

The European Partnership
on Metrology

Draft Proposal - June 2020



Draft proposal for a European Partnership under Horizon Europe

About this draft

In autumn 2019 the Commission services asked potential partners to further elaborate proposals for the candidate European Partnerships identified during the strategic planning of Horizon Europe. These proposals have been developed by potential partners based on common guidance and template, taking into account the initial concepts developed by the Commission and feedback received from Member States during early consultation¹. The Commission Services have guided revisions during drafting to facilitate alignment with the overall EU political ambition and compliance with the criteria for Partnerships.

This document is a stable draft of the partnership proposal, released for the purpose of ensuring transparency of information on the current status of preparation (including on the process for developing the Strategic Research and Innovation Agenda). As such, it aims to contribute to further collaboration, synergies and alignment between partnership candidates, as well as more broadly with related R&I stakeholders in the EU, and beyond where relevant.

This informal document does not reflect the final views of the Commission, nor pre-empt the formal decision-making (comitology or legislative procedure) on the establishment of European Partnerships.

In the next steps of preparations, the Commission Services will further assess these proposals against the selection criteria for European Partnerships. The final decision on launching a Partnership will depend on progress in their preparation (incl. compliance with selection criteria) and the formal decisions on European Partnerships (linked with the adoption of Strategic Plan, work programmes, and legislative procedures, depending on the form). Key precondition is the existence of an agreed Strategic Research and Innovation Agenda / Roadmap. The launch of a Partnership is also conditional to partners signing up to final, commonly agreed objectives and committing the resources and investments needed from their side to achieve them.

The remaining issues will be addressed in the context of the development of the Strategic Research and Innovation Agendas/ Roadmaps, and as part of the overall policy (notably in the respective legal frameworks). In particular, it is important that all Partnerships further develop their framework of objectives. All Partnerships need to have a well-developed logical framework with concrete objectives and targets and with a set of Key Performance Indicators to monitor achievement of objectives and the resources that are invested.

Aspects related to implementation, programme design, monitoring and evaluation system will be streamlined and harmonised at a later stage across initiatives to ensure compliance with the implementation criteria, comparability across initiatives and to simplify the overall landscape.

In case you would like to receive further information about this initiative, please contact:

Lead entity (main contact):

EURAMET e.V., Duncan Jarvis, duncan.jarvis@euramet.org

Commission services (main contact):

DG R&I F3, Gustaf Winroth, Gustaf.WINROTH@ec.europa.eu

Partnership sector in DG R&I (overall policy approach for European Partnerships and its coherent application across initiatives), E-mail: RTD-EUROPEAN-PARTNERSHIPS@ec.europa.eu

¹ https://www.era-learn.eu/documents/final_report_ms_partnerships.pdf

Contents

1	General information.....	5
1.1	Draft title of the European Partnership	5
1.2	Lead entity (main contact).....	5
1.3	Commission services (main contact).....	5
1.4	Summary (max 500 characters)	5
2	Context, objectives, expected impacts.....	5
2.1	Context and problem definition.....	5
2.1.1	Emerging challenges in the field.....	7
2.1.2	EMRP	10
2.1.3	EMPIR	11
2.2	Common vision, objectives and expected impacts	13
2.2.1	Vision.....	13
2.2.2	Objectives.....	15
2.2.3	Expected external impacts	16
2.2.4	Expected internal impacts - Restructuring the metrology community	18
2.3	Necessity for a European Partnership.....	20
2.3.1	Why not just use standard Horizon Europe calls?	21
2.3.2	Metrology funding outside Europe.....	22
2.4	Partner composition and target group	23
3	Planned Implementation.....	25
3.1	Activities	25
3.1.1	The European Metrology Networks	25
3.1.2	Joint Research Projects.....	27
3.1.3	Capacity building	29
3.1.4	Funding structure	31
3.2	Resources	33
3.3	Governance	36
3.3.1	EURAMET e.V.	36
3.3.2	STAIR-EMPIR.....	39
3.3.3	Euramet’s Liaison Organisations.....	40
3.3.4	The European Commission	40
3.4	Openness and transparency	40
4	Annex - SRIA	43
4.1	Preparation for the annual call	43

4.2	Stakeholder interaction	44
4.2.1	Interaction with industrial stakeholders and standardisation bodies.....	46
4.2.2	Interaction with societal stakeholders and regulatory bodies.....	46
4.2.3	Interaction with stakeholders from academia.....	47
4.3	Stage 1 process (identifying metrological challenges)	47
4.4	Stage 2 process (selecting Joint Research Projects).....	49

Figures

Figure 1:	Role of metrology in addressing the priorities of the new commission	18
Figure 2:	Coordinated metrology research in Europe under EMPIR	19
Figure 3:	Coordination in European metrology beyond EMPIR.....	19
Figure 4:	The Regional Metrology Organisations	24
Figure 5:	Funding structure of the Partnership	32
Figure 6:	Expected National Commitments to the Partnership.....	34
Figure 7:	Share of National Commitment if the UK and Switzerland are associated.....	35
Figure 8:	Share of National Commitment amongst the EU and EEA states.....	35
Figure 9:	Proposed call budget profile over the life of the Partnership	36
Figure 10:	Euramet member countries.....	37
Figure 11:	Process for defining the areas to be opened for an annual call.....	43
Figure 12:	EMN alignment with stakeholder communities and challenges.....	45
Figure 13:	Process for stage 1 of a call	48
Figure 14:	Process for stage 2 of a call	49

1 General information

1.1 Draft title of the European Partnership

The European Partnership on Metrology

1.2 Lead entity (main contact)

Dr Duncan Jarvis
EURAMET eV
Bundesallee 100
D-38116 Braunschweig
Germany

Duncan.Jarvis@euramet.org

1.3 Commission services (main contact)

Dr. Ir. Gustaf WINROTH
Research Programme Officer
European Commission
DG Research & Innovation

gustaf.winroth@ec.europa.eu

1.4 Summary (max 500 characters)

Metrology, the science of measurement, underpins all domains of science, technology and innovation. Increased accuracy, precision and new measurement capabilities are central to addressing societal challenges and emerging technologies. This proposal is for a new initiative for metrology in Europe. Its aim is the development of a self-sustaining integrated metrology system for Europe by 2030 at least equal to the top global performers.

2 Context, objectives, expected impacts

2.1 Context and problem definition

Often hidden from the public view, metrology is a building block of our industrialised, increasingly globalised society and affects almost every aspect of modern life. Precision in industrial production and processes, the reliability of medical diagnosis, environmental monitoring, data quality for regulation and many more applications rely on correct and comparable measurements, which require a sound underpinning metrology system.

Such a system is achieved by ensuring traceability to the International System of Units, referred to as the SI, covering the base units (second, metre, kilogram, ampere, kelvin, mole, candela) and the derived units. Internationally compared and harmonised standards on a primary level ensure that all measurements which are traceable to them, are comparable in absolute terms. This comparability of measurements and interoperability is crucial, with

obvious examples being the atomic clocks that form the basis of international time keeping, and with it communications, banking, navigation etc., or the protection of the environment, which requires decision making regarding climate control on the basis of reliable measurements comparable on a world-wide scale and over long times. Another example is industrial innovation and production process control where precise and traceable measurements allow the accurate assembly of a single machine from parts delivered by different suppliers.

All governments in advanced technological countries support a metrology infrastructure because of the benefits it brings. The metrology infrastructure, and in many cases the associated research, are primarily managed and delivered via the National Metrology Institutes (NMIs), supported by "Designated Institutes" (DIs). The NMIs, some of them in operation for more than 100 years, are additionally charged with ensuring that the international system of measurement functions appropriately and so they are firmly imbedded in the mechanisms of the Metre Convention².

Today, Euramet e.V., the European Association of National Metrology Institutes, has 38 member states³, each of them providing a metrology infrastructure and being represented by an NMI, assisted in some states by Designated Institutes.

