptake of new approaches. INNOSUP has a budget of €54.1 million over 2016-2018 [42].

**INTERREG MED (EU)**

INTERREG MED is an example of an inter-regional programme that involves 13 Member States. The programme aims to help the Member States support sustainable growth by promoting innovation and a reasonable use of resources in the Mediterranean area. The total budget is €265 million over 2014-2020 [43].
The call “Towards EU Regional Economic Convergence (TREC)” was launched in April 2015. Its aim is to enable the launch of pilot projects to reinforce collaboration among clusters and technology centres. Being aligned with regional smart specialisation priorities, these pilot projects are expected to seize growth opportunities and boost regional economic convergence across different EU regions. The total budget for the call was €500 000 [45].

To support innovation by exploiting the potential of the “knowledge triangle”, i.e. the integration of research, education and business, the EIT launched a call for a new Knowledge and Innovation Community (KIC) on Added-Value Manufacturing (KIC AVM) in January 2016. This is considered an important initiative at European level for supporting the adoption of AMT. As mentioned in the call, "whilst supporting the development of new products, services, business models and manufacturing processes, emphasis should be put on sustainability and eco-innovation, with the reduction of resource and energy inefficiencies, maximising positive environmental impacts, but also contributing to strengthening positive economic and social impacts" [46]. The KIC AVM would also have a very important role and impact at regional level in fostering the creation of interconnected regional clusters with local transfers and collaboration, developing competences in high-end manufacturing technologies, and excellence in manufacturing technologies.

From a financial perspective, the European Fund for Strategic Investments (EFSI) is an ambitious and significant EU initiative launched in 2014 by the European Investment Bank, the European Investment Fund and the European Commission to address existing investment problems in the EU by releasing and mobilizing some private financing [47]. With an expected investment of €315 billion over a three-year period, the EFSI dedicates €75 billion to investment in European companies, including SMEs. As at 31 August 2015, the EFSI had triggered 17% of the investment in 10 Member States [48]. InnovFin SME venture capital is a financial instrument launched within the framework of H2020 with the involvement of the EIB to support SME investments with €1 billion of mobilised funding. Service INNOVFIN is also offering total funds of €1 billion under its SME Guarantee programme over the period 2014-2020 [49]. There are other accompanying measures too, launched by the EC to help SMEs
access finance by providing debt and equity instruments. InvestHorizon is a programme for boosting investment by SMEs, especially in innovation. This is planned to be done by means of a defragmentation of the SME investment market in Europe to increase the number and quality of investments in SMEs [50]. The communication entitled "An action plan to improve access to finance for SMEs" of December 2011 proposed to respond to the difficulties SMEs encounter in accessing finance through various actions that included improving the regulatory framework, specific financing budgets and the exchange of best practices [51].

From a policy governance standpoint, the European Technology Platforms are major players cooperating with the European Commission for the definition and implementation of programmes and initiatives. The European Technology Platform ManuFuture is a major European initiative created with the support of the European Commission that involves European companies, universities, research centres and public decision bodies in supporting the development and competitiveness of manufacturing in Europe. The ManuFuture mission is to propose, develop and implement a strategy based on Research and Innovation and capable of speeding up the rate of industrial transformation to high-added-value products, processes and services, securing highly-skilled employees and gaining a major share of the world's manufacturing output in the knowledge-driven economy of the future [52]. The main role of ManuFuture is to manage research, technological development and innovation efforts aiming for the transformation of the European manufacturing industry at two levels: (i) the policy level, for the continuous development of the ManuFuture vision and the promotion of the Lisbon objectives; and (ii) the operational level, by taking a technological approach capable of exploiting all possible synergies arising from the converging nature of science and technologies.

**MANUFUTURE**

The European Technology Platform ManuFuture was created with the support of the European Commission and aims to involve different actors across the EU - companies, RTOs, clusters, organisations, universities, etc. - in enhancing the competitiveness of manufacturing in Europe. The plan is to achieve this through the transformation of industry as well as RTOs and research infrastructure based on the five pillars, namely: new added value products and services; new business models; advanced industrial engineering; emerging manufacturing science and technologies; and infrastructure and education [52].
In addition, there are initiatives implementing the **Private-Public Partnership**\(^{21}\) between the EU and the private manufacturing sector in various technology domains. **Factories of the Future (FoF)** was launched under the European Economic Recovery Plan and aims to boost innovation in high added value manufacturing technologies in order to implement high-performing and environmentally and socially sustainable factories. The indicative budget under Horizon 2020 over 2014-2020 is €1.15 billion \([53]\). Other similar schemes include **SPIRE** \(^{22}\) (in the process industry), **Robotics PPP**, **Photonics PPP**, **HPC PPP**\(^{23}\) and **ECSEL**\(^{24}\).

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**Factories of the Future**

‘Factories of the Future’ is an important European Union contractual PPP supported under Horizon 2020 with a budget of €1.15 billion over 2014-2020. It is one of the EU’s major actions for the development and uptake of AMT.

The research priorities identified in the ‘Factories of the Future 2020’ roadmap developed by EFFRA include: Sustainable Manufacturing, ICT-enabled intelligent Manufacturing, High-productivity Manufacturing, and Materials in Manufacturing.

The FoF-Impact project is a two-year European project coordinated by EFFRA and funded through the Factories of the Future PPP. The project’s objective is to increase the impact of the European Union’s ‘Factories of the Future’ partnership under Horizon 2020. It ultimately aims to speed up and improve the exploitation and uptake of the results of ‘Factories of the Future’ projects \([53]\).

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**Photonics PPP (EU)**

The Photonics PPP aims to connect all stakeholders in the photonics sector in Europe, including technology providers, end users and experts. Under Horizon 2020, the Photonics PPP has an overall budget of €700 million, of which at least €2.8 million will be provided by the photonics industry \([54]\).

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\(^{21}\) A public-private partnership is a long-term contract between a **private** party and a government entity, for providing a **public** asset or service, in which the **private** party bears significant risk and management responsibility, and remuneration is linked to performance (Source: The World Bank).

\(^{22}\) https://www.spire2030.eu/


\(^{24}\) http://www.ecsel-ju.eu/web/index.php
### Robotics PPP (EU)

The Robotics PPP is the “teaming up of the robotics industry, research, academia and the European Commission to launch a joint research, development and innovation programme in order to strengthen the competitive position of European robotics. The total budget devoted to the PPP in robotics is around €700 million in Horizon 2020. This is expected to trigger additional private investment in the ratio of 3:1 (i.e. around €2 billion)” [55].

### 3.2.4 Policy actions outside the EU

Outside the EU, there are several policy measures focusing on specific technologies for manufacturing companies. In the US, the National Network for Manufacturing Innovation (NNMI) is a programme begun in 2013 and based on the “Advanced Manufacturing Partnership (AMP)” [25].

#### National Network for Manufacturing Innovation (US)

The National Network for Manufacturing Innovation (NNMI) is a programme begun in 2013 and based on the “Advanced Manufacturing Partnership (AMP)” previously launched by President Obama in June 2011. With an annual budget of $300 million in 2015, the initiative aims to address US industry challenges by creating integrated and effective research infrastructure linking academia and industry. This is done through linked Institutes for Manufacturing Innovation (IMIs), each focusing on a specific field but all with the same goal, that is to facilitate technology transfer to industry. At each NNMI institute, partners from industry, academia and governmental institutions work together to boost manufacturing innovation. Within 10 years the NNMI is expected to consist of 45 IMIs. For 2016, the NNMI has an overall budget of $300 million [56].

In 2013 the US National Institute of Standards and Technology launched a programme to accelerate the growth of AMT called AMTech. This programme provides funding for collaborations between industry and academia to target the challenges that prevent growth and the uptake of AMT. The programme is not devoted to a specific audience, all companies, universities, research centres and governmental agencies can take part [57].

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Another US initiative is **Small Business Innovation Research (SBIR)** with the purpose of exploitation and commercialisation of the research results for innovation.

**Small Business Innovation Research (US)**

The Small Business Innovation Research (SBIR) programme is a US scheme designed to involve SMEs in federal R&D activities with a view to the potential commercialisation of the results. The main goal of the programme is to stimulate technological innovation by providing funding in the form of contracts or grants to SMEs. The amount awarded each year through the SBIR is around $2.5 billion [58].

Meanwhile, there are several initiatives in the US to form alliances and boost cooperation between top scientists, industry and academia on the matter of AMT such as the **National Robotics Initiative (NRI)**\(^{26}\), the **National Photonics Initiative (NPI)**\(^{27}\) and the **National Nanotechnology Initiative (NNI)**\(^{28}\).

In China, the **Made in China 2025** initiative aims to upgrade Chinese manufacturing by focusing on quality, sustainability and structural improvements. The scheme is mainly oriented towards intelligent manufacturing and inspired by “Industry 4.0” initiative in Germany [59].

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\(^{27}\) [http://www.lightourfuture.org/home/](http://www.lightourfuture.org/home/)

\(^{28}\) [http://www.nano.gov/](http://www.nano.gov/)
Made in China 2025 / China Manufacturing 2025, 中国制造2025
Made in China 2025 is a strategic initiative for upgrading Chinese industry as a whole. It draws on Germany’s Industry 4.0 scheme, but on a broader scale. The plan was drafted by the Ministry of Industry and Information Technology with the support of the Chinese Academy of Engineering. Its main objectives are to make manufacturing more innovation-driven, emphasize quality over quantity, achieve green development, optimise the structure of Chinese industry and nurture human talent. Unlike earlier approaches, this plan focuses not only on innovation but on the whole manufacturing process at various levels. It includes:

- creating a **manufacturing innovation infrastructure system** (by establishing 40 manufacturing innovation research centres);
- developing **Intelligent Manufacturing Capabilities** in the country’s leading firms (along the lines of Germany’s Industry 4.0 initiative);
- strengthening **Manufacturing Fundamentals** in education and industrial practice (providing more support for firms that are important for growth and job creation);
- increasing support for **green manufacturing** projects.

One major change vis-à-vis earlier strategies is that political attention is paid not only to the classical high-technology industries and cutting-edge advanced manufacturing, but also to modernising traditional industries and services that are in many cases still struggling with the transition from Industry 2.0 to Industry 3.0. Based on a realistic assessment of the status quo, the goal is a comprehensive upgrading of the Chinese industry.

### 3.3 Mapping of service offerings

Service offerings refer to existing support services offered to SMEs by service companies and organisations such as technology service companies, financial organisations, companies providing legal and IPR services, marketing and strategic consulting companies, platforms, clusters, network organisations, etc.

#### 3.3.1 Service offerings at regional level

The scope of service offerings at regional level in Europe is quite broad and diversified.

There are clusters that provide facilitation services, i.e. for networking, match-making, stimulating innovation, etc. They can deliver to SMEs the information and competence aligned with the latter’s needs. A number of AMT supply-side clusters exist in EU regions. Some outstanding examples, awarded the Gold Label based on cluster excellence evaluation system,
are: **EMC2**\(^{29}\) (Pays-de-la-Loire, France), **microTECSüdwest s.V.**\(^{30}\) (Freiburg, Germany) and **Cluster-Exzellenz**\(^{31}\) (Baden-Württemberg, Germany) [60]. The European Cluster Observatory has documented success stories and best practices in the development of clusters in many Member States at various levels, such as the national-scale Leading-edge Cluster Competition in Germany, the AFIL\(^{32}\) and the CFI\(^{33}\) in Italy, the MecaTech\(^{34}\) Cluster in Wallonia, and the AFM\(^{35}\) (Association of Manufacturers of Machine Tools) in Spain.

**Mittelstand 4.0** is a network of competence centres in Germany currently offering services to SMEs in 6 regions: Berlin, Lower Saxony, North Rhine-Westphalia, Hessen, Thuringia and Rhineland-Palatinate. The number of centres is expected to rise to 16 over the course of 2017 [61]. In the French *Pays-de-la-Loire* region there is the **EMC2**, an industrial cluster for advanced manufacturing that brings together several innovation stakeholders for advanced manufacturing and aims to boost collaborative innovation in order to promote business development. It offers a wide range of services to facilitate technology transfer and speed up the commercialisation of research results [62].

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**EMC2**  
*(Pays de la Loire, France)*

The “**EMC2**” is an industrial cluster for advanced manufacturing founded in 2005 by five major companies (Airbus, DCNS, STX, Bénéteau and ACI, a subsidiary of Renault) to facilitate production process modernisation. The EMC2 brings together several innovation stakeholders in advanced manufacturing with the aim of boosting collaborative innovation. It offers a wide range of services to facilitate technology transfer and speed up the commercialisation of research results. The cluster has so far initiated €1.7 billion of R&D investment, co-funding 198 projects with a total budget of €1.2 billion. The plan is to initiate €1.4 billion’s worth of R&D projects by 2018, creating 5 000 jobs in the process [62].

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29 http://www.pole-emc2.com/
30 http://microtec-suedwest.de/en/
31 https://www.clusterportal-bw.de/cluster-exzellenz/
32 http://www.afil.it/
33 http://www.fabbricaintelligente.it/
35 http://www.afm.es/about-us
In the German region of Baden-Württemberg, ClusterAgentur is a service provider that designs new services to be implemented by clusters to enable them to customise the services they offer to firms [63]. In the same region, the Allianz Industrie 4.0 is a network that aims to promote an advanced culture and partnerships for spreading Industry 4.0 technologies in industry and SMEs [64].

There are also several financial service providers operating at regional level. In Germany IBB is an investment bank in the Berlin region providing financial services for innovation to enterprises, including SMEs [65]. In Lombardy (Italy), Finlombarda is a regional agency offering SMEs not only financial services, but also innovation-promoting services such as coaching for entrepreneurs, networking and internationalisation services [66]. In the Brandenburg region of Germany, the Brandenburg Economic Development Board (ZAB) is a service provider for SMEs and start-ups, and for potential investors. It offers various types of consulting service on matters of innovation, workforce management and investment for innovation [67].

