

Title: Support for a European Metrology Network on Advanced Manufacturing

Abstract

Manufacturing, with its approximately 20 industrial sectors, is the backbone of the European economy. Advanced Manufacturing has been identified by the European Commission as one of six Key Enabling Technologies (KETs), with applications in multiple industries. Various EURAMET projects have partly addressed metrology needs for Advanced Manufacturing. However, high level coordination of the metrology community is currently missing and therefore a European Metrology Network is needed to maximise the metrological impact and establish a single hub for stakeholder consultation, knowledge transfer, and a strategic agenda for research and training to push forward Advanced Manufacturing and related KETs and strengthen Europe's position in Advanced Manufacturing.

Keywords

Advanced Manufacturing, Key Enabling Technologies (KET), Innovation, Additive Manufacturing, Flexible Manufacturing Infrastructure, Industry 4.0, Virtual Instruments, Industrial Internet of Things (IIoT), Cyber Physical Production Systems (CPPS), Machine Learning

Background

The Key Enabling Technologies (KETs) are a group of six technologies: micro and nanoelectronics, nanotechnology, industrial biotechnology, advanced materials, photonics, and advanced manufacturing. They have applications in multiple industries and tackle many societal challenges.

Innovative developments in manufacturing are often related to the addition of nanomaterials. These advanced materials can be utilised in advanced manufacturing processes to realise new or optimised products with improved material properties. There are many outstanding metrology challenges to this aspect of advanced manufacturing alone and coordinated input from the metrology community is essential.

The EU has initiated several activities in support of KETs, such as the Factories of the Future public-private partnership (PPP), associated European Factories of the Future Research Association (EFFRA) and the ECSEL Joint Undertaking - the Public-Private Partnership for Electronic Components and Systems. However, there is currently no link to metrology issues within these programmes. Other stakeholders such as the European Association of the Machine Tool Industry and related Manufacturing Technologies (CECIMO) and the Institute of Measurement and Control (InstMC) also need to be identified and engaged.

Funded under the European Commission's Seventh Framework Programme (FP7), CO-NANOMET is a programme of work to address the need in Europe for a measurement framework to successfully support the development and economic exploitation of nanotechnology. The European Society for Precision Engineering and Nanotechnology (Euspen), runs a vocational activity (ECP²: Euspen Certified Precision Engineer). There is a need to align with existing training activities such as those undertaken by Euspen and the EMC2 Advanced Manufacturing Cluster to maximise impact.

To date, a number of EMRP and EMPIR joint research projects covering topics related to Advanced Manufacturing have been successfully completed or are near completion. Additionally, certain EURAMET Technical Committees (TCs) have a strong impact on Advanced Manufacturing, such as TC-Length, TC-Temperature, TC-Mass and related quantities, however there is no single contact point for all issues of relevance to the KET Advanced Manufacturing. There is a need to build on these projects by addressing specific aspects of relevance to Advanced Manufacturing and for better coordination between TCs to address the need for an integrated roadmap to meet the metrology demands of Advanced Manufacturing and its related KET topics. The expertise and knowledge from TCs can then be integrated and made available to stakeholders.

How and where NMIs should focus limited resources to obtain maximum impact for society urgently requires a strategic plan and significant coordination both at European and global levels. No single NMI has the expertise or resource to tackle all or even a significant fraction of the most critical priorities without collaboration. Without coordination, there is a strong likelihood of unnecessary duplication, with NMIs (nationally and/or regionally) potentially independently choosing to focus efforts on the same challenge with consequential neglect of others. EURAMET is considering establishing a European Metrology Network to coordinate the European NMI response, to establish close links to the stakeholder community, to develop and implement a strategic agenda and establish a knowledge, technology transfer and promotion plan, to ensure an effective response is put in place. This SNT is intended to elaborate how a network could support EURAMET and to support that network in its initial tasks.

Objectives

Proposers should address the objectives stated below, which are mainly based on the PNT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical / legal / regulatory / market constraints, but the reasons for this should be clearly stated in the protocol.

The JNP shall focus on developing a long term ongoing dialogue between the metrology community and relevant stakeholders. This dialogue should support the take-up of research outputs from the metrology community and the collection of needs from stakeholders to inform future research.

The specific objectives are:

1. To establish regular, constructive dialogue and liaison between the project and stakeholders in advanced manufacturing, as well as overlapping areas in advanced materials and nanotechnology. The project should foster new and existing collaborations including those with relevant societies (e.g. the European Society for Precision Engineering and Nanotechnology (Euspen), the Institute of Measurement and Control (InstMC) and standards bodies.
2. Using the feedback from stakeholders in Objective 1, to develop a Strategic Research Agenda (SRA) and roadmaps for advanced manufacturing metrology. The SRA should identify gaps in current metrological capabilities and take into account existing networks and roadmaps (e.g. EURAMET TCs, EMC2, European Factories of the Future Research Association (EFFRA), European Association of the Machine Tool Industry and related Manufacturing Technologies (CECIMO).
3. Using the feedback from stakeholders in Objective 1, to set up a knowledge-sharing programme for advanced manufacturing stakeholders, in order to promote the dissemination and uptake of results, including those from previous, relevant EMRP and EMPIR projects. This should take into account existing training programmes (e.g. Euspen, EMC2) and include a range of regularly hosted activities, e.g. exchange of researchers, industry focussed events and training courses.
4. Using the feedback from stakeholders in Objective 1, to develop a web-based platform for advanced manufacturing stakeholders. The platform should include easy access to European metrology capabilities and links to other relevant European and international networks (e.g. Factories of the Future partnership, ECSEL Joint Undertaking), as well as service desk to answer stakeholders' questions. It should be developed in a manner that allows it to be maintained by a future EMN.
5. To develop a plan for a joint and sustainable European metrology infrastructure for advanced manufacturing via a European Metrology Network. The plan should be completed within 12 months of the start of the project and should (i) use coordination and smart specialisation of capabilities (ii) align with other running initiatives and projects, (iii) promote the development of emerging member states, and (iv) consider how to extend collaboration to third countries.

The proposed activities shall be justified by clear reference to the measurement needs within strategic documents published by the relevant stakeholders. Proposers should establish the current state of the coordination in this area, and explain how their proposed project goes beyond this.

The proposed activities should not include those essential for the establishment and operation of the EMN. EMNs will be established and operated by the EURAMET members using their own national resources regardless of whether specific EMPIR proposals are funded. EMPIR funding is for specific tasks aimed at ensuring a proposed EMN will progress quickly towards its establishment and implementation and contribution to the objectives of the programme.

EURAMET expects the average EU Contribution for the selected JNPs in this TP to be 0.4 M€, and has defined an upper limit of 0.5 M€ for this project.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners and collaborators will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the sustainability of the organisation. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JNP results are going to:

- Address the SNT objectives and deliver solutions to the documented needs,
- Provide a lasting improvement to coordination in the European metrological community and communication with their stakeholders beyond the lifetime of the project,

You should detail other impacts of your proposed JNP.

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically, the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased

Time-scale

The project should be of up to 4 years duration.