All NMIs and DIs follow broadly the same three core objectives: to underpin industrial needs for product quality and innovation, to support sound policy and regulation (and thus to protect the citizen) and to provide ever better tools for other scientific disciplines. The major impact of metrology provided by NMIs and DI is being leveraged up through a continuous chain of successively greater numbers of traceable calibrations at secondary and tertiary laboratories and research and technology organisations at other levels of the calibration hierarchy of increasing measurement uncertainty.

The national metrology remit on an NMI/DI level is technologically very broad and requires long-term approaches, international harmonisation and impartiality. Thus, any private or academic initiative would be insufficient and can be regarded as an example of 'market failure' where government and state intervention at national (NMI) and European (Euramet) levels is essential. On the other hand, many of the secondary calibration laboratories whose metrology is underpinned by Euramet members, are often operated commercially – as is appropriate at this level.

The metrology landscape is far from static. National metrology research programmes and activities respond to the demand for measurement standards of ever-increasing accuracy, range and diversity. This requires substantial efforts in research, and a large fraction of the more than 5000 staff of the Euramet members are researchers. Close relations are maintained at the same time between national metrology and academic researchers and there are several examples of re-definitions of the SI which are based on Nobel-prize winning fundamental research.

Increasingly complex and demanding needs for quality-assured measurement in industry, and those associated with the grand societal challenges of energy, environment and health,

² The Metre Convention was signed in 1875 by 17 states. It was the first international diplomatic treaty. The signatory states (now there are 60 plus 42 associates), agree to adopt the metric system.

³ Albania, Austria, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Montenegro, Netherlands, North Macedonia, Norway, Poland, Portugal, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, United Kingdom

cannot be sufficiently covered by the traditional, nationally fragmented system. These considerations are among the key motivations for the integrated European approach organised by Euramet.

This "market pull" approach is supplemented by a "technology push" element. Implementing new cutting-edge measurement technologies for the sake of development of better measurement standards allows a parallel, additional technology transfer into industry. Consequently, some NMIs participate in national technology transfer programmes.

Given this over-all background, and considering the common mission of all its member institutions, Euramet's Mission is to ensure that:

- Europe provides an appropriate, integrated and fit-for-purpose measurement infrastructure, providing metrological traceability and declared measurement quality, which in turn ensures products and processes of required quality
- the European measurement infrastructure is internationally recognised and is based on robust and high-quality science
- the European metrology programmes are coordinated for maximum impact.

European industry benefits as a result of these services and activities,

- from metrological services for secured quality control of prototyping and production and international recognition of measurement results
- from international harmonisation of the system of units for reduced technical barriers to trade
- from metrological research and development for innovation and competitiveness
- from knowledge and technology transfer.

The European regulators, society and the single citizen benefit

- from reliable and secured reference data and advice for policy making
- from reliable and secured measurements in the field of legal metrology
- from reliable and comparable measurements for control and protection purposes such as in monitoring of environmental parameters, safety and security, or in medical diagnosis and treatment
- from key measurements and reference data in academia.

2.1.1 Emerging challenges in the field

The speed at which innovation is coming to the market is increasing rapidly. Metrology is a key enabler in the innovation process. Europe will not succeed in building critical industrial value chains and maintaining global leadership if metrology services are not up to speed. This is demonstrated in areas ranging from health to quantum and other emerging technologies.

- **Laboratory Medicine:** Laboratory testing is at the heart of modern health care. Up to 70 % of medical decisions depend on in vitro diagnostics (IVDs). Proper diagnostic tools for all forms of laboratory testing mobilise every aspect of metrology because of the need for precise measurements traceable to reference materials and primary standards. Metrology capacity must also be swift and accurate. Hence, the measurement procedure needs to be improved constantly to adapt to the fast changing needs, to avoid shortages and false negatives/false positives. This is all the

more evident in the current period of a virus pandemic when testing capacity and availability of reference materials must be increased rapidly. As the current crisis demonstrates, response capacity varies across Europe, highlighting the need for increased integration and merging of metrology efforts, in particular for laboratory testing and provisioning of reference materials.

- **Medical use of Ionising Radiation:** Cancer affects everyone regardless of age, gender or social status and represents a tremendous burden for patients, families, and societies at large. If no further action is taken, the number of people newly diagnosed with cancer every year in Europe will increase from the current 3.5 million to more than 4.3 million by 2035. Radiotherapy plays an important part in the fight against cancer, and treatment regimes based on applications of new types of ionising radiation therapies have contributed greatly to current success. However, procedures for diagnosis and treatment are currently not well harmonised, relying on third-party publications or updates to national or international protocols, potentially resulting in slow implementations of the newer, more effective, techniques. The metrology community has a significant role in supporting the standardisation of ionising radiation medical technologies and the harmonisation of methods with sound supporting evidence of effectiveness.
- **Quantum Technologies:** Quantum technologies are rapidly creating new market opportunities. A range of companies, both SMEs and large entities, have started to develop quantum devices or have begun to integrate them into their products. These technologies place new and challenging demands on the metrology system, creating requirements of increasingly accurate measurements and often requiring entirely new forms and methods of metrology to support the innovation process.
- **Advanced Manufacturing:** Various digital concepts propose transformative improvements to production quality and efficiency, and therefore boost the competitiveness of Europe's manufacturing industries. While overall production quality has improved in recent decades, the cost of quality issues still equates to between 5 and 40 % of total sales. Concepts like Industry 4.0, that combine automation and data exchange within manufacturing technology and processes, suggest new opportunities for innovation, in emerging sectors such as additive manufacturing, new materials and nanotechnology. Here, production decisions are reliant on measurement data that will be required to be traceable and comparable for these decisions to be fully capable of trust. Input from the metrology community is necessary to build this confidence.

Metrology also underpins trustworthy and up-to-date regulation, which needs to be up-to-speed to ensure Europe maintains a global competitive edge in areas from the energy transition to climate neutrality.

- **Smart Electricity Grids:** In order to fully exploit the capabilities of renewable energy sources, and to integrate these sources in the electricity distribution system, reliable smart grids must be implemented. This means significant re-engineering and a roll-out of new technologies that require stable and accurate measurement technology, available across the full space of the Energy Union.

- **Energy Gases:** In striving towards a reliable, sustainable and diverse energy network, and in responding to the Green Deal targets, it is vital to address outstanding fundamental challenges to establish climate neutral gases as a fuel source. The energy transition to climate neutral gaseous fuels will require an entire new set of metrology solutions across Europe for an effective implementation.
- **Climate and Ocean Observation:** Metrology stands in the centre of providing accurate and precise measurements for physical, chemical, and biological climate variables that are essential to observe climate trends over short and long time periods. The establishment of a European metrology system for these variables will rapidly enable the capacity to observe how climate change affects the environmental changes in the atmosphere, in the ocean, and on land.
- **Clean Energy:** The European “Green Deal” includes a comprehensive policy framework for the climate and environmental challenges. It aims to transform the whole economy and society to put it on a more sustainable path and to bring the net emissions of greenhouse gases to zero by 2050, thus supporting the EU’s climate ambitions. The Green Deal is a technological challenge, and the ‘Clean energy’ policy area includes priority areas such as interconnected energy systems, innovative technologies (Hydrogen, photovoltaic, fuel cells, batteries and energy conversion, transport and storage), energy efficiency and eco-design, offshore wind energy, decarbonisation of the gas grid and smart integration and promotion of EU standards. New or improved technologies are being developed for clean and efficient energy generation, transport, storage and use. Metrology support is key for these developments both in academia and industry.
- **Regulating Sources of Pollution:** Pollution affects both the environment and the health and well-being of citizens and ecosystems. The importance of monitoring pollution in order to regulate and reduce it, is recognised through a number of EU directives and regulations, such as for example, the Water Framework Directive, the Groundwater Directive, the Industrial Emissions Directive, the Ambient Air Quality Directive, and the Urban Wastewater Treatment Directive. Accurate and traceable measurement underpins all these regulations.
- **Reliable Radiation Protection:** Radiation protection legislation has been overhauled to better protect European citizens. A revision of the EURATOM Directive broadened its scope to radiation sources and categories of exposure. Occupational, medical, public and environmental risks are now all covered, partly in response to lessons learned from the Fukushima nuclear accident. Radiation protection measurement (dosimetry) will need to be responsive to changing needs, including supporting new technologies such as pulsed doses in nuclear medicine, harmonised worker protection measures, and digitalisation trends. In the next few years the metrology community will be key to introducing a legally enforceable European quality assurance system in this area.
- **Mathematics and Statistics:** Measurement science increasingly relies on new analytical and computational methods. This requires that metrology capacity is improved in the areas of applied mathematics, statistics, and numerical computation, and state-of-the-art computational tools.