The science and technology parks located in various EU regions are another type of service provider. The Lindholmen Science Park in Gothenburg, West Sweden, is an important facility for supporting the implementation and uptake of Industry 4.0, focusing on areas such as transport, ICT and media [68]. Innovatum36 in Trollhättan is another science centre with a specific focus on production technology and on environmental and energy technologies. The Advanced Manufacturing Park (AMP) in South Yorkshire (UK) is a science and technology park co-financed by public and private bodies and offering services for research and innovation. The aim of the AMP is to reinforce the manufacturing capability of regional companies, specifically in terms of AMT [69].

Universities and research centres also play an important part in providing training services for AMT. The DHBW in Baden-Württemberg is a cooperative state university that delivers education services in close cooperation with regional SMEs.

36 http://www.innovatum.co.uk/
Baden-Württemberg Cooperative State University  
(Baden-Württemberg, Germany)

The DHBW is a university initiative offering dual-education programmes in cooperation with regional enterprises; it has several campuses across the Baden-Württemberg region. The DHBW offers job-integrated learning programmes, which include compulsory student internships with local SMEs as part of the course of studies at DHBW. University lectures and internships are very much aligned and closely integrated in order to maximise the knowledge transfer [70].

Another type of service provider is the regional technology centres, which offer training and also technological and consulting services. ITAinnova, for instance, is the technological institute of Aragon that helps companies improve their technological competences. The centre offers specific services in areas of Industry 4.0 and AMT such as robotics, ICT for logistics, etc. [71].

3.3.2 Service offerings at national level

There are several service offerings at national level within Member States.

In Finland, the Smart Machines and Manufacturing Competence Centre (SMACC) aims to support SMEs by offering services such as technical consulting, as well as technology and research services in the field of AMT. The centre was created jointly by VTT, the Technical Research Centre of Finland, and the Tampere University of Technology. The main areas covered by the SMACC are advanced digital manufacturing, digital services, additive manufacturing, robotics, etc. [72]. In Germany, there is Steinbeis37, which pools together a large number of small institutes at mid-range universities that provide know-how and technology transfer services. This solution successfully bridges the gap between knowledge providers and knowledge users. The various institutes offer specialised services in terms of R&D, consulting, training and workforce development. In Finland, Nivala38 is a major industrial and technology park providing SMEs with technology, business and economic development services. The German Federation of Industrial Research Associations (AiF) is a national organisation that supports SMEs’ R&D by establishing close collaborations between academia

37 http://www.steinbeis.de/de/
and industry. In particular, the Industrial Collective Research (IGF) is a major service offering developed by this organisation to link research results to industrial applications in SMEs. The services offered by the AiF/IGF concentrate mainly on innovative technologies for SMEs and transnational collaborative research [73]. In France, the IRT Jules Verne is a provider of services for industry, and SMEs in particular. Its service offerings include R&D, access to facilities and technology transfer [74]. AWS-Austria Wirtschaftsservice GmbH is the Austrian federal promotional bank that helps enterprises to pursue innovation by various means such as loans and subsidies. It provides funding for companies that have difficulty accessing funds from other sources. It has a specific budget of €80 million for SMEs over the period 2009-2026 [75]. In the UK there is the SWMAS, which provides services to manufacturing SMEs with a view to improving their technological capabilities and productivity. The services it offers include consultancy services, running public funding programmes, dealing with complex funding arrangements, supporting businesses to leverage UK and EU funding for growth and innovation, and training services [76]. There is also the High Value Manufacturing Catapult39, a Catapult centre with 7 physical nodes across the UK that provides technical service offerings to companies, and SMEs in particular. Two of the centres focus on offering AMT-related services, namely the Advanced Manufacturing Research Centre in Rotherham and the Manufacturing Technology Centre in Coventry. These centres benefit from extensive facilities for research conducted jointly by academic and industrial partners. The centres provide technological consulting, training and other services. Funded with an initial investment of £140 million, the High Value Manufacturing Catapult has attracted over £219 million of additional investment. It receives significant support from industry, which provides 40% of its income. In general, for every £1 of government funding, the High Value Manufacturing Catapult generates £3.90 of commercial and collaborative R&D income [77]. In France, the Cetim (Technical Centre for Mechanical Industry) was established in 1965 to help French companies become more competitive and to promote technical progress. Today Cetim is a significant actor providing companies with services such as technological foresight, technological innovation, distribution of technological information, and technological training [78]. It also supports collaborations between SMEs and RTOs by providing incentives. The Lloyds Bank Advanced Manufacturing Training Centre in the UK is another example of a national service provider for the purpose of redressing the skills gap in the high value manufacturing sector [79]. In Belgium, Agoria (the Belgian Federation of Technology Industries) is a national service provider in the field of manufacturing technology development. It delivers technical and business services, as well as spreading the culture of new business models among SMEs [80].

39 https://hvm.catapult.org.uk/
Some organisations such as national investment banks are dedicated to providing financial services to companies, with a specific focus on SMEs. In France, Bpifrance supports SMEs to facilitate their access to financial resources. BPI France recently defined two new financing tools as part of a financial initiative under the umbrella of the Junker plan. The service offering will be in the form of loans for innovation and seed-stage investment loans with a total budget of €420 million [81], [82]. In Germany, KfW is a national development bank that provides financial services to companies, including SMEs. In particular, the “KfW ERP innovation programme” aims to help SMEs to invest enough to improve their processes. The service can include a 100% financing up to €50 million. For some innovative technologies, such as sustainability-related technologies, the amount will even be increased by €25-50 million [83].

In Germany, clusters have an important role in linking technology providers and technology users. NanoValley is a German cluster focusing on nano- and micro-manufacturing technologies that aims to promote knowledge and technology transfer to companies (especially SMEs) and to strengthen the links between research institutes, academia and companies [84]. In Italy, the recently-created institutional mechanism of clusters led to the setup of the Cluster Fabbrica Intelligente, which offers networking services for community building in manufacturing, the object of which is to achieve the critical mass needed to trigger and manage high-impact national innovation projects [85].
The teaching factory for providing the training needed for AMT is an emerging concept that is being used more and more in various Member States, especially the more advanced ones in terms of AMT. A notable example is the Festo teaching factory in Germany.

**Cluster Fabbrica Intelligente (Italy)**

An example of a national governance framework to align European, national and regional policies is the Italian “Cluster Fabbrica Intelligente” initiative. Cluster creation was triggered by the Ministry of Research, University and Education in 2012, with a view to obtaining a reliable private-sector counterpart representing the national manufacturing innovation ecosystem in terms of industrial research and innovation priorities. The Ministry launched an open call for the presentation of a strategic plan to create a cluster and a set of highly strategic innovation projects supported by significant aggregations of manufacturing stakeholders. Major national research institutes, universities, associations and companies then came together to jointly design the initiative and their proposal was approved and funded by the Ministry, which is now defining national policies in partnership with the cluster. In outlining its strategic roadmap, one of the main priorities was to align proposed strategic areas with those defined at European and regional levels. The cluster therefore implemented a rule whereby regional clusters participate as members in national clusters and sit on their boards, representing regional specialisations. This mechanism means that the resulting national policies consider synergies and complementarities of regional policies represented by regional clusters. The first methodological step towards the definition of the roadmap involved analysing the main existing European manufacturing roadmaps in order to give stakeholders the wide European framework to consider when deciding national priorities in the light of their specialisation [85].

**Festo teaching factory (Germany)**

Festo provides services for training the workforce in the scope of Industry 4.0 through its “training factory” programme. Thanks to its innovative industrial technologies labs, Festo provides trainees with the practical knowledge they need in digital production. The topics vary, but they all focus on Industry 4.0 and smart factory issues such as cyber-physical systems, RFID and NFC technologies, Plug & Produce, mobile robotics, the monitoring of systems and energy consumptions, intelligent vertical and horizontal networking, etc. [86].
3.3.3 Service offerings at European level

At the European level, the Smart Specialisation platform is a key service offered by the European Commission. The platform supports Member States in defining and implementing appropriate research and innovation strategies for smart specialisation. The services offered by the platform include “providing good practices and guidance materials, access to data, conducting high-quality research to inform strategy formation and policy making, facilitate peer review and mutual learning, organise sessions for policy makers” [87]. In June 2016, the European Commission launched the Smart Specialisation Platform for Industrial Modernisation and Investment. This platform aims to put in place a partnering process for strategic inter-regional collaborations by means of which SMEs, in particular, together with other innovation actors and clusters, can be supported in their efforts to find partners with complementary competences and gain access to value chains that cut across national, regional and sectorial boundaries, as well as to technology centres, including KETs infrastructure and digital innovation hubs.

<table>
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<tr>
<th>Smart Specialisation Platform for Industrial Modernisation</th>
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<td>The aim of the Smart Specialisation Platform for Industrial Modernisation is to provide a platform for the EU regions to support their efforts to develop investment projects, bearing in mind the RIS3 priorities for industrial modernisation. These efforts will involve different actors such as companies, business organisations, clusters, research centres, etc. The platform was launched in June 2016 and aims to develop a partnering process for strategic inter-regional collaboration [87].</td>
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The European Factories of the Future Research Association (EFFRA) was established by the ManuFuture technology platform and key industrial associations to bring together private and public partners under the umbrella of FoF in order to promote research and innovation in manufacturing technologies [88]. The EFFRA Innovation Portal[^40] is a reference where members of the community can share the results of projects, facilitate the set-up of partnerships and identify suitable service providers.

The European BIC Network (EBN) is a service provider at EU level that supports innovation in SMEs. The EBN connects business support organisations, universities, corporations, investors,

[^40]: http://www.effra.eu/flux88/index.php
clusters, innovation parks and government organisations. It provides a wide variety of services, including networking and the development of joint industry-research projects [89].

The Enterprise Europe Network (EEN) is another major service offering at European level that helps SMEs to innovate and grow, providing them with various types of partnership, advisory and innovation service. It particularly supports SMEs in their efforts to access R&I funding and find the most appropriate technology for their needs. It also offers dedicated support services for SME instrument beneficiaries. The EEN is co-financed by COSME for the period of 2014-2020 with an overall budget of €2.3 billion [90].

The European Investment Fund (EIF) is an EU body that provides financial support for SMEs. As part of the European Investment Bank Group, the EIF is a specialist provider of finance to SMEs using either its own resources or those provided by the European Commission and third parties. The service offering includes investment to support SMEs in technology transfer [91].

In 2012 the European Commission launched a vibrant platform for cluster organisations called the European Cluster Collaboration Platform (ECCP). This is an internet service facility offering cluster organisations modern tools for improving their collaboration among regional clusters within the EU and elsewhere. Many of them are concerned with advanced manufacturing. The platform currently has over 950 registered clusters from all over Europe. Another European initiative launched by the European Commission concerns the European Strategic Cluster Partnerships (ESCPs), the aim of which is to encourage cooperation and explore synergies among clusters in Europe in order to make it easier for European SMEs to enhance their competitiveness [92].

Launched in 2010, the purpose of the Regional Innovation Monitor is to support the sharing of intelligence on innovation policies in some 200 regions across 20 Member States. The RIM Plus 2015-2016 is evolving from a general monitoring of innovation policies towards establishing a more thematic focus in selected areas in order to contribute to improving the competitiveness of European regions [93]. The RIM Plus 2015-2016 provides the following services:

- a 'knowledge base' on regional innovation policy measures, advanced manufacturing activities, policy documents and organisations;
- a single point of access for knowledge sharing and good practice dissemination on regional innovation policy in Europe;
- a network of regional experts with thematic specialisation and knowledge hub services;
- the organisation of a series of policy events; and
- a new communication platform for innovation stakeholders.
3.3.4 Service offerings outside the EU

In the US, the “US Manufacturing Extension Partnerships (MEP)” is a major provider of services for manufacturing companies with a specific focus on SMEs that aims to boost their innovation in manufacturing activities.

### Manufacturing Extension Partnership (US)

The “US Manufacturing Extension Partnership” (MEP) is a major provider of services for manufacturing companies with a specific focus on SMEs, that aims to boost their innovation in manufacturing activities. Forming a network of 392 centres, the MEP provides services and support for SMEs’ process and product improvement through the expertise and competencies available at its centres across the country. The MEP is also very active in terms of promoting federal funding opportunities to SMEs. According to their estimate, for every dollar of federal investment, the MEP generates $17 in new sales growth and $24 in new client investment. This results in $2.3 billion in new sales annually. In addition, for every $1 900 of federal investment, the MEP creates or retains one manufacturing job [94], [1].

3.4 Critical analysis of existing policies and service offerings

Once the relevant existing policy actions and service offerings had been mapped, a critical analysis was conducted to identify their potential benefits or shortcomings, as well as inspiring examples of good practices at various geographical levels (from among those introduced in Sections 3.2 and 3.3).

The analysis prompted the following conclusions:

- There are numerous programmes, initiatives and service offerings promoting the uptake of AMT in Europe at all geographical levels, several of which focus specifically on SMEs (e.g., COSME, the EFSI SME facility, the H2020 SME instrument, InnovFin SMEG, etc.).
- Several platforms, especially at European level, offer various types of service for manufacturing technologies, acting as a reference for the provision of strategic services to Member States, companies and other manufacturing stakeholders across the EU. Examples are ManuFuture, EFFRA, and the Smart Specialisation Platform for Industrial Modernisation.
Although the coordination of measures for promoting AMT uptake, and for supporting SMEs more generally, has improved at European level, but programmes and initiatives at different geographical levels still seem to be fragmented and poorly interconnected. This fragmentation can be seen from two perspectives, one financial and the other relating to a balanced access to service in various EU regions. In the former case, better links between regional, national and European programmes and initiatives would enable greater funding synergies and complementarities. In the latter, not all SMEs in the various countries and regions of Europe seem to be able to exploit the opportunities offered by the available programmes and initiatives. According to EC statistics, more than 60% of the Horizon 2020 SME Instrument funding (for a total budget of €108 million) has gone to SMEs in just four Member States. UK companies rank first (having received over €17 million), followed by France, the Netherlands and Spain [95]. This issue has already been addressed by means of inter-regional programmes for exchanging best practices and policies among various EU regions, but the problem persists in a paucity of inter-regional programmes focusing specifically on the uptake of AMT by SMEs. There are examples of policy actions at European level (e.g., INTERREG and INNOSUP), at national level (e.g., the Cluster Fabbrica Intelligente in Italy, which strives to link national, regional and European policy levels), and at regional level (e.g., voucher programmes centred on the “Seal of Excellence” label in Lombardy, or the GLOBALmidt initiative for interregional cooperation in Denmark).