EURAMET aims to develop and disseminate an integrated, cost effective and internationally competitive measurement infrastructure for the whole of Europe. Its priorities are driven by the needs of industry, business and governments Europe wide. Euramet supports its members to meet their national requirements, to establish a balanced European measurement infrastructure and demonstrate the impact of metrology. While most activities are best coordinated at the European level there are some that Euramet's members can coordinate with their near neighbours more successfully, and in greater depth, than they would with the whole community. This greater capacity for coordination may stem from geographical closeness, common cultural and linguistic roots, or common economic drivers. Wherever these local factors enable Euramet's members to do things together better on a regional level than they could do alone, or across the whole of Europe, a regional network promoting smart specialisation can be the appropriate vehicle for managing the cooperation. Euramet is piloting this idea in the Nordic/Baltic region.

While the topics above are strategic and long-term priorities, as a horizontal activity underpinning much of modern society, metrology also has to respond quickly to sudden events. In the current crisis our members have been applying their knowledge and resources in key areas – helping to save lives by using measurement to improve confidence in Personal Protective Equipment, helping companies innovate and develop new ventilators, supporting confidence in medical laboratory tests, temperature measurement and providing the traceability to ensure that oxygen supplies are the correct purity. As the immediate crisis abates and the priority moves to recovering from the economic effects, then the metrology community will again respond by providing confidence in measurements wherever necessary to help Europe prosper.

Over the past decade, European states have combined their national metrology system funding and (with a contribution from the EU Framework Programmes) established two joint programming initiatives:

2.1.2 EMRP

The 400 M€ European Metrology Research Programme (EMRP) was established in 2009 by the then twenty-two participating countries and the European Union, utilising Article 169 (now Article 185) of the European Treaty. Euramet - the European Association of National Metrology Institutes - was the body responsible for the implementation of the EMRP. The core activity of the EMRP consisted of funding multi-partner transnational joint research projects to advance metrology and its applications⁴. In view of the concentrated capacities in metrology, the core part of the EMRP was executed by National Metrology Institutes and Designated Institutes identified by the participating States. The joint research projects were supplemented by three researcher grant schemes: Researcher Excellence Grants aimed at broadening metrological expertise in the programme and were exclusively available to the wider non NMI/DI research community. Researcher Mobility Grants encouraged transnational mobility between the programme participants but also provided an opportunity for the European countries not participating in the Article 169 to engage in capacity building of their metrology research capability. The Early Stage Researcher Mobility Grants provided

⁴ <https://www.euramet.org/metrology-for-societys-challenges/>

the next generation of metrology researchers from the participating NMIs and DIs with an opportunity to gain transnational experience.

Details of individual projects funded by this programme are available at <https://www.euramet.org/emrp-calls>. All these projects are now complete and this site provides the final technical reports and summaries of each of the 119 projects.

A formal analysis of the impact of the programme against the objectives in the decision was carried out and is available at <https://www.euramet.org/emrp-impact-report>.

2.1.3 EMPIR

The 600 M€ European Metrology Programme for Innovation and Research⁵ (EMPIR) was established in 2014 by twenty-eight participating countries and the European Union, utilising Article 185 of the European Treaty. It follows on from the European Metrology Research Programme (EMRP) that held its last call for Joint Research Projects in 2013. Euramet - the European Association of National Metrology Institutes - is the body responsible for the implementation of EMPIR. The Decision of the European Parliament and of the Council of 15 May 2014 (No 555/2014/EU) established the Programme, and a Delegation Agreement (H2020 EMPIR) was signed with Euramet on 27 April 2015.

Annual Commission Decisions have made financing decisions and approved the workplan:

- For 2014 - Commission Decision of 31.10.2014 (C(2014) 7958)
- For 2015 - Commission Decision of 13.11.2015 (C(2015) 7760)
- For 2016 - Commission Decision of 5.1.2016 (C(2015) 9414)
- For 2017 - Commission Decision of 16.12.2016 (C(2016) 8446)
- For 2018 – Commission Decision of 6.11.2017 (C(2017) 7267)
- For 2019 – Commission Decision of 7.12.2018 (C(2018) 8117)
- For 2020 – Commission Decision of 07.11.2019 (C(2019) 7903)

The core activity of EMPIR consists of funding multi-partner transnational joint research projects to advance metrology and its applications. In view of their concentrated capacities in metrology, the core part of EMPIR is executed by National Metrology Institutes (NMIs) and Designated Institutes (DIs) identified by the participating states.

The key differences between the EMRP and EMPIR are the replacement of the Researcher Grant schemes by the involvement of non-NMIs and non-DIs as directly funded partners in the Joint Research Projects and the development of new types of project. Both “Research Potential” and “Support for Impact” calls were piloted in 2014, the first being research projects aimed at developing research capacity in newer NMIs, the second being a support action aimed at new opportunities for exploiting the results of completed EMRP and EMPIR projects. In 2015 the third new type of call – that to support standardisation activities was piloted. All three calls were repeated in following years with improvements learnt from the previous calls. In 2018 a new call to support European Metrology Networks was piloted.

Details of individual projects funded by this programme are available at <https://www.euramet.org/empir-calls>. Most projects are still in progress, those in the first call have completed their reporting. This site provides publishable summaries for each of the funded projects

⁵ <https://www.euramet.org/research-innovation/research-empir/>

Euramet reviewed the impact of EMPIR against the objectives in the decision. The report is available at <https://www.euramet.org/empir-interim-evaluation>.

The EC also held a mid-term review of EMPIR at the same time as the final evaluation of the EMRP. Their joint report is available at https://ec.europa.eu/research/evaluations/pdf/emrp-empir_expgrp_report_final.pdf.

That evaluation concluded:

- While the previous initiatives have gone a long way in establishing a coordinated metrology infrastructure, it is not yet firmly embedded or sustainable without support. The previous initiatives have largely focused on processes for developing and delivering joint research projects. This has worked well at a project level but has not resulted in deeply embedded and sustainable structure for cooperation or integration a of metrology research across Europe.
- While the most recent initiative under H2020 has increased its openness to participation beyond the core metrology community, more openness to industrial, academic and research partners would create a more integrated community that can better respond to society's emerging needs
- The impact of the metrology initiatives can be further improved through wider participation (as above) and through better alignment of research activities with industrial needs and policy needs directly related to societal challenges
- There is more to be done to involve and develop the capacities of smaller metrology institutes

In summary, mechanisms need to be developed that will create more strategic, long term cooperation among a wider community of metrology experts, researchers and end users in order to identify and conduct metrology research with greatest economic and social impact. A mechanism that will last and operate independent from project funding, creating a sustainable integrated structure for metrology research and a pathway to exiting from the Article 185 mechanism.

The context for Euramet's proposal for the European Partnership on Metrology is therefore:

- Each state maintains a national measurement infrastructure to ensure that the measurements required for trade, regulation, taxation and innovation can be made reliably with a known confidence. This involves the appointment of an institution in each state to be the focus of that infrastructure and coordinate between states to ensure this confidence is spread worldwide.
- Europe is special. Unlike other regions in the world, Europe has a single market and common regulations, so the coordination of the national measurement infrastructures has to be that much closer. This requires close institutional cooperation at the European level, an integrated European metrology infrastructure based on common strategic agendas, joint research projects and agreements on delivering services to customers from shared infrastructures.
- The EMRP and EMPIR have gone a long way in establishing this integrated infrastructure, but it remains fragile. It is centred on the processes for developing and delivering joint research projects, this works well but when projects are complete the detailed cooperation fades and links to stakeholders revert to national concerns rather than the European level. The next stage of the integration requires the development of vehicles for long term cooperation and interaction with stakeholders (including regulators) in priority areas. Something that will last and operate

independent from project funding. This will require the development of mechanisms that structure the sharing of national resources and make joint decisions on research priorities. EU funding to joint research projects will still be necessary at first, but by the end of the Partnership there needs to be robust infrastructures in place that can attract funding from diverse sources.