Analysing more than 80 policy actions and service offerings at various geographical levels showed that, apart from certain technology categories (i.e., Industry 4.0 and Robotics), many existing policy actions and service offerings target a broad audience with no specific focus on a given technology or company size. There are a few inspiring examples, however, that are clearly dedicated to technology uptake by SMEs. At European level, I4MS and ActPhast are two such initiatives for supporting SMEs in the uptake of digital and photonic technologies; at national level, the RonostartPME programme in France helps SMEs adopt robotics cells; and at regional level, Pathway towards AMT for SMEs in Pays-de-la-Loire (France) and RENOVE Maquinaria in Basque Country (Spain) both support the adoption of AMT and machinery renovation.

European Member States and regions differ in the accessibility of research and innovation infrastructure. Recent studies show that two in three technology facilities providing services to SMEs in the field of advanced manufacturing are located in only four Member States (Germany, UK, France, Spain) [1]. This means that pilot and innovation facilities are not easy to access for companies in some EU countries. There appears to be a significant imbalance between western and eastern EU states in this regard. According to EC statistics, Western Member States have around 12 times as many national research facilities as those in Eastern Europe and virtually all the pan-European infrastructure is in
Western Europe. EC statistics also show that there are nearly 5 times more technological service centres supporting SMEs in the field of Key Enabling Technologies in Western Member States [96]. The Vanguard Initiative is an inspiring example of an initiative aiming to establish a pan-European network of pilot lines and demonstrators across different EU regions.

- **Some programmes outside the EU** could be considered as a benchmark for the EU, such as MEP, the SBIR and the NNMI in the US, and Made in China 2025.

- **Vouchers seem to be effective in supporting SMEs**, and there is evidence of successful experiences across various regions in Europe. Vouchers can be used to partially fund the uptake of AMT, and their easy applicability and bureaucratic simplicity make them an effective tool for SMEs. Innovation vouchers are useful for stimulating innovation in SMEs and strengthen the ties between SMEs, RTOs and other knowledge providers [64]. Examples of successful voucher programmes include the Dutch voucher system, the Scottish innovation voucher, and the creative credit programme in Manchester (UK). By enhancing the qualifications and training of their skilled workforce, the **Innovation Assistant programme has also proved effective for SMEs pursuing innovation**. This programme promotes mobility between academia and businesses, and the transfer of innovation management, as well as providing advisory services. Funds are made available to SMEs that employ innovation assistants. There has reportedly been “a positive response by beneficiaries to the measure and the objective to promote innovative activities in companies has been largely achieved” [97]. This instrument is currently only available in the most advanced manufacturing regions in Europe, however. Some examples are the Innovation Assistant programmes in various regions of Germany (Saxony-Anhalt, Brandenburg, North Rhine-Westphalia), Austria and Denmark, while there is little evidence of such schemes existing in other Member States, especially in Eastern Europe.

- Several policy actions adopted inside and outside the EU involve Public-Private Partnerships (PPPs) as a mechanism to increase total funding for R&D projects. Examples at European level include Factories of the Future, SPIRE, Robotics, Photonics21, etc., while national schemes like Pôles de Compétitivité41 in France, Forschungscampus in Germany and NNMI in the United States are examples of good practices.

- There seems to be **a shortage of programmes connecting mid-range universities and colleges with firms and SME consortia at local and regional levels**. Such programmes are used to define policy actions and establish suitable colleges and universities for bridging

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the gap between academia and SMEs. Germany adopts a dual education system whereby students work at a company while completing their formal education at vocational schools. Other examples of cooperative education programmes to combine work experience with a university education are the “Research at college with Enterprise” (FHprofUnt) programme in Germany, the Universities of Applied Science in Baden-Württemberg, and the Baden-Württemberg Cooperative State University.

- Some training programmes and initiatives focusing on the uptake of AMT by SMEs can be considered as good practices, including the “Lifelong learning” programme and the “Blueprint for sectoral cooperation on skills” initiative at European level, the “Festo” teaching factory in Germany at national level, and the Industry 4.0 training programme in Navarre (Spain) at regional level.

- Across Europe, the national and regional programmes and initiatives are numerous and vary considerably in scope and budget, as shown in Tables 1 and 2 in Annex A to this deliverable. They form a somewhat fragmented picture and the budget is diluted over numerous small and medium-sized programmes instead of being concentrated into more far-reaching interconnected programmes. Outside the EU, the US seems to dedicate a considerable amount of financial resources to the uptake of AMT through large-scale initiatives and programmes. The budget for 2016 of the National Nano-technology Initiative, for instance, amounted to $1 billion. The federal budget for the NNMI was $150 million in 2016, and its total budget was estimated at around $300 million, far more than for any national and most EU programmes. One EU funding initiative as ambitious as those of the US is the Juncker plan, with an expected investment of €315 billion over a three-year period, €75 billion of which are dedicated to SMEs. It is difficult to compare this initiative with US programmes in terms of their support for the diffusion of AMT, however, because its focus is not only on manufacturing but also on other sectors. The data available a year after the start of the programme suggest that the Juncker plan may only reach a limited number of SMEs for the time being: of the funding worth €11.2 billion that has been approved so far, only €3.4 billion has gone to SMEs, while the remainder (€7.8 billion) is for infrastructure and other innovation projects. The total budget planned for SMEs of €75 billion over a three-year period would result in an average of €25 billion a year for SME funding projects. This discrepancy might indicate that SMEs lack the capabilities needed to access and exploit such a large amount of funding.

- There also seems to be a general shortage of suitable intermediaries capable of helping SMEs to establish efficient partnerships for innovation and develop networks in order to access complex funding schemes. The very diverse and fragmented offering of intermediation services in different European regions and nations makes it difficult for SMEs to identify the local service provider suited to their needs. Some examples of
intermediaries providing appropriate services are regional clusters like EMC2 in Pays-de-la-Loire (France) and AFIL in Lombardy (Italy).

In short, the analysis of existing policies and service offerings led to the identification of the following issues:

- Fragmentation and complexity of existing public funding instruments;
- Limited complementarities and synergies between European, national and regional policies;
- A shortage of instruments for supporting uptake, especially for non R&D-related mature AMT;
- Insufficient education and training systems meeting the specific needs of SMEs;
- Inadequate institutional mechanisms for incentivising research-industry cooperation;
- Shortage of instruments for inter-regional cooperation;
- Disparity of access to services and innovation infrastructure in Member States;
- Shortage of qualified regional intermediaries capable of triggering AMT uptake;
- Heterogeneity of regional service ecosystems in Europe;
- Diversity of roles for clusters and service providers;
- Limited ability of intermediaries to relate to a logic of smart specialisation;
- A generally inadequate specific technological focus in regional and national programmes for SMEs;
- Unavailability in some EU regions of programmes with a significant critical mass for the uptake of AMT.
4 Conclusion on Overall Issues based and Definition of Improvement Actions

The issues identified by the consortium partners in the light of the critical analysis of case studies, surveys, policy actions and service offerings are summarized in Table 4, classified as internal and external issues. The internal issues require action on the part of technology and service providers to help SMEs overcome barriers, while for the external issues policy-makers need to take contextual action to modify the policy framework. The issues to consider are grouped by macro-area (financial, funding, competences/skills, technology, supply chain cooperation, service offering and policy).

The issues raised in the previous section and the desired policy intervention that emerged from the empirical analysis suggest the need for a set of improvement actions to be implemented by policy makers and service companies, including:

- **Provide suitable resources for AMT uptake**, addressing the financial and funding issues specific to AMT in the light of the particular nature of SMEs;
- **Ensure better qualifications for AMT uptake** by addressing the competence and skills of SMEs and of relevant service providers;
- **Create new frameworks and infrastructure for cooperation in AMT uptake**, addressing technology and supply chain cooperation issues that affect the uptake process;
- **Create far-reaching, efficient service provision networks** to address service offering and policy framework issues;
- **Improve the political framework** to address policy framework issues.

Such improvement actions should overcome the barriers identified in the empirical analysis (Figure 2). The following section contains detailed recommendations for policy-makers and service providers implementing such improvement actions.
### Table 4: Issues emerging from the empirical and policy analysis

<table>
<thead>
<tr>
<th>Financial issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Limited investment capacity against unclear benefit (especially HPMTs)</td>
<td>• Market uncertainty and turbulence makes ROI in AMTs uncertain</td>
</tr>
<tr>
<td></td>
<td>• Costs and revenues of new technologies are unclear and uptake risk is too high</td>
<td>• SMEs cannot cope with the fragmentation, complexity and bureaucracy of existing public funding instruments</td>
</tr>
<tr>
<td></td>
<td>• Market uncertainty and turbulence makes ROI in AMTs uncertain</td>
<td>• Insufficient instruments for supporting AMT uptake by comparison with those for research/innovation, especially for the most mature AMTs</td>
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<td></td>
<td>• Insufficient instruments for inter-regional cooperation</td>
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<tr>
<th>Funding issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Private financial organizations have little awareness of the potential and risks of AMTs</td>
<td>• Shortage of education and training systems meeting the specific needs of SMEs</td>
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<td></td>
<td>• Insufficient interdisciplinary competence for understanding new technologies and their benefits</td>
<td></td>
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<td></td>
<td>• Insufficient interdisciplinary competence for forecasting ROI in AMTs</td>
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<tr>
<td></td>
<td>• Workforce not skilled enough to integrate, implement and operate AMTs</td>
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<tr>
<td></td>
<td>• Inability to identify and exploit suitable funding opportunities</td>
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<tr>
<td></td>
<td>• Insufficient evidence of robustness and performance of AMTs</td>
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<tr>
<td></td>
<td>• Integration of AMTs in existing processes is complicated and generates a risk of decline in performance and customer loss (especially for ICT)</td>
<td></td>
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<tr>
<td></td>
<td>• The conception of some AMTs followed a pure technology-driven approach</td>
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<tr>
<th>Competence and skills issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Insufficient interdisciplinary competence for understanding new technologies and their benefits</td>
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<td></td>
<td>• Insufficient interdisciplinary competence for forecasting ROI in AMTs</td>
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<td></td>
<td>• Shortage of education and training systems meeting the specific needs of SMEs</td>
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<tr>
<th>Technology issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Weak cooperation between RTOs and industry for the uptake of AMTs</td>
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<td></td>
<td>• Imprecise knowledge of customers’ needs and limited marketing action by technology suppliers</td>
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<td></td>
<td>• Limited engagement of technology suppliers in customer-supplier relationships</td>
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<td>• Insufficient evidence of robustness and performance of AMTs</td>
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<td></td>
<td>• The conception of some AMTs followed a pure technology-driven approach</td>
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<td></td>
<td>• Disparity of access to services and innovation infrastructure in different EU countries</td>
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<td></td>
<td>• Heterogeneity of regional service ecosystems in Europe, with different roles for clusters and service providers</td>
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<td></td>
<td>• Shortage of qualified regional intermediaries capable of triggering AMT uptake in a logic of smart specialisation</td>
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<tr>
<th>Supply chain cooperation issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Shortage of clear and qualified communication and circulation of information about AMTs</td>
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<td></td>
<td>• Lack of a clear map of potential service providers for SMEs</td>
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<td></td>
<td>• General shortage of suitable SME-tailored contents and formats in the offering of AMT-related training and education services</td>
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<td></td>
<td>• Weak cooperation between RTOs and industry for the uptake of AMTs</td>
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<td>• Imprecise knowledge of customers’ needs and limited marketing action by technology suppliers</td>
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<tr>
<th>Service offering issues</th>
<th>Internal Issues</th>
<th>External Issues</th>
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<tbody>
<tr>
<td></td>
<td>• Sustainable technologies are adopted mainly to cope with regulation</td>
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<td></td>
<td>• No regulatory approach to the creation of extended value chains using ICT solutions</td>
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<td></td>
<td>• No clear synergy and complementarity among European, national and regional policies</td>
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<tr>
<td></td>
<td>• With a few exceptions, not enough specific technological focus in many regional and national programs</td>
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<tr>
<td></td>
<td>• Programmes for the uptake of AMTs are not available in all EU regions</td>
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</table>

Source: Own analysis
Figure 2: Summary findings on main areas of policy action facilitating the uptake of advanced manufacturing

Source: Own analysis
5  Definition of Policy Recommendations

This section outlines a set of policy recommendations for promoting the adoption of AMT by SMEs. The recommendations were first drafted by the consortium partners, then discussed at a validation workshop held with policy-makers and experts, whose comments and feedback led to the revision and improvement of the draft recommendations. Further details on the validation workshop are provided in Section 3.1. The final set of recommendations is presented in Section 3.2, indicating for each recommendation the issues it targets, the policy actions already in place to address these issues, the steps recommended to overcome the shortcomings of existing actions and a set of concrete actions to implement the recommendation on the various geographical levels and for different actors and service providers across the value chain.

5.1  Validation workshop

The purpose of the validation workshop held in Brussels on 13 September 2016 was to collect the feedback and comments from over 20 policy-makers and experts from all over Europe to examine and validate the draft recommendations prepared by the consortium partners. The first part of the workshop was dedicated to a general presentation of the study, the results of the empirical analysis and the draft recommendations prepared by the consortium partners. This was followed by an open discussion during which participants gave general feedback and comments on the study and on general recommendation areas. In a second part of the workshop, the participants were divided into two groups to conduct a more detailed discussion of the recommendations. Each group had consortium members serving as facilitators and moderators. The two groups’ separate detailed discussions generated insight and feedback on concrete action for implementing the recommendations. The agenda, list of participants and final output of the workshop are attached in Annex B to this deliverable. The recommendations, revised in the light of the comments and feedback collected during the workshop, are presented in the next section.

5.2  Contextualisation of the recommendations in the light of various levels of technological complexity and potential user readiness

In its various empirical stages, this study also collected information on the conditions and industrial frameworks in which certain policy measures can be most relevant, important and effective. While these findings were not always entirely clear, certain aspects were repeatedly reflected from various angles. The following paragraphs summarise these findings from the perspective of a readiness-oriented framework.
As a basic premise, this framework builds on the finding emerging from all three former deliverables that the readiness of firms to adopt AMT not only differs by country and firm size, but also depends on the complexity and novelty of the manufacturing technology concerned.

- Overall, the leading manufacturers that can engage in research-driven projects and are ready to adopt and implement cutting-edge technologies are numerically relevant, but limited to the industrial sector concerned.
- There is a substantially larger number of firms sufficiently aware of the potential of adopting AMT and they usually also have a workforce sufficiently qualified to deploy them.
- There nonetheless remains a substantial number of firms (forming the basis of Europe’s industrial sector) that have yet to develop these qualifications and that are often not sufficiently aware of the opportunities inherent in AMT.

For the central policy recommendations advanced in this report, this situation has several important implications.

- Supply-side measures promoting the uptake of leading-edge technologies by leading manufacturers are essential to maintaining and reinforcing Europe’s global leadership in advanced manufacturing, but they are likely to remain inaccessible to many other firms that are important for growth and job creation.
- As a result, pilot lines, demonstrators and shared infrastructure for illustrate and promoting the immediate technological and economic benefits of adopting novel, yet already more established AMT will have a broader effect on the uptake of AMT across the European Union.
- The readiness of many potential AMT-user firms needs to be fostered by means of three steps - building awareness, qualifying the workforce and providing suitable risk-alleviating finance - before these firms will dare to adopt more AMT to transform their existing production processes.
- The provision of basic networking and consultation services regarding the fundamentals of AMT remains crucial for many firms forming the basis of Europe’s industry that must first meet international production standards before they can attempt any further, more ambitious transitions.

In short, the findings of this study indicate that a strong emphasis should be placed on actions to support the building of basic capacities, networks and infrastructure.

While there is no doubt that Europe is home to a sizable number of high-level actors whose commitment provides the foundations for building a framework architecture for international leadership, it is equally undeniable that their circle could be productively extended by means of enabling and capacity-building measures for the large number of industrial firms that contribute to job creation and growth across Europe but are not part of this high-level group.
In conclusion, an effective, multi-level strategy for industrial modernisation will have to be founded on three main pillars:

- Measures and actions on the supply (or provider) side to make relevant technologies and technological services with various level of sophistication accessible;
- Measures and actions on the demand (or user) side to enable and qualify more firms to take part in and profit from related offers;
- Measures and actions on the basis of European industry to ensure that the known benefits of technology uptake are leveraged by as many firms as possible.

**Figure 3:** Recommendations to service organizations and firms

Source: Own figure, based on own analysis
5.3 Final recommendations

The detailed recommendations are presented here in a systematically interrelated framework addressing multiple policy goals. Given the methodology and process adopted in the present study (see Figure 1) to develop these final recommendations, it should be noted that:

- the recommendations cover a broad range of issues from capacity building to pushing the technological frontier;
- the recommendations are based on a value chain approach, taking the perspective of both technology suppliers and users into account, and thus moving a crucial step beyond the usual technology-oriented perspective. Factors relating to the concrete commercial relevance of investment in AMT have also been considered in relation to drivers and external issues;
- the recommendations are based on a cross-cutting analysis of different technologies, sectors and countries. They are deliberately presented in a general manner applicable to all three AMT categories identified by the European Commission Taskforce on Advanced Manufacturing. Where major specificities have a role, this is mentioned. A concluding section expands on the relevance of differences between technologies, sectors and countries in more detail.

Based on the issues listed in Table 4, four main goals were considered for the purpose of deriving policy recommendations:

I. Strengthening Capacity for SMEs

Many European firms still lack the sufficient capacity to adopt AMT. Shortcomings concern know-how, human capital, organisational and managerial capacity as well as financial capacity. A better AMT ecosystem for SMEs to support them in building their capacities in all areas of advanced manufacturing is essential to provide them with the basic enablers needed for the uptake of AMT.

II. Promote High-end AMT Uptake

The uptake of the latest AMT at the frontier of technological development poses significant challenges even for already more advanced industrial SMEs. Therefore, for these SMEs, high-quality demonstration environments and other suitable framework conditions need to be established to enable them to pilot and absorb the most recent solutions and relevant research results, in cooperation with research and technology organisations (RTOs) as well as other relevant AMT firms.

III. Improve the AMT Offer to manufacturing firms

Currently, many AMT providers still fail to fully capture and consequently meet the needs of SMEs regarding the uptake of AMT. The solution lies in the technology suppliers’ and
their customer businesses’ co-participation in the uptake process, instead of the traditional customer-supplier relationship. To strengthen the uptake of AMT, new **business models for technology firms** have to be promoted that **allow their SME clients to invest under conditions of uncertainty**.

**IV. Strengthen policy coordination**

While many pertinent support measures are already available in the EU, their coordination across different levels of policy making needs to be improved, emphasising synergies and complementarities, as well as offering SMEs a more straightforward and coherent policy framework. This is particularly important for the introduction of new measures and tools in future policy programmes and initiatives.

Within this overall framework, eight detailed policy recommendations were developed: for policy-makers addressing **external issues** and for AMT and service providers aiming to help European SMEs to deal with **internal issues** that prevent them from investing in AMT.

Figure 3 shows the four main categories of policy recommendations.

**Figure 4: Four main categories of policy recommendation**

Source: Own figure, based on own analysis

To build a broad basic capacity for AMT uptake, detailed recommendations target the creation of more efficient innovation infrastructure for service provision, improving skills and making available risk-compensating financial resources. For the more advanced firms and for the uptake of the latest AMT, the development of shared pilot plants and demonstrators, new options for exploiting the results of research and further efforts in the field of standardisation are advocated. To improve the AMT offer on the market from
a technology supply-side perspective, detailed recommendations address the diffusion of innovative service-oriented business models. Finally, transversal recommendations for policy coordination are provided.

Figure 4 summarises the whole framework, indicating the core concepts of the detailed recommendations.

**Figure 5: Systemically interrelated framework of policy recommendations**

![Diagram of policy recommendations](source: Own figure, based on own analysis)

These eight detailed recommendations are presented below, beginning with an explanation of the main issues addressed, and a mention of the initiatives in place that already address these issues\(^\text{42}\), in the form of existing policy actions and service offerings. The policy actions refer to the programmes, initiatives and other policy measures and instruments launched at various geographical levels (e.g. COSME, FOF, KIC AVM at European level, national instruments like MADE DIFFERENT and Catapult, and Innovation vouchers and Robotics loans adopted at regional level). The service offerings refer to existing support for SMEs provided by service organisations in the form of training, financial services, research facilities, and so on. This includes, for example, financial

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\(^{42}\) These initiatives are described in Sections 3.2 and 3.3 of this document
Service providers like the EIF at European level, the KfW at national level and Finlombarda at regional level. Service offerings also include networks and platforms (such as the EEN, the EIT, the RI3S Platform for Industrial Modernisation), which deliver specific services in a structured and organised way. Other service providers such as technology parks (e.g. Lindholmen Science park), technology service providers (e.g., SMACC), competence centres (e.g., Mittelstand 4.0 Competence Centre) and clusters (e.g. EMC2) are also included in the service offerings category. Detailed recommendations are given concerning the additional effort required to achieve the previously-outlined goals. Concrete actions to implement the recommendations are suggested, and the actors that could take responsibility for such concrete actions are identified.

Below eight detailed recommendations are presented with an indication of the core issues addressed, relevant initiatives already in place and the additional effort needed to achieve the outlined objective. Subsequently, these recommendations outline concrete actions needed to that effect and players who would have to take responsibility for them.

In summary, an overview of the detailed policy recommendations can be given as follows:

**Table 5: Recommendations derived from empirical and policy analysis**

<table>
<thead>
<tr>
<th>Strengthen Capacity for SMEs</th>
<th>Promote High-end AMT Uptake</th>
<th>Improve the AMT offer to manufacturing firms</th>
<th>Strengthen Policy Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Improve and extend AMT ecosystem for SMEs</td>
<td>1. Promote joint pilot plants and demonstrators</td>
<td>support new, risk-mitigating business models for AMT providers</td>
<td>better align European, national and regional efforts</td>
</tr>
<tr>
<td>2. Improve skills capacity for SMEs</td>
<td>2. Improve the exploitation of Horizon 2020 research by SMEs</td>
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<td>3. Financial support for diffusion</td>
<td>3. Adapt standardisation and regulation to AMT diffusion</td>
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Source: Own analysis
5.3.1 Strengthen capacity for SMEs

Recommendation I.1: Improve and extend the “AMT ecosystem for SMEs” across all the EU

This recommendation aims to address the following issues emerging from the analysis:

- lack of a clear map of service providers;
- disparity of access to services in different EU countries;
- lack of multidisciplinary competence for designing and introducing AMT;
- difficulties in identifying suitable funding opportunities;
- lack of clear and qualified communication regarding AMT;
- heterogeneity of regional innovation ecosystems;
- lack of qualified regional intermediaries (such as clusters) for triggering AMT uptake in the light of smart specialisation.

Cluster-related initiatives in Europe like the “European Initiative for Cluster Excellence”\(^{43}\) and the “European Cluster Observatory”\(^{44}\) play an important part in providing facilitation services for SMEs. The European Initiative for Cluster Excellence has established a system of certification with different labels (gold, silver, bronze), which can be used to assess the quality of clusters across Europe. Several cluster schemes are available at national and regional levels in various Member States, including the “National-level Leading-edge Cluster Competition” in Germany, the “EMC2 Cluster” in Pays-de-la-Loire (France), the “AFIL” and “CFI” in Italy, the “MecaTech Cluster” in Wallonia, the “AFM” (Association of Machine Tool Manufacturers) in Spain and “Produtech”\(^{45}\) in Portugal. There are also numerous other European, national and regional programmes and initiatives meant to offer services for the diffusion of AMT, such as “Made Different” in Belgium, “Catapult” in the UK, “Robostart PME”\(^{46}\) in France, “ActPhast”\(^{47}\) in Europe, etc.

Important efforts to create reliable innovation infrastructure in a larger number of Member States have already been made as part of the EU’s cluster policy and digital innovation hubs (DIHs). Similar initiatives have been promoted by ESIF sources at the national and regional level too.

Despite these various initiatives and good practices at all geographical levels, empirical analysis suggests that the service offering for facilitating the uptake of AMT by SMEs is

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43 https://ec.europa.eu/growth/smes/cluster/excellence/
44 http://www.clusterobservatory.eu/index.html
45 For more information on EMC2, AFIL, CFI, MecaTech, AFM and Produtech, see Sections 3.3.1 and 3.3.2
46 For more information about MADE Different, catapult and Robostart PME, see Section 3.2.2
47 See Section 3.2.3
still very fragmented and that a stronger presence and more homogeneous quality of such service offerings should be pursued. European industrial policy should therefore seek to support Member States and regions in their efforts to improve their service offering systems by leveraging the role of existing clusters and also developing additional, technologically broad-based, innovation infrastructure in collaboration with RTOs.

More specifically, it is recommended that Member States and regions further improve the quality and availability of their service offering systems for SMEs, promoting dedicated initiatives in the logic of smart specialisation. Clusters and other intermediaries, such as regional development agencies, should act as orchestrators of regional service capabilities and as contact points for SMEs to make it easier for the latter to access the existing offering of various types of service (e.g., financial, training, technology, etc.) that risk going under-exploited. Clusters have a thorough knowledge of the needs of their local member firms and are therefore in a good position to orient SMEs towards suitable support programmes and service providers.

As documented by the European Cluster Observatory, there are cluster development success stories and best practices in many Member States at various levels, some of which were mentioned earlier among the existing initiatives. The performance of clusters can nonetheless be significantly improved in many regions to support SMEs more efficiently. It is therefore recommended that the best practices be extended to improve the efficacy of clusters. When taking further steps to expand the activities of existing clusters or establish new ones, a quality assurance system such as the European Initiative for Cluster Excellence should be adopted to define basic criteria that new clusters must gradually meet in order to receive further funding. At the same time, initial support should provide new clusters with the means to provide professional services from the outset.

Alongside improvements to cluster-facilitated services, it is recommended that dedicated initiatives and programmes for the diffusion of AMT be established in all Member States and in many more regions to enable and promote a more balanced growth of the EU’s industrial capabilities. Inspiring examples can be drawn from leading regions, such as “Made Different” in Belgium, the UK Catapult Centres, the German Leading-Edge Clusters 48, etc. It is also recommended that local initiatives be tailored to the specific technologies and principal needs of local SMEs.

48 The leading-edge cluster competition was launched in 2007 by the Federal Ministry of Education and Research in Germany as part of a high-tech strategy to help the most advanced regional clusters to increase their international competitiveness [91].
CONCRETE ACTIONS to implement Recommendation I.1

At the European level

- Consider the establishment of AMT innovation hubs with a mission beyond pure ICT, modelled on the current digital innovation hubs promoted by DG CONNECT, but with a technological mandate that covers all areas relevant for industrial modernisation.

- Promote, propagate and support suitable models for service offering systems based on successful cases identified in various initiatives such as the European Cluster Observatory and the Regional Innovation Monitor, as well as the INNOSUP, INTERREG, and TREC projects.