- National resources are limited and are insufficient to meet the needs if each state tries to do everything by itself. Moving from the present system of weak coordination of European resources in metrology, to a fit-for-purpose and truly coordinated metrology infrastructure with appropriate use of joint infrastructures and coordinated services will allow Europe to make a contribution to the international effort that matches its share of the world economy and trade.

2.2 Common vision, objectives and expected impacts

2.2.1 Vision

Euramet believes that within the next decade European metrology resources should be enhanced to support metrology applications and industrial innovation, and the contribution from Europe should match its projected share of the world economy and trade. There are important steps to take in the near future to move from today's system with weak coordination of European resources in metrology, to a fit-for-purpose and truly coordinated metrology infrastructure in Europe with appropriate use of joint infrastructures and coordinated services.

Our common vision is to ensure that Europe has a world-leading metrology capability, based on high-quality scientific research, and an effective and inclusive network-based infrastructure to meet the rapidly advancing needs of end users.

Our goals are:

- To ensure that Europe's metrology infrastructure and networks develop in a way that enhances industrial innovation, competitiveness and international trade, and responds to the grand societal challenges.
- To address challenges in internationally competitive joint approaches beyond the capabilities of a single institute.
- To give special attention to the needs of emerging members, and initiate, develop and implement activities to assist them through knowledge transfer in achieving metrological capability where needed, and to provide reliable cross-border services where not.
- To strengthen and coordinate the contributions of the European metrology infrastructure needed to enable regulation.

Euramet is deeply convinced that joint European metrology research programmes beyond the capabilities of national research are needed and will create huge additional benefits for science, society and industry. Both, the value of metrology at the borders of technologies for science and the ability of the metrology community to create impact for society and industry have been demonstrated.

This proposal from Euramet is for a European Partnership on Metrology that builds on the progress achieved under EMPIR. It will break new ground by contributing to the development of self-sustaining, coordinated (joint) metrology infrastructures, with the capacity to continue to do research after 2030, but primarily being established to deliver services under the

permanent public service missions of the partners. These infrastructures are long term, unlike the projects under previous programmes where the cooperation fades at the end of the contract, these infrastructures will continue the commitment and the cooperation for as long as the need remains. They are both the core element of the new partnership and the exit strategy from A185 funding schemes.

A wide variety of industry needs to access facilities that enable it to test, validate, and ensure compliance with regulation. The National Metrology Institutes were established over a hundred years ago in the most industrialised nations to provide this infrastructure. They were established not by research ministries but by economic ministries, not primarily to do research but to enable industry to measure what it produced and prove that what it produced was fit for purpose, to enable governments to regulate and prove in the courts that measurements demonstrating compliance with those regulations were correct. While every European state has a national metrology system, they are quite diverse in capability and ability to support the growth of their local economies. Inclusive productivity growth and convergence will require that the European Metrology System develops to enable a common distributed infrastructure to be accessed locally – the NMIs will need to form networks allowing all to serve their local customers based on the shared facilities and knowledge of them all. The networks will need to build capacity, infrastructure and engage with stakeholders in a coordinated fashion to ensure that services can be delivered at the required local level based on a common knowledge base.

Metrology is at least as important for key societal challenges as it is for industrial innovation and services. Euramet has identified more than 70 European directives and regulations that require a reliable metrology infrastructure and research. More than half of them have a background associated with public health, energy, environment/climate and food safety. Examples are the In-vitro Diagnostics Regulation, the Energy Efficiency Directive, the Water Framework Directive, and the Basic Safety Standards Regulation of Euratom, but there are many more.

This background is not static but the request for better and broader metrological capabilities in this context is steadily growing. New or lower concentrations of chemical and radioactive pollutants need to be measurable. Reference data and methods need to be improved and quality-assured to underpin climate models; this includes physical-chemical measurements in the deep ocean to atmospheric components to satellite-borne remote sensing which all need a precise and exact calibration.

There is a global consensus that CO₂ emissions need to be reduced to limit global warming. This will only be possible by a transformation of our energy systems. Metrology will make a substantial contribution: improved measurement capabilities can make power generation and energy transport more efficient, are needed to understand sector coupling better or for power-to-gas technologies.

New methods in diagnostics and therapy, which increasingly include big data and deep learning technologies, need to be quality-assured to help the physician and protect the patient.

The Calibration and Measurement Capabilities (CMCs) of National Metrology Institutes and Designated Institutes for all these applications are compared, quality-assured and

internationally recognised under the Metre Convention. They are listed in the Key Comparison Database (KCDB) of the BIPM⁶.

2.2.2 Objectives

The **general objective** of the Partnership should be:

To Create, by 2030, a self-sustaining and effective system for metrology at European level that ensures Europe has a world-class metrology system that:

- Provides metrology solutions, fundamental metrological reference data and methods, offering fit-for-purpose solutions supporting and stimulating European innovation and responding to societal challenges.
- Supports and enables effective design and implementation of regulation and standards that underpin public policies that address societal challenges

This would lead to the following **specific objectives**:

1. That the national contributions to the Partnership should enable the development of self-sustaining European Metrology Networks that provide metrological solutions for (i) innovative technologies and (ii) public policy and regulation for key societal challenges. These networks should have a strong stakeholder focus and significant role in the development of the strategic research and innovation agenda for the partnership.
2. That the European Union contributions to the Partnership should fund Joint Research Projects that aim to increase and accelerate innovation through effective use of metrology solutions, capabilities and infrastructure. With the result that an average of 50 M€ of European turnover from new or significantly improved products and services can be attributed to the Metrology Partnership and its predecessors each year.
3. That supporting activities associated with the Partnership should increase the role of metrology in design and implementation of public policy and regulation for key societal challenges. This should be demonstrated by the numbers of:
 - roles on European and international policy, regulation and standards committees directly related to addressing social challenges
 - contributions to European and international standards directly related to EU needs

Related **operational objectives** could include:

- The staff resources of the NMIs and DIs funded from the National Metrology budgets assigned to the priorities identified by the networks.
- The number of Euramet members participating in the networks
- The numbers of non NMI/DI partners participating in the Joint Research Projects and the fraction of the European Union funding they receive.
- The fraction of the European Union funding allocated to support regulation and standardisation activities in the Joint Research Projects.
- Publication and citation data from the EU funded projects
- Contributions to standardisation
- Training events both in projects and in the support actions for capacity building.

⁶ <https://www.bipm.org/kcdb/>

2.2.3 Expected external impacts

These objectives would support a wide range of European policies as the European metrology system underpins accurate, reliable and trustworthy measurements in support of a wide range of commerce and public services.

The Single Market

The metrology system was formed to facilitate competitiveness and fair trade. It ensures that measurements of quantity, performance and quality of products and services are consistent whenever and wherever they are made. This gives consumers, businesses and public agencies confidence that what they buy is what the seller says it is and performs as the seller claims it does. Reliable and consistent measurement enables complex global supply-chains to function, where components from around the world must fit together and perform as designed. It is critical that metrology continues to develop to meet the needs of emerging technologies and industries.

The Innovation Union

Metrology research supports innovation through state-of-the-art measurement capabilities that provide the means of demonstrating and validating the performance and functionality of novel concepts, technologies, products and services. It also enables producers to demonstrate that their innovative goods are superior to cheaper alternatives. Metrology research also creates new metrology knowledge, tools and techniques that enable industry to develop innovative instrumentation, sensors, analytical tools, systems and methods that underpin manufacturing and a wide range of service sectors including healthcare, communications, financial services, and environmental monitoring.