- Reinforce instruments such as EEN and improve their integration into existing national and regional innovation networks to support SMEs in terms of receiving required service offerings for AMT uptake.

- Communicate experiences and specific knowledge across Member States and regions aimed at improving service offerings in regions where it remains necessary to build professional capacity. Both the Horizon 2020 section on ‘Spreading Excellence and Widening Participation’ and EU actions supporting the ‘Cooperation between Regions and Countries’ (e.g. INTERREG) can be suitable tools in this regard.

- Monitor AMT uptake processes and of the performance of regional manufacturing innovation systems. Support for initiatives like the Regional Innovation Monitor, Re-Confirm, Innobarometer and the future European Manufacturing Survey could provide relevant leverage in this regard [98, 99].

- Exploit the forthcoming KIC on added-value manufacturing to consolidate efficient service offerings in the EU through better collaboration between academia, research and industry.

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49 For more information about INNOSUP, INTERREG and TREC, see Section 3.2.3.
50 See Section 3.2.3.
51 See Section 3.3.3.
53 Innobarometer is a European survey collecting data and feedback for policy-makers from the general public and EU businesses on the topic of innovation, https://ec.europa.eu/growth/industry/innovation/facts-figures/innobarometer_en.
55 See Section 3.2.3.
At national/regional levels:

- **Incentivise clusters to increase the quality of their services** according to European quality standards, launch dedicated programmes for the diffusion of AMT among SMEs based on regional specialisation and previous successful initiatives.

- **Diffuse successful regional service models** through trans-regional/national cooperation.

- **Launch specific actions to improve the service offering systems and the role of clusters according to the smart specialisation paradigm** taking note of the standards identified and defined by the European Initiative for Cluster Excellence and drawing on existing sources of funding.

To clusters:

- **Act as mediators and orchestrators of technological and business-oriented services in regions** to connect SMEs to service suppliers that can most adequately address their needs with respect to technological issues, organisational development and management challenges.

- **Act as regional intermediaries between the policy level and manufacturing companies**, communicating local SMEs’ needs and priorities to regional and national decision-makers while, at the same time, informing those about available support offerings and how they can be combined.

- **Actively engage in the interregional cooperation efforts for the uptake of AMT establishing strategic relationships with other European clusters under the logic of smart specialisation considering the practical needs of their regional firm population.**

- **Leverage existing sources of ESIF and ESF funding to hire qualified cluster managers** with a background in industry and allow them to take part in relevant qualification and training measures (beyond good-practice exchanges) on a regular basis.

- **Aggregate SMEs’ demand in front of technology and other service providers and communicate their specific needs and requirements** to better allow AMT producers to understand new markets to which they have had little access so far.

- **Participate in relevant European Initiatives on clusters.**

To technology and other service providers:

- **Cooperate with clusters in order to better access additional markets** and offer own competencies in the framework of an organised regional service offering system.
Recommendation I.2: 

Improve skills capacity for SMEs

By focusing on the transfer of knowledge and skills, this recommendation addresses the following issues emerging from the analysis:

- lack of AMT-related competences in SMEs;
- weak cooperation between research organisations and universities or other training organisations on matters of AMT-related training and education;
- weak cooperation between SMEs and RTOs or universities in the joint development of AMT solutions.

Some existing European initiatives focus on training and knowledge transfer, such as the Lifelong Learning Programme (LLP) and its sub-programmes like Leonardo Da Vinci. Under the LLP, various projects have been funded to develop training systems for AMT that can be applied as best practices, including “KTRM” for the development of an innovative training system in the field of additive manufacturing and “MIMAN-T” in the area of micro-manufacturing [35], [36]. The “Know-fact” project dealt with the design of new education paradigms such as teaching factories. Other more strategic and long-term initiatives include the “Sectoral Skills Alliance” under the EACEA (the Education Audio-visual and Cultural Executive Agency of Europe), the “Blueprint for Manufacturing Skills” and the forthcoming KIC on added value manufacturing, the purpose of which is to put the knowledge triangle (education, innovation and business) into practice. There are also regional and national schemes for ensuring an effective cooperation between SMEs and universities (like the dual education model and Steinbeis in Germany, or the training centres on Industry 4.0 in Baden-Württemberg) and public-private models for skills development (e.g., the Lloyds Bank advanced manufacturing training centre in the UK).

Leaving aside the cited examples, good practices appear isolated in Europe and there is huge potential for replicability and improvement in many Member States and regions. Results generated in recent European projects and initiatives should be widely implemented in European industry.

The recommendation emerging from the present study is to promote new models of cooperation between universities and SMEs for tailor-made training systems focusing on regional smart specialisation. This can be done by establishing appropriate institutional frameworks and initiatives to support SMEs collaborating with research institutions.

56 http://www.knowfact-project.eu
57 http://mtc-trainingcourses.co.uk/
centres and universities on the uptake of AMT and the development of skills and competences in SMEs. To meet the needs of SMEs in terms of education, a very important factor is “practical training” to gain skills and competences that can be immediately transferred to companies adopting AMT. To provide practical training on technologies and industrial applications of real relevance to SMEs, it is important to focus on industry/university cooperation in selected groups of technologies based on smart specialisation, introducing new approaches such as teaching factories and e-learning (as in the case of the network of training centres on Industry 4.0 implemented in Baden-Württemberg). Curricula should be decided jointly with industry, and the latter’s active participation in the education process is essential, as amply demonstrated for many years in the context of Germany’s different tiers of dual education models. The introduction of new formats such as e-learning and teaching factories should exploit experience gained from past EU projects such as “KTRM”, “MIMAN-T” and “KNOW-FACT”.

One of the main reasons for the limited cooperation between SMEs and RTOs is that research organisations and universities traditionally focus on generating outputs with a strong scientific impact, so cooperating with SMEs on activities aiming at AMT uptake is often not among their priorities. It is therefore also recommended that efficient cooperation models be promoted between SMEs and RTOs to improve the co-creation of AMT solutions. Inspiring examples specifically addressing this issue include: the German system of universities of applied sciences with their mission (supported by a coherent organisation and career paths for researchers and professors) to generate relevant impacts for companies in terms of the uptake of innovative solutions and the development of skills; the Steinbeis foundation stimulating universities and research centres to create service companies that can transfer the results of research to industry; the TTO Circle managed by the JRC, which established a network of technology transfer offices for research organisations sharing best practices; the recent initiative launch by the Danobat Group in Spain for a significant industry-research cooperation project for implementing AMT in industry, supported by the EIB “InnovFin-EU Finance for Innovators” initiative. Other examples of successful schemes to stimulate cooperation between research and industry on the SME side are the resource pooling models, such as the AiF/IGF in Germany or Cetim in France, whereby SMEs are incentivised to share challenges for collective pre-competitive innovation activities contracted to research

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60 For more information about AiF/IGF and Cetim, see Section 3.3.2.
organisations or purpose-built innovation centres in order to benefit from a higher critical mass.

The forthcoming KIC on added-value manufacturing could also be a suitable framework for developing and disseminating such cooperation models for the uptake of AMT by SMEs and for the development of their competences and skills.

**CONCRETE ACTIONS to implement Recommendation I.2**

At the European level

- **Persist in the strategic effort of designing European curricula for AMT and of finding innovative education paradigms for SMEs** (e.g., teaching factories, e-learning) and build on initiatives like the “Blueprint for Sectorial Cooperation on Skills” and “Sectoral Skills Alliance”\(^{61}\).
- **Promote the exchange of successful experiences of cooperation between universities-research and SMEs** across nations or regions.
- **Exploit the knowledge generated within existing programmes and initiatives** such as the “Leonardo da Vinci” programme\(^ {62}\).

At national/regional levels

- **Provide adequate normative and organisational frameworks** to establish or improve the cooperation between industry and universities (such as dual education systems, joint SMEs-University regional training centres focused on local technology specialisation, etc) and in particular between RTOs and SMEs (such as SME pooling resources models for joint innovation, secondment of researchers in SMEs, and industrial PhDs, etc).
- **Activate strategic processes, supported by clusters, universities and RTOs, for the long-term identification of innovation and education needs of SMEs.**

To training organisations:

- **Design and provide specific multi-disciplinary training offering for the uptake of AMT by SMEs.** Introduce new methods such as effective e-learning systems for companies, the dual-training approach, as well as the teaching factory paradigm, exploiting the available pilot and demonstration infrastructure.

To RTOs and training organisations:

\(^{61}\) For more information, see Section 3.2.3.

\(^{62}\) For more information, see Section 3.2.3.
• **Promote the secondment of researchers and students to SMEs** and the realisation of PhD and Masters theses at SMEs.

**To Clusters:**

• **Facilitate the cooperation among SMEs and universities/research centres**, on regional and national levels as well as their participation in the forthcoming KIC on added-value manufacturing.

**To all:**

• **Exploit the framework of the forthcoming KIC on added value manufacturing** to set up and disseminate academia-research-industry cooperation models on a stable basis, making sure that significant impacts are generated for SMEs.

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**Recommendation I.3:**

**Provide adequate financial support for AMT diffusion**

This recommendation is deemed to address the following issues:

• High adoption risk due to limited investment capacity against unclear benefit;
• Fragmentation, complexity and bureaucracy of existing public funding instruments;
• Lack of instruments supporting the uptake of mature AMTs;
• Lack of instruments allowing transnational and trans-regional cooperation;
• Inadequate awareness of SMEs regarding available funding opportunities.

Financial obstacles are often the main barrier when SMEs are considering an investment in technologies that are already mature and supplied in a standardised manner (such as robots, handling systems, automated warehouse management systems, standard high-performance machinery, etc.). In such cases, public support programmes for research and innovation are not very effective since they are designed to compensate for the significant risks associated with the development of very innovative solutions. Even investing in more established AMT carries higher risks than traditional technologies, because of their complexity, novelty and organisational implications for an SME, and this may easily make them “unbankable” for private financial organisations. **Public support is needed to add momentum to the uptake of more proven AMT** on a broader basis, and thereby contribute to industrial modernisation.

At the European level, there are currently several structured funding instruments to support SMEs, such as the COSME Equity Facility for Growth and the COSME Loan Guarantee Facility, the SME Instrument under H2020, the EIF InnovFin SME Guarantee Facility, the InnovFin SME Venture Capital, the SME initiative launched by the EIB⁶³.

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⁶³ For more information about these initiatives, see Section 3.2.3.
Empirical analysis showed that SMEs are not well acquainted with existing opportunities, however, and that their complexity and procedures pose a serious challenge. Some Member States have fairly well developed supporting instruments in this area, such as Germany with its KfW64 system and complementary local development banks (e.g., IBB Berlin), Finlombarda65 in Italy and technology voucher schemes in various Member States. Many other regions and Member States profit from financial instruments co-financed or guaranteed by the ESIF, though such opportunities are not equally available everywhere in Europe due to a shortage of financially robust local support. Even where they are available, such instruments are often unclearly communicated and many SMEs fail to grasp their potential.

To overcome the above-mentioned shortcomings, it is recommended that the potential of existing European instruments be better exploited at regional level, promoting new financing mechanisms and improving existing financial models to enable the funding of technology and service providers beyond the funding authority’s regional boundaries. The vast majority of existing regional and national instruments currently lack this approach. It is also recommended that awareness among SMEs of the existing financial mechanisms for supporting the uptake AMT be improved in order to broaden their financial culture.

**CONCRETE ACTIONS to implement Recommendation I.3**

At the European level

- Improve regional capabilities to exploit the opportunities of EFSI (European Fund for Strategic Investment) and ESIF (European Structural & Investment Funds) programmes for the uptake of AMT by SMEs, leveraging the role of clusters in support of establishing efficient services to SMEs at local level.
- Prolong the EIF’s (European Investment Fund) SME Initiative (drawing on COSME, Horizon 2020 and EIB Group resources) to facilitate European SMEs’ access to funding.
- Differentiate instruments for different types of technologies and geographic areas.
- Continuously review and monitor existing instruments such as the COSME Equity Facility for Growth and of the EFSI SME Facility.

At national/regional level

- Offer multi-step support to SMEs to overcome the barriers they encounter in the different phases of the funding process. This can be realised, for example, by using voucher schemes dedicated to the different phases (i.e. business planning, identification of funding mix, design of the funding package, etc).

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64 For more information, see Section 3.3.2.
65 For more information about IBB Berlin and Finlombarda, see Section 3.3.1.
- Add momentum to the ESIF-funded deployment of public-private financial instruments, in which the public party provides equity funding to SMEs for AMT uptake on sustainable conditions, limiting associated administrative complexity. Private parties should participate in allocation decisions and constantly monitor the impact of the uptake project.

To clusters:

- Diffuse awareness of available financial support for the uptake of AMT.
- Facilitate participation of SMEs in initiatives that require a critical mass of competences, manpower or investment, as do the KIC on added-value manufacturing, areas of Horizon 2020 and the investment from the EFSI SME facility.
- Establish cooperation relationships with clusters of other regions/states and facilitate internationalisation of SMEs, based on regional specialisation. Experiences already gained in the Vanguard Initiative should be exploited.

5.3.2 Promote High-end AMT uptake

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<th>Recommendation II.1:</th>
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<td>Promote the development of joint pilot plants and demonstrators</td>
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This recommendation targets some issues mentioned by companies as barriers to the adoption of AMT including:

- Inadequate awareness and understanding of AMT and their benefits;
- Doubts concerning the robustness and performance of AMT;
- Difficulty in designing solutions to integrate AMT in existing processes;
- Disparity of access to service and innovation infrastructure in the EU;
- Lack of specific AMT-related training for SMEs;
- Weak cooperation among research organisations and SMEs.

Several initiatives and policy measures adopted in Europe already focus on establishing pilot infrastructure, such as the Vanguard Initiative. There are also examples of regional schemes like the “Mechatronics De- and Re-manufacturing” pilot plant in Lombardy. A number of EU projects under Horizon2020 and FP7 address this issue too, including the “EXPLORE” project, which aims to induce cross-fertilisation of AMT and to map pilot

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66 See Section 3.2.1.
68 http://explore-fp7.eu/
plants in different EU regions, and the “Multi-KETs Pilot Lines”\(^\text{69}\) project for nurturing a shared understanding on future actions to be taken in Europe, which focuses on multi-KETs pilot lines. The forthcoming KIC on Added-Value Manufacturing\(^\text{70}\) initiative is also expected to contribute to improving European pilot plants and demonstrators for the uptake of AMT.

To overcome the above-mentioned issues, it is recommended that **momentum be added to the existing efforts to establish and improve a broad European network of regionally-anchored pilot plants and demonstrators open to SMEs with a focus on AMT.**

The number and diversity of such initiatives may lead to fragmented efforts and the risk of failure to achieve the critical mass needed to build high-impact pilot plants and demonstrators. There is often no clarity on the future business model of these innovation infrastructures, especially in terms of the conditions needed to make it sustainable for SMEs to use them.

Looking at European regional policy, **pilot plants and demonstrators should be conceived in a logic of smart specialisation, while also ensuring synergies and complementarities at EU level.** They should offer SMEs sustainable access to innovative AMT-based equipment implemented on a Technology Readiness Level suitable for various purposes such as: ascertaining in detail which novel technological options are available; developing tailored solutions in cooperation with AMT suppliers; examining performance parameters and conducting financial analyses in order to draw up concrete business plans; and training personnel “on the machines”. Importantly, it is recommended that **pilot plants and demonstrators be not only hardware installations, but ecosystems where SMEs can meet technical service providers with the necessary multidisciplinary expertise for AMT uptake and qualification.** This approach will give SMEs new opportunities for AMT uptake that have so far been limited to large companies able to afford the independent construction and use of this type of infrastructure.

To meet the needs of SMEs in the different European regions, it is recommended that **existing pilot plants and demonstrators be improved and interconnected.** Where they are still unavailable, they should be established according to the logic of smart specialisation. The type of AMT and the industrial applications demonstrated in a given region should be chosen on the grounds of the available technological and service capacities as well as the specialisation of the local industrial system expected to use the

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\(^{69}\) [http://www.mkpl.eu/home/](http://www.mkpl.eu/home/)

proposed infrastructure. Specialised pilot plants in different regions will have to **exploit mutual synergies and complementarities**, helping SMEs to identify and access the pilot plants and demonstrators that meet their specific needs.

**Adequate funding support should be provided** at all policy levels to avoid losing momentum and **to accelerate the passage from the design to the implementation phase**. In this regard, it is recommended that regional, national and European policy-makers act in synergy to concentrate funding on key strategic innovation infrastructure achieving critical mass.

**CONCRETE ACTIONS to implement Recommendation II.1**

**At the European level**

- **Continue supporting the existing initiatives on pilot plants and demonstrators and create synergies among them** to achieve critical mass and concentrate funding on a limited number of highly strategic pilot infrastructures. The Vanguard Initiative is a key measure to be further deployed. Moreover, the recently launched “Smart Specialisation Platform for Industrial Modernisation”\(^{71}\) and the forthcoming KIC on added-value manufacturing can be opportunities to aggregate research, academia and industry for this purpose.

- **Provide enabling support to coordinated regional initiatives** like the Vanguard Initiative, which would benefit from centralised support complementing regional efforts and funding to add momentum to the development of concrete action plans for pilots.

- **Open pilot plants to SMEs and stimulate RTOs and universities to make available existing demonstrators and FabLabs**\(^{72}\) on a stable basis. In the short term, the Horizon2020 section for Industrial Leadership could be a framework to launch related initiatives. In a long-term perspective, relevant provisions could be added to the coming ESIF support period’s CPR. In the long run, transnational funding should be expanded to enable the establishment of networks of pilot infrastructures. In the meantime, INTERREG, INNOSUP and Art. 70 CPR\(^{73}\) could be leveraged more strongly.

**At national/regional level**

- **Support pilot lines development in the direction of national/regional specialisation**, enable and support transnational/regional cooperation for the development and exploitation pilot plants and demonstrators, including also converging regions.

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\(^{71}\) See Section 3.3.3.

\(^{72}\) Fabrication Laboratory, a type of Makerspace

\(^{73}\) Article 70(2) CPR(1) permits the ESIF funding of operations outside a specific ESIF programme area, for instance in other regions of the same country or in other Member States. In practice, it is hardly used.
At all European/national/regional levels:

- Define, support and implement private-public funding models for the establishment of pilots and demonstrators by combining available funds from different levels. In doing so, policy-makers can build on existing experiences, e.g. from the Vanguard Initiative. This decentralised process could be supported by the European Commission, for example, under the H2020 section ‘Spreading Excellence and Widening Participation’.

To technology providers and clusters:

- Exploit existing pilot plants and demonstrators to demonstrate and communicate the potential of AMT and to increase awareness and culture of SMEs about AMT.

To technology providers:

- Exploit existing pilot plants and demonstrators to collaboratively set-up tailored solutions for SME and illustrate their viability and concrete applicability to mitigate SMEs’ perception of the technological risk of AMT uptake.

To training organisations and universities:

- Exploit pilot plants and demonstrators to design and implement new education methods according to the teaching factory paradigm. Exploit knowledge generated in past projects (e.g., “Know-Fact” FP774) and existing practices (e.g., “Festo Teaching Factory”75). Furthermore, refer to the “Blueprint for Sectorial Cooperation on Skills” recently launched by the European Commission.

To RTOs and universities:

- Exploit the existing pilot infrastructure not only for purposes of academic research, but also for offering industrial services and technical consultancy to SMEs on a continuous basis.

To all:

- Take part in the future KIC on added value manufacturing to set up a high-level European pilot infrastructure, meeting the needs of advanced industries.

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75 See Section 3.3.2.
**Recommendation II.2:**

**Improve the exploitation of Horizon2020 research by SMEs**

This recommendation addresses the difficulties mentioned by companies in exploiting the technology and results generated by EU-funded research projects.

Existing initiatives at FoF 76 EU platform level, such as the FoF Clustering projects, the EFFRA innovation Portal 77 and the FoF Impact Workshop, have already been launched to enhance the industrial application and exploitation of EU-funded research projects in FoF.

For some years now, the Commission has embraced the logic of combining research projects in homogeneous thematic areas to achieve synergies and a greater critical mass for their exploitation. Clusters of projects can share efforts in communication and dissemination activities, for example, enlarge the number of prospects, carry more weight on standardisation committees, and so on. The European Commission has also funded the “FoF Impact 78” CSA (coordination and support action) to intensify the impact of the FoF PPP under Horizon 2020 by increasing and accelerating the uptake of the results of project funded under the FoF. More in general, the H2020 “SME instrument” is made available to help SMEs absorb the results of research in their processes.

The EFFRA, European Factories of the Future Research Association, promoted the development of its “EFFRA Innovation Portal”, as a reference point for use by members of the FoF community and industry to communicate and circulate research outcomes available for uptake, to facilitate the set-up of partnerships to exploit them, and to identify suitable service providers for supporting such exploitation processes.

For the last six years, the European Commission has organised the annual “FoF Impact Workshop”, in cooperation with EFFRA: this is a large FoF Community forum for discussing barriers, best practices and solutions for exploiting the results generated by research.

Outside the EU, in the United States, the Small Business Innovation Research 79 is an initiative for offering public support to SMEs and engaging them in technology innovation projects, providing they have potential for commercialisation. The Small Business Research Initiative 80 in the UK is a similar scheme designed to connect solution

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76 See Section 3.2.3.

77 See Section 3.3.3.


79 See Section 3.2.4.

80 See Section 3.2.2.
providers and potential users in the framework of “competitions” based on strategic challenges defined by the government.

Although the above-mentioned European-level initiatives seem useful for promoting the exploitation of the results of research, the emphasis should be placed on a wider implementation of the measures devised in all these schemes in order to maximise the impact of research projects.

Hence the recommendation to pursue the establishment of proper processes and measures to enable SMEs to exploit the results of AMT-related research, by adding momentum to existing measures (in the frame of the FoF Public-Private Partnership, for instance) and designing new dedicated national and regional programmes and initiatives. It is also advisable to draw on existing models and programmes outside the EU (e.g., SBIR) for inspiration.

**CONCRETE ACTIONS to implement Recommendation II.2**

At the European level:

- **Include exploitation partners in project consortia** from the beginning, in particular in relevant projects supported under the H2020 pillar for ‘Industrial Leadership’.
- **Provide clear and measurable targets for projects** with which project partners can engage and on which they can be measured at the end.
- **Encourage consortium partners to better exploit the outcome of their research projects**
- **Launch actions dedicated to the uptake and further development of project results in demonstrators and pilot plants**. Connect available research results generated in European projects to existing and future initiatives on pilots and demonstrators, creating a ‘pipeline to practice’.

At national/regional levels:

- **Support the exploitation of results generated in European projects following the logic of smart specialisation**, thus customising developed enabling technologies with respect to specific applications and solutions of local industry.
- **Align national/regional programmes with European programmes** in order to exploit complementarities and build upon already existing experiences.

To clusters:

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81 See Section 3.2.3.
• Communicate opportunities resulting from the EU-funded research to SMEs. Adopt a concrete communication style using a language suited to SMEs.

• Maximise the potential of already existing tools for the valorisation of European research results in cooperation with FoF and other similar platforms.

• Support national and regional governments, as well as the European Commission, in the identification of possible but not yet leveraged synergies between policies in order to better exploit European results in the logic of smart specialisation.

• Support RTOs and universities in the diffusion to industry of results generated in research projects funded by the EU.

Recommendation II.3:
Adapt standardisation and regulation to the diffusion of AMT

In this study, companies mentioned barriers to standardisation and regulation issues that make it difficult to exploit sustainability-related and ICT-related AMT.

In the ICT manufacturing domain, the digital manufacturing revolution is beneficial to SMEs because it supports the establishment of efficient, extended value chains that can be managed in real time by connecting multiple geographically-distant SMEs. Given the structure of the European manufacturing industry, this will help to overcome fragmentation and achieve a higher critical mass, but it will only be feasible if the ICT solutions are interoperable (i.e., if various applications can exchange data easily among themselves) and customisable to suit the various applicative domains of SMEs. This interoperability could be achieved through standardisation. Discussions on this issue have been triggered in the context of CENELEC and the European Telecommunications Standards Institute, through the Joint Standardisation Initiative, for example. Standardisation was also mentioned as a relevant factor in supporting the exploitation of results of research in the frame of the recent FoF Impact Workshops. Europe is actively trying to keep pace in these fields, but the constant emergence of new technologies makes this a continuous task.

Concerning sustainable technologies, conscious regulation could have an important role. For the time being, the diffusion of new sustainable technologies appears to be limited in many cases because of standards on waste management, which make the materials management processes along the supply chain bureaucratic and complicated. Significant steps have already been taken in this regard, as in the “Circular Economy Package” of

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82 A European initiative to create a shared vision for European standardisation, file:///Users/golboopourabdollahian/Downloads/20160929%20SIS%20signed%20MS.pdf

the European Commission, but removing obsolete, uninspired or unintended regulations negatively influencing the already hesitant stance of many firms with regard to AMT uptake remains an issue. Further actions and arenas of discussion are needed, involving all industries and intermediaries concerned, to clarify what needs to be done and act accordingly.

Based on this state of the art, additional efforts are recommended to put standardisation and regulation issues at the top of the agenda for policy-makers as important factors for enabling the uptake of AMT. **Forthcoming initiatives on standardisation for the diffusion of AMT should be aligned** with the main context of the Joint Initiative on Standardisation promoted by CEN (European Committee for Standardization), CENELEC (European Committee for Electrotechnical Standardization), and ETSI (European Telecommunications Standards Institute) and they should take high priority on the agenda of the Annual Union Work Programme for European Standardization. It is also recommended that initiatives be launched to foster an industry standardisation/regulation culture and related activities. Both companies and intermediaries need the resources to engage in these discussions, with high-level staff and sufficient time. They may also need support for making dedicated investments in the testing and piloting of specific proposals that they want to advocate and further develop.

**CONCRETE ACTIONS to implement Recommendation II.3**

**At the European level:**

- **Improve European directives** to enable, facilitate and trigger the establishment of sustainability-related businesses.
- **Participate in the definition of future standards** that will define the evolution of ICT-enabled manufacturing technologies in the coming decade.
- **Stimulate and support the participation of relevant partners of high-level European funded projects in relevant standardisation committees.** Where relevant, stimulate the participation of members of standardisation organisations in project consortia.
- **Support the follow-up of European research projects’ implications for standardisation and regulation** after their formal termination.
- **Create a central European point of contact to which concerned SMEs and facilitating organisations can report obsolete and obstructive regulation** and which can communicate it to the relevant services of the European Commission.

**To Clusters:**

- **Aggregate the needs of SMEs to provide relevant inputs in terms of standardisation and regulation** (for example by establishing “standardisation and regulation fora”).
• Support and facilitate the participation of cluster members to standardisation committees and other committees defining the amendment of existing regulations.
• **Diffuse awareness and increase industrial culture** around standardisation and regulation issues related to AMT.

### 5.3.3 Improve the AMT offer on the market

**Recommendation III:**

**Support new service-based business models for the diffusion of AMT**

This recommendation aims to address the following issues emerging from the analysis:

- High adoption risk due to limited investment capacity against unclear benefit;
- Market uncertainty and turbulence;
- Not proven performance of AMT;
- Lack of multidisciplinary skills for introducing and operating AMT;
- Limited engagement of technology suppliers in customer-supplier relationship.