Digital Single Market

State-of-the-art measurement capabilities support the functioning of digital services such as communications and financial services. Without the precise timing infrastructure provided by the metrology infrastructure, telecommunication networks would fail as would the electricity supply grids. In financial services it enables each financial trade to be accurately time-stamped to provide robust evidence of transactions and ensure compliance with European financial regulations. Traditional metrology activities are also adapting to the new demands of industry as it responds to the digital revolution, themes like “Factory of the Future” and “Internet of Things” are a key source of new metrology needs and services.

Energy Strategy and Energy Union

Metrology provides the measurement infrastructure that provides confidence in trading and taxing fuel. This started with the measurement of the quantity and quality of fossil fuels, but new traceability systems and measurement capabilities are required for new lower and zero carbon fuels such as biofuels and hydrogen. Metrology research also supports the development, testing and standardisation of the instrumentation required to operate smart grids. Metrology solutions for the future energy system will be more multidisciplinary and holistic: they will need to address sector coupling and cover whole chains from energy production over transport and storage to efficient consumption. For example, metrology solutions will support the exploitation of fluctuating wind or solar energy through power-to-gas/hydrogen transformation for storage and transport.

Climate Action and Environmental Policies and Regulations

Accurate and traceable measurement capabilities enable environmental monitoring to inform society about the state of the climate and the effective design and enforcement of environmental regulations that mitigate against pollution and climate change. For example, the WMO, to which Euramet is well connected, has defined critical climate variables and essential ocean variables. Both fundamental reference data for their physical-chemical properties and metrological, traceable measurement capabilities are of utmost importance for climate models and the understanding of ocean-atmosphere interaction.

As another example, NO_x emissions of vehicles have been identified as harmful and the regulation has been tightened consequently. The implementation of the associated conformity assessment has only been possible because measurement technologies were developed under EMRP and EMPIR⁷. Euramet anticipates even stricter regulation in future and the inclusion of other types of emissions and will respond with the help of the Partnership.

Public Health

Reliable measurement enables healthcare to be provided safely and effectively e.g. that diagnostic tests provide robust results and accurate doses of pharmaceuticals or radiotherapy can be prescribed. Metrology research ensures the metrology system develops to support new medical technologies and therapies. Euramet expects two key developments in the next decade, namely the increased use of deep learning and big data technologies e.g. in medical imaging, and methods for personalised medicine. Both require comprehensive metrology research to support diagnostics and therapy decisions of physicians and to protect the patient.

Sustainable Development Goals

From these activities it can be seen that Metrology particularly contributes to the following Sustainable Development Goals (SDG):

- Industry: SDG9 Industry, Innovation, and Infrastructure and SDG12 Responsible Consumption and Production
- Energy: SDG7 Affordable and Clean Energy
- Climate and natural resources: SDG13 Climate Action, SDG14 Life Below Water, SDG15 Life on land, SDG6 Clean Water and Sanitation
- Health: SDG3 Good Health and Well-being

Priorities set by the new Commission

Metrology also underpins key aspects of Europe's policy priorities post-2020, as illustrated by its potential contribution to realising the Political Guidelines of the Von Der Leyen Commission.

⁷ <https://www.euramet.org/metrology-for-societys-challenges/metrology-for-environment/case-studies-creating-a-clean-safe-environment/>

Figure 1: Role of metrology in addressing the priorities of the new commission

Priority	Illustrations of Role of Metrology
European Green Deal	Providing metrics for achieving climate neutrality, measurement methods enabling reduction of pollution, and technology for clean energy solutions
Economy that Works for People	Innovative and more accurate measurement tools are integral to a successful plan to fight cancer
Europe Fit for Digital Age	Standard-setting for 5G networks, Artificial Intelligence and digital services
Protecting our European Way of Life	Provide confidence in a fully functioning Schengen Area to reinforce the European approach to customs risk management
Stronger Europe in the World	Underpins Europe’s role as a standard setter in leading a strong, open and fair-trade agenda and a functioning Emissions Trading System
New Push for European Democracy	Providing a fair and just basis for the enforcement of law and ensuring standards to protect Europe against covert external interference

As Figure 1 summarises, metrology is an important enabler across all the EU’s policy priorities beyond 2021. The progress made under previous partnerships in the field have equipped Europe with an advanced metrology system fit to contribute effectively to these priorities.

2.2.4 Expected internal impacts - Restructuring the metrology community

At present the European metrology community is structured around several coordination mechanisms - the Mutual Recognition Arrangement under the Comité International des Poids et Mesures (CIPM-MRA), the Euramet Technical Committees and, most prominently, the European metrology research programmes. The NMI/DI community helps to meet the socio-economic challenges through the establishment of an appropriate metrology infrastructure. The necessary metrology research is identified in a coordinated manner, laid down in the strategic research agenda and carried out in joint research projects (JRPs) under EMRP and EMPIR. The JRPs improve the cooperation among partners on a project level, help to achieve a critical mass, especially in new fields, and allow the realisation of important projects of pan-European importance which could not be handled by a single institute. But, as the national strategies are usually not disclosed, in many cases the JRP outputs do not lead to sustainable joint structures and to more coordination after the conclusion of the project. The conversion of joint research project outputs into infrastructures and services remains on a national level (or even un-exploited) as illustrated in Figure 2.

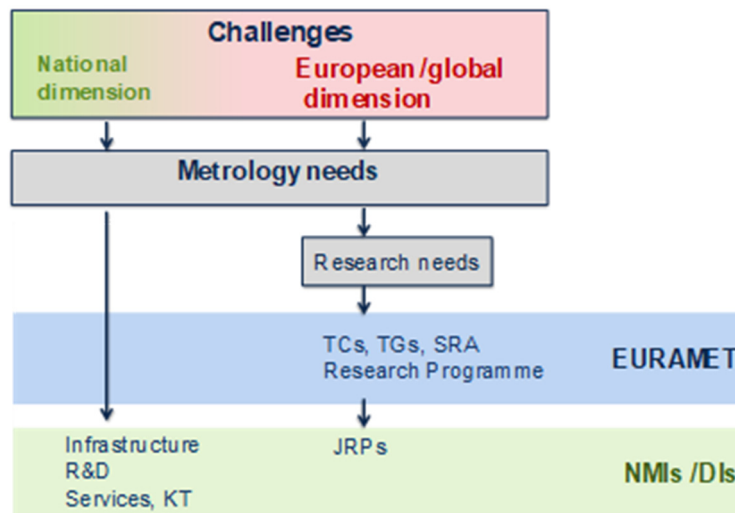


Figure 2: Coordinated metrology research in Europe under EMPIR

At present the metrology needs are deduced from the challenges and we concentrate on the research needs related to these metrology needs. At the European level, a strategic research agenda is set up as the basis for the call scopes of the research programmes. The NMIs respond individually to these needs through participation in the JRPs. There is no exchange about the National strategies. Even within the JRPs, the strategies of the partners may not be known. Sustainable structures beyond the limits of the JRPs are the exception not the rule.

The future should be a truly coordinated and shared metrology infrastructure, this requires a shared vision and the agreement on a common agenda. This coordination has to occur in key areas focussed on stakeholder needs rather than technical capability - the establishment of joint structures which go beyond joint research as illustrated in Figure 3.

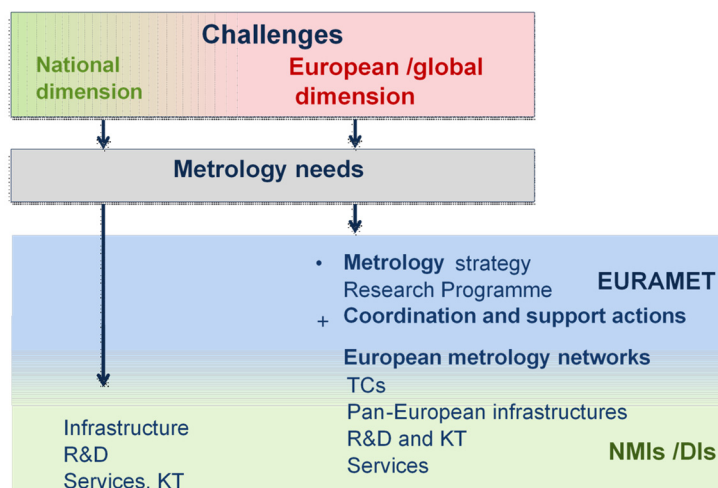


Figure 3: Coordination in European metrology beyond EMPIR

Here, the European and global metrology needs are analysed at the European level. Metrology networks address the needs in a coordinated manner. The members formulate a common metrology strategy which includes aspects like research, infrastructure, KT and even services. The members commit themselves to contribute to the network, thereby contributing to the establishment of sustainable structures. This closes the gap between the EURAMET and the NMI/DI level.

In this vision, the research programming and the development of a joint infrastructure or service landscape building on this research, are strategically planned from the beginning. The overall objective is to create sustainable structures in areas of strategic importance for the future of European metrology by:

- Creating and disseminating knowledge,
- Gaining international leadership and recognition, and
- Building coordinated infrastructure.

2.3 Necessity for a European Partnership

Horizon Europe has three pillars: Excellent Science, Societal Challenges and European Industrial Competitiveness, and Innovation Europe. Given the mandate and funding sources for the National Metrology Institutes, their work is more applied than most academic institutions and they rarely work in the mode of the ERC (European Research Council). They do fundamental metrology in ensuring that the measurement system is consistent with (even based on) the fundamental laws of physics, even contributing to new discoveries, but the vast majority of their work expects a practical implementation. The Partnership will have a pillar in “Excellent Science”, but this will be excellent science with a purpose – to enable society to measure in order to meet its priorities whether that be regulation or Global Challenges. A second pillar will be “Innovation”, this aligns well with “Open Innovation” principles as metrology is useless if done in secret – metrology is only of benefit to society when it allows communication, a medic to compare results from a test in the USA with one in the UK, an engineer in Brazil to specify a component to be manufactured in China.

The final pillar of the Partnership will be “Integrated European Metrology”. This goes beyond the expectations of Horizon Europe and scientific research and is closely aligned with the core missions of the National Metrology Institutes. They were created to provide a key national infrastructure and have always had to cooperate internationally to meet their purpose, but Europe is unlike the other regions, it is more integrated and aims to be even more integrated. The Metrology community must also respond at that level – delivering services to European consumers at a local level based on a common knowledge base. During the Partnership Euramet wants to explore with the Commission how this final pillar can be extended into a deeper relationship supporting EU priorities beyond the Framework Programmes.

A significant part of these infrastructures will be associated to the more than 70 European regulations that require metrology support. Euramet’s 2030 vision includes the aim of a special long term relationship with the EC related to regulation. NMIs usually work on national level, which does not include guaranteed service provision on the European level. However, EU regulation applies to all; there is a fundamental EU interest in a coherent and efficient implementation of regulation across Europe. Euramet would be in a position to deliver this on behalf of both the EU and member states, justifying co-funding from EU and member states. This future institutional co-funding may cover “pre-regulatory” research, joint technological developments, training, capacity building measures, and capabilities for policy advice under the responsibility of Euramet. This could develop into a long-term bespoke relationship, outside the framework programmes. Starting from regulation, building on the strong links to the European Standardisation Organisations developed in EMPIR, it may also include other areas of fundamental EU interest that benefits from or requires metrology. Euramet and WELMEC would be very keen to explore and pilot such a relationship during the Partnership.

The Partnership should be based on the A185 instrument. This is needed to allow the community to be structured by Euramet to develop into the 2030 vision. Past experience shows that A185 programmes have been essential in structuring the community to its present position and enabling it to enter new fields that would not have been possible without the EU funding. The EMRP brought consensus on a Research Agenda, developed a common understanding of project management principles, budgeting and reporting. It allowed the national programme owners to agree on a process of joint prioritisation starting from stakeholder needs rather than researcher curiosity. EMPIR extended the processes to a wider community, both stakeholders (such as the formal processes agreed with the European Standardisation Organisations), greater external participation in the research from industry and academia, a broadening of internal participation, from 23 countries to 28, and building capacity in emerging NMIs. At the mid-point of EMPIR we have a well-developed system that drives cooperation and collaboration in the European Metrology System. Thanks to the support by the EU, challenges at European and global level could be addressed far beyond the capabilities of the individual NMIs.

Only an A185 would give Euramet the role as the implementation body with the flexibility needed. This role as implementation body is key – its success with EMRP and EMPIR has been demonstrated. We think, that the unique mandate of Euramet combining joint research with a service-related mandate under the international Metre Convention is one of the main reasons for its success.

2.3.1 Why not just use standard Horizon Europe calls?

Horizon Europe is large in scale and its traditional calls provide the opportunity for collaborative R&I across a wide range of disciplines and application areas. As a general-purpose technology with numerous applications, metrology's applications stretch across almost the entire Horizon Europe programme in Pillar II (everything except perhaps Cluster 2 - Culture, Creativity and Inclusive Society) and arguably Pillars I and III as well. Therefore, while metrology currently sits within *Pillar II's Cluster 4: Digital, industry and space*, its relevance is much wider and it is also a rather 'hidden' piece of the research and innovation system. This presents a significant challenge to ensure metrology R&I priorities are sufficiently reflected in the thematic work programmes amongst more 'obvious' thematic challenges. This is likely to result in sub-optimal levels of metrology research at the European level and therefore not adequately address the issue of meeting the increasing demands for metrology capabilities as a result of under-investing in their creation. The total scale of metrology R&I in Europe matters, it needs to be sufficient to enable breadth in R&I to meet the many economic and societal needs that metrology contributes to and depth in the key underpinning scientific concepts to ensure Europe remains a world-leader.

In addition to sub-optimal quantities of research investment, metrology R&I activities are likely to be distributed across the clusters, thematic priorities and work programmes, with a low level of strategic directionality and a rather ad hoc selection of which metrology needs are prioritised. This also leads to a distribution of national investment across a range of priorities as there is no underlying process to coordinate the most appropriate national expertise to where it can create most impact and reduce the overall fragmentation in a system of national metrology institutes driven by national policy. Coordination and support actions might address coordination in specific domains but would likely have a relatively short-term horizon rather than support long-term structures for strategic coordination, so would not fundamentally address the fragmentation problem.

The key to maximising the scientific quality and impact of metrology research is collaboration among Europe's NMIs and DIs and with collaborations with the best relevant academic research - bringing the NMIs and DIs with the best international scientific reputations together with latest academic thinking, but also bringing in the smaller and developing NMIs and DIs with niche and/or emerging capabilities, to widen the skills and knowledge base across Europe and bring it closer to end-users. Under traditional calls this form of project level collaboration is possible, although there is a risk that only the large, more experienced NMIs and DIs, with higher research resources, skills and management and administrative support would participate, limiting opportunities for building capacity in metrology across Europe.

Traditional calls are designed to create R&I collaborations with industry and other end users and this is absolutely essential for conducting the most relevant metrology research and developing capabilities to meet real identified needs. However, to widen the reach of metrology R&I and collaborate across the value-chain, and not only with first-tier users, requires addressing the wider low awareness of metrology and better developing a better understanding of end-users needs, before such businesses and other end-users are likely to collaborate. This is particularly the case where the end-users are policy makers and regulators who have a more limited engagement with the research base in general, and are not particularly well-engaged with NMIs and DIs. Traditional calls will not serve to create new collaborations between NMIs/DIs and policy makers and regulators in key policy fields.

In summary, traditional calls under Horizon Europe would

- support a degree of important metrology research but investment in metrology would be expected to be sub-optimal in quantity, cover a narrow range of metrology needs, involve limited participants within the NMI/DI community and across the value chain and lacking in directionality.
- Metrology research would remain fragmented and defined by national policy. There would be no strong driver for developing a more coordinated metrological infrastructure.
- Scientific quality would likely still be high but focused on just a few priorities and restricting Europe's ability to meet needs across the economy and society and retaining the concentration of the state-of-the-art capabilities in a few larger NMIs.