In recent years, significant research has been conducted on the subject in European-funded projects (e.g., in the frame of the “NEXT FP6” and “DEMAT FP7” projects, focusing on the conception of innovative production systems and business models for their uptake) and in spontaneous research initiatives like the “European Manufacturing Survey” (a European longitudinal survey on technological, organisational, service and business model innovation), as well as in the more general academic literature (in the area of “servitisation” and “product-service systems”). In H2020, efforts to promote business model innovation in practice have been made in the framework of the “Industrial Leadership” pillar, and particularly in the ICT Innovation for Manufacturing SMEs (I4MS) challenge. Specific events and communication actions for spreading the culture and opportunities afforded by new business models among SMEs have been organised at regional level, by Agoria (the Belgian Federation of Technology Industries), for instance, and by MUSP, an Italian consortium of machine tools and production systems in Emilia Romagna.

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84 [http://cordis.europa.eu/project/rcn/74842_it.html](http://cordis.europa.eu/project/rcn/74842_it.html)
85 “A multi-technological approach to dematerialising production systems within a view of productive, reliable and eco-efficient machining processes, an EU-funded project under FP7”
87 See Section 3.2.3.
88 See Section 3.3.2.
89 [http://www.musp.it/](http://www.musp.it/)
In spite of the above-mentioned initiatives and efforts, the practical implementation of innovative business models for the acquisition of novel technologies still seems to be lacking at the industrial level.

To address this issue, technology providers need to explore and adopt unconventional business models that provide novel options for the acquisition of AMT through closer customer-supplier relationships and risk sharing. Examples of such business models include: leasing, renting and pay-per-part models (from the financial perspective); the provision of skilled personnel and support for operations management (from the skills perspective); and the guarantee of machine availability, production capacity or a pre-set manufacturing process quality (from a technical and operational standpoint).

It would be particularly essential for technology providers to offer such innovative business models when production at the manufacturing plants of SMEs needs to be scaled up and the necessary knowledge and practical capabilities can no longer be gained from pilot plants or demonstrators alone. At this point, potential users of AMT rely on the availability of qualified and reliable accompanying services in the areas of maintenance, operations management, skills development, and so on. The proposed new business models help firms to move on from the initial demonstration to a broad-based uptake, meaning that technology providers can make a crucial contribution to improving AMT uptake in Europe (in cooperation with other service suppliers, such as financial organisations, logistics companies, training organisations, etc.).

It is recommended that these service-oriented business models move from the conception stage to a broader European implementation and diffusion. Bearing in mind the above-mentioned existing initiatives and projects focusing on adopting service-based business models, it is also advisable to exploit concepts, tools and information already available from previous EU-funded and academic research projects for the purpose of AMT diffusion.

CONCRETE ACTIONS to implement Recommendation III

At the European level:

- **Capitalise the knowledge and experience gained in European projects and initiatives dealing with new business models for AMT uptake**, including also the monitoring of the diffusion and efficiency of such business models. The CSA Instrument under H2020 would be a suitable tool for this purpose.

- **Stimulate the concrete implementation of European industrial transformation towards new business models**. It could be considered to support such projects under a specific headline of the H2020 pillar ‘Industrial Leadership’ building on experiences of the ICT Innovation for the Manufacturing SMEs (I4MS) challenge.

- **Diffuse successful regional business models**. Less experienced Member States should be encouraged to explore options jointly with partners that already have new
business models in place. For this, actions under the ‘Spreading Excellence and Widening Participation’ framework could be suitable tools.

- **Analyze the diffusion and performance of new business models in the light of national/regional specialization** by leveraging actions like Re-Confirm or available sources of information like the Regional Innovation Monitor.

**At national/regional levels:**

- **Leverage ESIF for SME development by setting up relevant support programmes and actions** for new business models diffusion.
- **Support regional technology and service providers (clusters) in their efforts to build strategic partnerships and local service offering systems in the direction of new business models** through approaches that are affordable for SMEs, such as voucher schemes.

**To clusters:**

- **Improve coordination among regional technology and service providers in order** to support clusters with the design and implementation of new business models.
- **Communicate to SMEs the benefits of novel business models** for AMT uptake.

**To financial organisations:**

- **Cooperate with technology providers on risk sharing** in order to provide the financial arrangements needed to establish new business models.
- **Cooperate with European institutions**, as for example in the context of the SME Initiative of the EIF, to explore further options for the financing of specific actions.

**To technology providers:**

- **Exploit existing pilot plants and demonstrators as a support for the offering of new business models** (for example for training purpose, technology performance assessment, etc).
- **Establish strategic partnerships with providers of other services that are needed for the setup of new business models.** Exploit existing facilitation services offered by clusters to build such a service network.

### 5.3.4 Strengthen policy coordination

<table>
<thead>
<tr>
<th>Recommendation IV:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improve the alignment of EU, national and regional policies</td>
</tr>
</tbody>
</table>

This recommendation aims to address the lack of clear synergies and complementarities between European, national and regional policies.
Aligning policies at various levels would enable a better exploitation of synergies and complementarities, as well as generating a higher critical mass for actions supporting the uptake of AMT by SMEs.

Several initiatives at European level strive to establish and reinforce such an alignment, including the Vanguard Initiative and the RIS3 Platform for Industrial Modernisation, which aims to coordinate the actions of various regions and to interface them with EU programmes such as INTERREG. At the same time, the Stairway to Excellence initiative (S2E)\textsuperscript{90} seeks to ensure a better combination of different sources of European funding while high-level technological initiatives like ECSEL (Electronic Components and Systems for European Leadership)\textsuperscript{91} receive combined funding from European, national and regional sources. Further ground nonetheless remains to be covered in this area.

Empirical evidence shows that the fragmentation and complexity of existing policies often still prevents SMEs from being aware of all the funding opportunities and discourages them from applying for them. It is therefore recommended that action be taken to ensure that SMEs have at their disposal an efficient portfolio of synergic supporting instruments that can be combined together to enable the co-funding of the AMT uptake process. A better alignment is needed from both a policy content standpoint (i.e., the thematic areas supported by different policies) and a financial standpoint (i.e., enabling the combination of relevant sources of funding). For the former, some first important steps have been taken with the establishment of the RIS3 Platform for Industrial Modernisation. For the latter, an example of financial alignment is the voucher program adopted in Lombardy, based on the “Seal of Excellence” (a project proposal that exceeds the threshold but is not funded at EU level due to a shortage of funds may be funded at regional level instead).

It is important to bear in mind that policy alignment cannot be managed at European level, but it has to stem from a gradual process of mutual learning and it should be deeply rooted in regional and national smart specialisation. Policy-makers at all relevant levels should cooperate, each with their own respective competences. The regional level decides the specialisation strategy driving regional policy because it usually knows the local enterprises’ practical needs best and can leverage on the local system of intermediaries. It may lack the critical mass needed to support leading-edge actions, however, in which case the national level should take into account the needs and specialisations of different regions in designing an excellence-oriented national

\textsuperscript{90} An EU project as part of smart specialisation platform to support 13 Member States who joined the EU in 2004 and later to close the innovation gap and promote excellence, https://ec.europa.eu/jrc/en/research-topic/stairway-excellence-s2e
\textsuperscript{91} An EU PPP, http://www.ecsel-ju.eu/web/index.php
innovation policy. Then the European level provides an arena for consolidating joint efforts on a larger scale, along value chains, for coordinating the sharing of good practices, and for financing the highest-profile projects for the development of more general enabling technologies.

It is worth exploiting positive experiences gained in some regions and Member States, such as the recent clustering policy in Italy and some of its regions with a view to defining a coherent national and regional policy for firms based on smart specialisation.

**CONCRETE ACTIONS to implement Recommendation IV**

At the European level:

- **Continue supporting European regions in elaborating and consolidating their smart specialisation plans** and to subsequently exploit synergies at EU level.
- **Update policies in a post-H2020 perspective** considering the inputs of new technology roadmaps as well as of the regional smart specialisation plans.

At national/regional levels:

- **Define place-based industrial policies based on smart specialisation** considering at the same time the opportunities offered by European policies with a view to synergies and complementarities, building on the activities of the RIS3 Platform for Industrial Modernisation.
- **Support trans-national/trans-regional cooperation for AMT uptake by SMEs**, based on the respective smart specialisation strategies of partners, thus identifying selected partners and technology groups, leveraging Article 70 CPR or INTERREG actions.
- **Take advantage of the “Seal of Excellence” label** to ensure alternative funding for strategic projects that are not financially supported at the European level due to lack of budget. Take advantage of the positive experiences already available in the EU.
- **Empower the role of clusters as partners in the process of policy definition** to identify and communicate industrial priorities as well as existing European support offers.

**To clusters:**

- **Create a better awareness of European policies among SMEs** and facilitate the design of a portfolio of funding instruments including European funding opportunities coherent with their specialisation.
- **Elaborate strategic research and innovation roadmaps outlying potential links with European policies** coherent with regional specialisations. Existing success cases, such as the recently created CFI and AFIL clusters in Italy, should be considered.
• **Actively engage in relevant European RIS3 initiatives**, such as the Smart Specialisation Platform for Industrial Modernisation and the Vanguard Initiative.

• **Contribute to political strategies in the area of trans-national/-regional cooperation** based on the specialisation of local industry and on the availability of specialised suppliers and service providers in other European regions, e.g. in the context of the Smart Specialisation Platform for Industrial Modernisation.

A detailed illustration of the cross-analysis conducted on the recommendations and issues is given in **Table 6**.
### Table 6: Cross-analysis of recommendations and issues

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>I.1</th>
<th>I.2</th>
<th>I.3</th>
<th>II.1</th>
<th>II.2</th>
<th>III</th>
<th>IV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmentation and complexity of existing public funding instruments</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Shortage of instruments supporting the uptake of more mature AMT</td>
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<td>X</td>
<td></td>
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<tr>
<td>Shortage of education and training systems meeting the specific needs of SMEs</td>
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<tr>
<td>Shortage of institutional cooperation mechanisms incentivising research-industry cooperation</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Shortage of instruments for fostering inter-regional cooperation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Disparity of access to services and innovation infrastructure in Member States</td>
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<td>X</td>
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<td></td>
<td></td>
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<td>Heterogeneity of regional service ecosystems in Europe</td>
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<td>X</td>
<td></td>
<td></td>
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<td>X</td>
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<td>Shortage of qualified regional intermediaries capable of triggering AMT uptake</td>
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<td></td>
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<tr>
<td>Limited ability of intermediaries to relate to a logic of smart specialisation</td>
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<td>X</td>
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<td></td>
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<tr>
<td>Different roles of clusters and service providers</td>
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<td>X</td>
<td></td>
<td></td>
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<td></td>
<td>X</td>
</tr>
<tr>
<td>No clear synergies and complementarities between European, national and regional policies</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>In general, no specific technological focus in many regional and national programmes</td>
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<tr>
<td>Effective programmes for the uptake of AMT are not available in all EU regions</td>
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<tr>
<td>Limited investment capacity against unclear benefit</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
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<tr>
<td>Costs and revenues of new technologies are not clear and uptake risk is too high</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Issue</td>
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<td></td>
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<tr>
<td>Banks have little understanding of the potential of investing in AMT and related risk structuring</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Private financial organisations have little understanding of the potential and risks of AMT</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Insufficient interdisciplinary competence on new technologies and their benefits</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
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<tr>
<td>Insufficient interdisciplinary competence for forecasting the return on investment in AMT</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
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<tr>
<td>Shortage of skilled workforce for integrating, implementing and operating AMT</td>
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<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Shortage of skills for identifying and applying suitable funding opportunities</td>
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<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>No proof of the robustness and performance of AMT</td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Integration of AMT in existing processes is complex and generates a risk for performance</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The conception of some AMT has mainly followed a pure technology-driven approach</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weak cooperation between RTOs and industry for the uptake of AMT</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poor understanding of customers’ needs and limited marketing action by technology suppliers</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limited engagement of technology suppliers in customer-supplier relationship</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shortage of clear and qualified communication and dissemination concerning AMT</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Lack of a clear map of service providers for SMEs</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>General lack of suitable SME-tailored contents and formats in offers of AMT-related training</td>
<td>X</td>
<td></td>
<td>X</td>
<td></td>
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<td></td>
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<tr>
<td>Difficulty of industrially exploiting the results of funded research projects</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sustainable technologies are mainly adopted to comply with regulations</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>No standardisation approach to create extended value chains through ICT solutions</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Own analysis
References