Therefore, the overall scientific impact would be a marginal increase over a national approach to metrology R&I and would put Europe's current global lead and influence in metrology at risk.

2.3.2 Metrology funding outside Europe

Europe is facing major challenges from other global regions in terms of scale of investment, focus of investment and the long-term financial commitment to metrology objectives.

The budget of the Scientific and Technical Research and Services (STRS) programme of the National Institute of Standards and Technology (NIST) in the US, which is broadly comparable to the scope of the Partnership, has had an overall annual budget of 724.5 M\$ in 2019 and 754 M\$ in 2020. This highlights the strategic investment of the US in metrology-related fundamental research and innovation.

According to the latest information available, the National Institute of Metrology (NIM) in China had a budget of 180 M€ in 2018. In addition, China implemented a targeted research

programme for metrology between 2016-2019 of about 65 M€ and funded 160 collaborative research projects across China.

Given the scale of investment of our competitors, which Europe cannot match through centralised funding from the EU budget, a partnership with Member States involving long-term financial commitments is essential. In this context, the interim evaluation of EMPIR is pertinent. It highlighted the strategic setback to the development of European metrology when support was discontinued under the Fifth Framework Programme, leading to a loss of capacity for new forms of measurement, inability to maximise opportunities in new areas of European competitive advantage and, consequently, a hindering of competitiveness.

2.4 Partner composition and target group

At the core of the Partnership are the 38 European National Measurement Institutes that are the members of Euramet. These have been given unique responsibilities by their state under the Metre Convention to ensure the international traceability of measurements in that state. In some states the NMI is assisted by one or more “Designated Institutes” in specific technical areas. These DIs are Associate Members in Euramet. All NMIs and DIs are governmental authorities or agencies or are government-owned.

In the current Programme, 28 of the 38 states make a financial commitment. By broadening the type and scope of activities under the new partnership Euramet hopes that more members will make a financial commitment. Even without a commitment all Euramet members benefit from the activities, they participate in the projects as funded partners, they engage in capacity building activities, they receive enhanced services from the Euramet secretariat that are only possible because the implementation of the programme generates central capabilities.

While the Euramet members take joint responsibility for the implementation of the Partnership, the activities involve a wide range of actors:

- The science base is expected to contribute novel ideas and techniques that push the boundaries of measurement, both by identifying new requirements and new solutions. Academic partners are expected as funded and unfunded beneficiaries in the projects under standard Horizon Europe terms.
- European Industry is expected to be the main beneficiary of the Partnership. The new and improved measurement methods should enable novel products and processes, improving competitiveness and thereby increasing European growth and prosperity. The Partnership will engage with industry at all levels – from European Trade bodies that can assist with the identification of trends and needs, through the large enterprises that will be the early adopters of the new technologies developed, to SMEs developing niche measurement products. Industrial partners are expected as funded and unfunded beneficiaries in the projects under standard Horizon Europe terms.
- The European Standardisation Organisations play a key role in building consensus between producers, consumers and regulators. They identify needs for better measurements and their documentary standards can provide international agreement on what measurements are required for specific purposes, how they should be made, reported and used in decision making. The ESOs will continue the role they have in EMPIR of contributing to the definition of programme calls and being a key exploitation route for the project outputs.

- Regulators use measurement as objective evidence in determining policy, in ensuring fair trade, in the justice system to promote a secure and inclusive society. Euramet wants to build new consultation processes during the Partnership to understand emerging needs in this area better.
- For key stakeholder groups, Euramet is forming networks to bring together the major NMIs working in the area with the key stakeholders. These develop strategic agendas to inform the calls and enable the NMIs to build capabilities that serve Europe effectively at a local level without wasting resources on unnecessary duplication.
- The NMI network exists globally. All 102 states and associates of the metre convention appoint NMIs. They cooperate in Regions (see Figure 4) with organisations similar to Euramet covering the Americas (SIM⁸), Asia & Australasia (APMP⁹), Africa (AFRIMETS¹⁰), COOMET¹¹, GULFMET¹². Together they work through the BIPM in Paris to promote and advance the global comparability of measurements for:
 - Scientific discovery and innovation,
 - Industrial manufacturing and international trade,
 - Improving the quality of life and sustaining the global environment.
 Euramet will promote the Partnership through these networks, encouraging non-European NMIs to participate in the calls and projects wherever appropriate. To date, 51 countries have participated in EMPIR projects.



Figure 4: The Regional Metrology Organisations

⁸ <https://sim-metrologia.org/>

⁹ <http://www.apmpweb.org/>

¹⁰ <http://www.afrimets.org/SitePages/Home.aspx>

¹¹ <https://www.coomet.net/>

¹² <https://www.gulfmnet.org/>

3 Planned Implementation

3.1 Activities

Euramet considers that the following activities are a necessary part of the Partnership:

- The development of the European Metrology Networks and their coordination by Euramet so that the European Metrology Infrastructure emerges at the end of the Partnership able to benefit from multiple diverse funding sources and not reliant on a single A185 instrument for its operation. These activities should be mostly funded by the national contributions to the programme.
- A series of calls for Joint Research Projects in priority areas, and for fundamental science, similar to those held under EMRP and EMPIR. These activities should be mostly funded by the EU contributions to the programme. These Calls may decline in value over the life of the programme to encourage the networks to seek other sources of funding for their priorities. The funding in these calls to industrial and academic partners should increase to an average of 40 % of the available budget (from 20 % in EMRP and 30 % in EMPIR).
- A supporting programme of capacity building activities, similar to those in EMPIR, funded from the national contributions. In addition, new mechanisms for implementing capacity building should be developed.

3.1.1 The European Metrology Networks

Euramet has already started to develop a concept for European Metrology Networks which will have a long term perspective and become less dependent on targeted EU funding.

European Metrology Networks will:

- cover an area of major strategic importance, with a European dimension
- consist of a core network of NMIs/DIs with a clear commitment to contribute to the network
- establish close links to a wider stakeholder community
- strive for scientific excellence
- plan the activities based on a strategic agenda
- establish a knowledge, technology transfer and promotion plan
- plan for sustainable structures
- develop and coordinate common infrastructure if needed.

Metrology, particularly related to establishing the SI and providing traceability, is global by nature. To improve coherence among member states, to support fundamental European interest as explicitly expressed in EU regulation and to take the lead on international level, a coordinated European approach in the establishment of the metrology infrastructure is needed. To cope with the related scientific and technological challenges, a collaborative metrology research effort on the European level is essential to maintain and develop an internationally competitive edge. The EMNs will provide this coordination.

The EMNs will have close links with the relevant European level stakeholders and provide a key consultation route to develop their strategic agendas, both feed into the overall Euramet strategy and national strategies, and thereby influence the strategic agenda of the Partnership and the subsequent work plans.

The EMNs provide an additional route to impact from the Joint Research Projects. Traditional research projects only exist for three years. The consortium comes together to propose the project and deliver it. Once the contract ends the consortium disbands. The exploitation of the results is left to the individual members. There may be a series of research projects (e.g. the programmes have supported a significant number related to Smart Electricity Grids) but no follow-on project inherits the obligation to curate and promote the results of previous projects. EMNs will provide a central contact point for stakeholders where the results of past projects are brought together, presented as a whole and can be joined together to provide coherent solutions to specific stakeholder needs.

The EMNs will coordinate the research work in their area that members agree to do together with their national funding. By discussing national priorities and developing proposals for joint projects to a range of funding sources they will capture new funding sources and develop a way of working that builds metrology infrastructure at the European level. Overall, they will seek to ensure effective and efficient use of resources, doing research jointly in a way that develops a coherent and consistent approach across Europe while ensuring that services to customers can be delivered locally and following national priorities.