### Annex A - Selected Budgets for AMT-supporting Initiatives

**Table Annex 1: Summary of existing initiatives and their budgets**

<table>
<thead>
<tr>
<th>Initiative</th>
<th>Budget / Fund</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>European Union</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EFSI</td>
<td>€315 bn</td>
<td>2015-2017</td>
</tr>
<tr>
<td>EFSI SME window</td>
<td>€75 bn</td>
<td>2015-2017</td>
</tr>
<tr>
<td>InnovFin SME venture capital</td>
<td>€1 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>InnovFin SME Guarantee</td>
<td>€1 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>FTI pilot</td>
<td>€200 m</td>
<td>2015-2017</td>
</tr>
<tr>
<td>TREC</td>
<td>€0.5 m</td>
<td></td>
</tr>
<tr>
<td>INFRADEV</td>
<td>€21.5 m</td>
<td>2016-2018</td>
</tr>
<tr>
<td>INNOSUP</td>
<td>€54.1 m</td>
<td>2016-2018</td>
</tr>
<tr>
<td>COSME</td>
<td>€2.3 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>KICs</td>
<td>€2.7 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>LLP</td>
<td>€7 bn</td>
<td>2007-2013</td>
</tr>
<tr>
<td>SME Instrument</td>
<td>€2.8 bn</td>
<td>2016-2018</td>
</tr>
<tr>
<td>INTERREG MED</td>
<td>€265 m</td>
<td>2014-2020</td>
</tr>
<tr>
<td>INTERREG IV</td>
<td>€321 m</td>
<td>2007-2013</td>
</tr>
<tr>
<td>Robotics PPP</td>
<td>€700 m</td>
<td>2014-2020</td>
</tr>
<tr>
<td>Photonics PPP</td>
<td>€3.5 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>(including €2.8 m provided by industry)</td>
<td></td>
<td></td>
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<tr>
<td>HPC PPP</td>
<td>€1.4 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>FOF PPP</td>
<td>€1.15 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>ActPhast</td>
<td>€10 m</td>
<td>2014-2020</td>
</tr>
<tr>
<td>I4MS</td>
<td>€33 m</td>
<td></td>
</tr>
<tr>
<td>SPIRE</td>
<td>€621.5 m</td>
<td>2016-2018</td>
</tr>
<tr>
<td>EEN</td>
<td>€2.3 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>ESIF</td>
<td>€110 bn</td>
<td>2014-2020</td>
</tr>
<tr>
<td>MEP (US)</td>
<td>€300 m</td>
<td>2014</td>
</tr>
<tr>
<td>Programme</td>
<td>Amount</td>
<td>Duration</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Catapult HVM</td>
<td>£63 m</td>
<td>2013-2014</td>
</tr>
<tr>
<td><strong>National</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BPI France</td>
<td>€420 m</td>
<td></td>
</tr>
<tr>
<td>AWS SME Fund (Austria)</td>
<td>€80 m</td>
<td>2009-2026</td>
</tr>
<tr>
<td>ZIM (Germany)</td>
<td>€543 m</td>
<td>2016</td>
</tr>
<tr>
<td>KfW ERP Innovation Programme (Germany)</td>
<td>€50 m</td>
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</tr>
<tr>
<td>RobotstartPME (France)</td>
<td>€33 m</td>
<td></td>
</tr>
<tr>
<td>FHprofUnt (Germany)</td>
<td>€176 m</td>
<td>2015</td>
</tr>
<tr>
<td>MADE (Denmark)</td>
<td>€24.4 m</td>
<td>2014-2019</td>
</tr>
<tr>
<td><strong>Regional</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VIS (Flemish, Belgium)</td>
<td>€706.2 m</td>
<td>2005-2015</td>
</tr>
<tr>
<td>Pathway towards AMT for SMEs (Pays-de-la-Loire, France)</td>
<td>€10 m</td>
<td>2014-2016</td>
</tr>
<tr>
<td>GLOBALmidt (Central Denmark)</td>
<td>€2.6 m</td>
<td></td>
</tr>
<tr>
<td>RENOV Maquinaria (Basque Country, Spain)</td>
<td>€575 m</td>
<td>2014-2016</td>
</tr>
<tr>
<td><strong>Outside of the EU</strong></td>
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<tr>
<td>NNMI (US)</td>
<td>$150 m</td>
<td>2016</td>
</tr>
<tr>
<td>(Federal Budget)</td>
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</tr>
<tr>
<td>NNI (US)</td>
<td>$1.4 bn</td>
<td>2016</td>
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</table>

Source: Websites and reports at European, national and regional level, Regional Innovation Monitor Plus
Table Annex 2: Summary of existing Voucher Schemes

<table>
<thead>
<tr>
<th>Name</th>
<th>Region</th>
<th>Budget</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creative Voucher</td>
<td>Baden-Württemberg</td>
<td>€3 m</td>
<td>2008-2010</td>
</tr>
<tr>
<td>VINCI</td>
<td>Salzburg, Austria</td>
<td>€5 000</td>
<td>Per company</td>
</tr>
<tr>
<td>Creative Credits</td>
<td>Manchester City, UK</td>
<td>£4 000</td>
<td>Per company</td>
</tr>
<tr>
<td>Technology Voucher</td>
<td>Lombardy, Italy</td>
<td>€8 m</td>
<td>Total Budget</td>
</tr>
<tr>
<td>Innovation Management Voucher</td>
<td>Germany</td>
<td>€20 000</td>
<td>Per company</td>
</tr>
</tbody>
</table>

Sources: Websites and reports at national and regional level, Regional Innovation Monitor Plus Online Repository and Regional Reports
Annex B - Policy Workshop

Figure Annex 1: Validation workshop agenda

High-level Policy Workshop
13 September 2016
Lombardy Region Delegation Office
Place du Champ de Mars 2
Brussels

Agenda
13:50 - Welcome coffee
14:00 - Welcome from the Lombardy Region Delegation in Brussels
14:05 - Introduction to the project by European Commission
(Christian Chassagne and Nikos Pantazos, DG Growth)
14:10 - Introduction to the project content and methodology
(Henning Kroll, Fraunhofer ISI)
14:20 - Tour de table to introduce workshop participants
14:30 - Summary of findings of empirical analysis
(Els Van de Velde, IDEA Consult)
14:40 - Summary of policy issues and draft recommendations
(Giacomo Copani, ITIA-CNR)
15:00 - First impressions and questions from experts
15:10 - Workshop phase 1: Experts will answer the following questions:
  - Is any relevant policy issue or recommendation domain missing?
  - Are recommendations well discussed?
  - Is the existing policy framework correctly included?
15:40 - Coffee break
16:00 - Workshop phase 2: Experts will discuss the priority of recommendations
16:20 - Workshop phase 3: Experts will be divided in two groups and will
  answer the following questions:
  - Is any precise recommendation to policy makers or service
    organizations missing?
  - Are current precise recommendations well proposed?
  - Can you propose additional/different inspiring examples or
    implementation tools for the precise recommendations?
17:00 - Coffee break
17:10 - Wrap up and final considerations
17:30 - End of meeting
**Figure Annex 2: List of Validation workshop participants**

<table>
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Notes taken during the Validation workshop

First Part

Topic: First impressions, any missing recommendations or policy issues

The study was generally perceived as unusually broad and comprehensive, and the recommendations were judged to be pertinent and well-chosen.

All participants had received concise but detailed preparatory material several days earlier, and no issues regarding inaccuracies were raised. Discussion on the specific question of whether some headline recommendations should be merged, split or refocused resulted in unanimous agreement that no such action was needed. Instead, individual aspects of several recommendations were strongly endorsed from various perspectives.

Some issues were raised by participants during the general discussion, however.

- **Cultural and behavioural barriers** to the adoption of AMT and innovation by SMEs can be more strongly emphasised in policy issues and in the recommendations. As Sergio (TTO circle) mentioned, despite governments’ efforts, there are cultural and behavioural issues that make SMEs reluctant to invest in AMT and innovation or adopt new technologies. Action can therefore be taken to address this challenge.

- It was confirmed that **uncertainty surrounding ROI** is a major barrier to the adoption of AMT since this matter is still not sufficiently clear.

- **Market uncertainty** was also confirmed as a barrier to the uptake of AMT.

- It was mentioned that, from an industrial policy perspective, recommendations should be considered not separately but in terms of a value chain. Thus it was suggested that we consider how the recommendations can be linked and connected to implement AMT in a value chain perspective, with a focus on value chain approach, digitalisation, smart specialisation, etc.

- Adoption costs were confirmed as an important barrier because SMEs are mainly concerned with reducing their costs.

- SMEs are unable to predict future standards reliably because this aspect is too complex.

- A question was raised about the pressure on SMEs (who are the suppliers of large companies) to adopt AMT, and whether this can be considered a driver for SMEs to move towards the application of AMT.

- For some recommendations, some of the **sub-recommendations** can be described in more detail, considering that we defined the recommendations based on the commonalities in different parts of the value chain.

- Pedro suggested that we put **more emphasis on internationalisation** as a major factor in the recommendations, pointing out that Portuguese companies, for example, are very interested in external markets (both EU and non-EU). So there
could be a focus on connecting providers from industrialised countries with SMEs in developing countries/regions.

- The importance of regional policies was confirmed, indicating that SMEs are usually unaware of what is available to them, so it is important to take action at regional level to support the SMEs.

- In terms of pilot lines, the regional position was mentioned as being very important and interesting. Some regions have more support than others: pilot plants located in a region that is not connected with other regions are less effective. So it would be more useful to consider pilot plants integrated from a regional perspective rather than a national one.

- The importance of aligning EU, national and regional policies and service offerings was confirmed, with emphasis on the fact that it would be important to understand which recommendations should be initiated at national level, and which at regional level.

- It was confirmed that there is a shortage of knowledge about financial and funding options especially for entrepreneurs, start-ups and SMEs. It was suggested that this point be emphasised and further clarified in the study.

- It was confirmed that access to finance is a major barrier to the adoption of AMT, but it was also suggested that we go into more detail to clarify the orientation of the problems involved (is it a problem of access to finance for technology applications alone, or of access to finance in general?).

- It was confirmed that clusters have an important role in connecting and linking different entities in regional level.

- It was confirmed that an inadequate awareness of how to apply for funds, and a shortage of internal resources to go through the application process is a barrier for SMEs.

Some points that might be missing or that warrant greater emphasis in the study:

- It was suggested that there should be more emphasis on strengthening the venture capital market in the EU, taking the example of the US venture capital market.

- It was suggested that we add a 9th recommendation domain focusing on transnational collaboration, considering existing initiatives such as Vanguard, KIC AVM.

- Regarding the shortage of skills, issues were mentioned that regard university demographics, fluctuations in the proportions of older professors and problems with potentially insufficiently-experienced new staff.

- Differentiation by technology: In pilots plants, we should address particular types of technology within the three defined groups of AMT.

- A point was raised about the geographical differentiation in the study, given that there are some regions where SMEs are more innovative and the integration of AMT has proved crucial to their success, while it has a less important role in other regions.
**Second Part**

**Detailed discussion on individual recommendations**

<table>
<thead>
<tr>
<th>1. Establish an EU-wide network of pilot infrastructure and demonstrators</th>
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<tr>
<td>- Participants agree that this is extremely important</td>
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<tr>
<td>- Need for integrated financial and funding mechanisms for pilot plants (at European, national and regional level)</td>
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<tr>
<td>- EU transnational (rather than cross-border) funding mechanisms should be further developed for this purpose</td>
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<td>- <strong>Need for sustainable business models</strong> for pilot plants prior to their financing</td>
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<td>- European network of pilot infrastructure – a transnational perspective (for which transnational financing is important)</td>
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<td>- <strong>Difference to digital hubs?</strong> –</td>
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<td>- <em>This recommendation is a core aspect of the Vanguard Initiative and crucial to the EU</em></td>
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<td>- Not only for SMEs but also for co-development schemes between SMEs, like joint development teams</td>
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<td>- As in regional innovation systems – there is a lot of interest in co-creation between SMEs</td>
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<td>- Mapping - this has to be done on a regional scale, showing what is available and where exactly. It has to be related to the local manufacturing environment.</td>
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<td>- How can such pilots plants and demonstrators affect a larger ecosystem (regionally, for instance)</td>
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<td>- How to engage other (regional and national) actors is the second point on the agenda. The main issue is that a robust regional pilot does exist.</td>
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<td>- How do we stimulate SMEs to participate? What do they have to gain? There are many questions that need to be answered before we install a pilot plant</td>
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<td>- SMEs are really interested in new technologies because they envisage new business possibilities. They seem more and more promising for them, with every year that passes. Hence the idea of sharing information on AMT (their use, integration, exploitation, etc.)</td>
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<td>- This part should also mention the financing (of pilots), even if we have a separate recommendation for the financing of AMT. On the matter of funding, everybody talks about banking, but there is always a part that has to be financed from the company’s own resources. This is a huge issue for clusters.</td>
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<td>- Change the model from cross-border funding to transnational funding – for companies willing to cooperate on a transnational level.</td>
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<td>- Transnational funding for facilitations – this is very complicated, which means that special expertise and institutions are needed</td>
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<td>- <strong>The transnational factor</strong> should be integrated in all recommendations</td>
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<td>- Multistep process</td>
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<td>- The instruments exist but we have to make better use of them</td>
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2. **Provide “facilitation services” for SMEs**

- **The EEN - Enterprise Europe Network has not been mentioned!** What is the EEN doing or not doing? Does it seem to be the first place where SMEs can go and obtain information?
- Clusters are back again – with the issue of how to develop recommendations for them
- If clusters want to apply for support, why should they spend so much time doing so? Huge bureaucracy
- **Cluster cooperation** platforms for checking at least whether there is a appropriate cluster
- **Quality is a big issue – aiming too high is not helpful!**
- **Finance** – how do we link money from original sources to users

3. **Support new service-based business models for the diffusion of AMT**

- The **Innovation voucher** debate should be addressed here
- **Skills development** - issue

4. **Provide adequate financial support for AMT diffusion**

- Distinguish between **different types of technology** when talking about financing AMT (especially when discussing the reluctance of banks to finance AMT, which AMT are we talking about? Mature, new, etc.?)
- **Multi-stage process**: first vouchers, then go a step further
- **Vouchers** to assess the ROI of technology
- Include other instruments such as **credits**
- **Integration of incentives for financial organisations** at different levels (EU, national, regional)
- There is no clear evidence of why COSME is not effective and sufficient
- **COSME Debt** instrument as an effective instrument
- **Tools for assessing businesses** (clusters)
- There is not an issue about financial “**standard technology**”
- Issue - **Bankability and private part in the financing** of projects should be integrated in the recommendations.

5. **Transfer AMT solutions and skills to SMEs through improved cooperation**

- Importance of **predicting the need for skills**, especially at regional level, by involving RTOs and universities to establish the future needs of SMEs in terms of skills over the next 5-10 years

6. **Exploit the results of EU-funded research projects**

- Manage **RTOs with technology portfolios** for SMEs strategically
7. **Promote regulation and standardisation in AMT**

   - *No particular issue raised*

8. **Align EU, national and regional policies**

   - Mutual policy learning not only among regions but also **transnationally**
   - Update existing strategies and policies while aligning them at different levels
   - Need for a **time horizon** for recommendations and strategies
   - Need for **medium- to long-term strategies** on all three geographical levels
   - Strategies and roadmaps should be updated considering **post EU2020** period
   - Simplification of access to grants, linking EU, national and regional levels
   - Policy learning among different layers to reduce complexity and bureaucracy