Euramet has established EMNs in the following areas:

- Climate and Ocean Observation¹³
- Energy Gases¹⁴
- Smart Electricity Grids¹⁵
- Laboratory Medicine¹⁶
- Quantum Technologies¹⁷
- Mathematics and Statistics¹⁸
- Smart Specialisation in Northern Europe¹⁹

And is considering developing further EMNs in

- Clean Energy
- Positioning, Navigation, Timing, and Geodesy
- Pollution Monitoring
- Advanced Manufacturing
- Medical Use of Ionising Radiation
- Radiation Protection Regulation
- Medical Device Regulation
- Food Safety
- Coordination and smart specialisation (e.g. metrology services) among further groups of neighbouring countries

The European Metrology Networks will include non-research actions such as the establishment of metrological services in addition to the research addressing the development of metrological capabilities. A strong leveraging effect is expected, such as

¹³ <https://www.euramet.org/climate-ocean>

¹⁴ <https://www.euramet.org/energy-gases>

¹⁵ <https://www.euramet.org/smart-grids>

¹⁶ <https://www.euramet.org/laboratory-medicine>

¹⁷ <https://www.euramet.org/quantum-technologies>

¹⁸ <https://www.euramet.org/mathmet>

¹⁹ <https://www.euramet.org/northern-specialisation>

through thematically related R&D actions funded by member states and capital investments by member states in service capabilities.

In summary, the EMNs develop joint capabilities that:

- underpin genuine EU interests, such as expressed in EU regulation and standardisation, and contribute to coherence among member states in research and infrastructural capabilities
- make JRP results sustainable
- are the starting point for an exit strategy as requested by the EU
- ensure capital investments by the member states – if possible supplemented by structural funds – are coordinated, initiated and leveraged by the programme.

EMNs are established by a subset of EURAMET members which share a common strategic agenda for the field addressed by the network and commit themselves to contribute to the network within a given framework. The strategic plans of different EMNs are not independent – NMIs/DIs may decide to reduce or stop activities in one field to free resources for the establishment of advanced capabilities in another field.

The most important element in the establishment of an EMN is the strategic agenda. It describes:

- The area to be addressed by the network and the collaborative R&D proposed
- The key challenges
- How the EMN will be sustained
- The metrology needs and the current capabilities
- The main stakeholders
- The possible investment / equipment needed and / or to be shared
- Further specific strategic objectives of the network.

Based on the strategic agenda, an implementation plan is established which contains the following elements:

- Research needs; plan for involvement of external partners and identification of appropriate research programmes;
- Human resources involved, critical mass;
- Structural measures;
- Governance (internal, external – with stakeholders);
- Plan for shared facilities and development of common infrastructure;
- Stakeholder involvement;
- Plan for knowledge and technology transfer;
- Communication measures;
- Organisation of the work: commitments of individual partners, responsibilities, workplan;
- Coordinated service delivery (capabilities and/or tools).

3.1.2 Joint Research Projects

While the national contributions to the Partnership drive the EMNs, the EU contributions will drive a series of calls for Joint Research Projects (JRPs) similar to standard Horizon Europe calls. They will address the specific contribution that the metrology community can make to the priorities identified for Horizon Europe.

Euramet proposes three strands to the calls. The first should cover fundamental metrology research, the second applied research, and the third research related to standardisation and regulation. Separation of the calls into these three strands helps to ensure an appropriate competitive project selection process and an appropriate allocation of the funding available to the different types of expected outcomes.

The call implementation will be similar to the one used under EMRP and EMPIR, which was very successful. A two-stage annual process will include a call for Potential Research Topics (PRTs) at stage 1, a sifting process by the EMPIR committee and writing of the specification documents – the Selected Research Topics (SRTs), before the Joint Research Proposals are developed by consortia against those SRT at stage 2. The proposals will be defended in person at a review conference, with the subsequent marking of the proposals against standard Horizon Europe criteria by independent experts generating a ranked list, and the final selection of where to draw the funding line in those ranked lists by the EMPIR committee.

Before the annual call starts there will be wide stakeholder consultation to inform the development of the scope for the calls. The stakeholder groups developed in the EMNs will constitute a key target for the consultation. Euramet will propose a work plan to the Commission which will undergo interservice consultation to further refine the scopes. Euramet will review the published work programmes for Horizon Europe, the plans of the missions and the intentions of other partnerships when developing the work plan. Euramet expects the interservice consultation to identify further possible synergies that may not be obvious from the publicly available information.

Further details of the consultation and call processes are given in the Annex at Section 4.

Euramet expects the funded Joint Research Projects to be mostly aligned with Pillar 2 of Horizon Europe – “Global challenges and European Industrial Competitiveness”, which is divided in six clusters:

1. Health
2. Culture, Creativity and Inclusive Society
3. Civil Security for Society
4. Digital, Industry and Space
5. Climate, Energy and Mobility
6. Food, Bioeconomy, Natural Resources, Agriculture and Environment

The scopes for Health calls would align with Cluster 1. Accurate measurement enables the effective use of data in health systems, provides public confidence in professional decisions and enables researchers to learn from each other. As technologies develop measurement capacity must keep ahead of routine implementation, giving health professionals the framework for their decisions and an infrastructure allowing best practice to be easily adopted.

Clusters 2 and 3 would benefit from the increased support for regulators planned in the Partnership. Accurate measurement enables the effective application of regulation and provides public confidence in justice systems. As technologies develop, measurement must keep ahead of routine implementation, giving regulators the framework for their decisions and an infrastructure allowing enforcement. Close cooperation with the European Standardisation Organisations has been a feature of EMPIR and will be extended in the Partnership. Providing appropriate metrology solutions into standards enables society to

support ethical and cultural values such as “fairness” and respect for diversity with objective criteria.

Cluster 4 is the traditional home of metrology. Enabling traceable measurement to support production and trade was the reason for establishing national measurement systems millennia ago and the first NMIs over a century ago. Advancing measurement technology to enable international trade and regulation and cost-effective and efficient exploitation of products and services by end-users has always been a key driver.

Cluster 5 has been a key driver of the calls under EMRP and EMPIR, extending traditional metrology research from its focus on specific measurement units to work in a cross disciplinary mode to address the Grand Challenges. This will continue in the Partnership – it has already been the focus for half of the established EMNs.

Work in previous programmes has supported the environment and bioeconomy parts of Cluster 6. The partnership will explore how metrology can support further parts such as food and agriculture through the consultation processes used for developing the work plans.

While the Joint Research Projects selected by the Partnership have the metrology infrastructure development as their focus, they will involve non-metrology-based partners as well. Academia joins bringing new basic research to be exploited in a metrology context. Industry and other end-users join to be the early adopters of the metrology being developed and guide that development to ensure it can be quickly applied to commercial benefit.

Meanwhile the EMNs will be seeking suitable opportunities to contribute small metrology focussed activities into other funding streams such as the standard Horizon Europe calls. They are unlikely to have a large part of any individual project as the prime focus will be on a specific application, but they will contribute key enabling technologies to the outputs of those projects. Currently the metrology community wins about 12 % of the funding it receives from EMPIR from standard H2020 project engagement. The EMNs have a long-term plan to grow this through their improved stakeholder engagement.

3.1.3 Capacity building

The capabilities of National Metrology Institutes in Euramet member states vary from country to country. Many European NMIs represent the cutting edge of global measurement expertise, actively participating in the development of new measurement technologies and new realisations of SI units. These institutes have a leading role in supporting the global competitiveness of the European economy as well as the development of measurement technologies required by a modern society. Other NMIs are in the early development stages, are less research- and more service-oriented, or are small with very limited resources but have to keep-up with their stakeholders' needs. The Partnership will include activities designed to help bridge the gap between emerging and well-developed members, thus developing a balanced and integrated metrology system. These activities in current programmes have included Joint Research Projects in the “Research Potential” topic, Researcher Mobility Grants and a significant programme of Human and Institutional Capacity Building training activities.

In the Euramet Board of Directors there is a Working Group on Capacity Building which considers the needs of all members (whether participating in the programmes or not) and a Capacity Building sub-committee of the EMPIR Committee which prepares its decisions related to relevant calls.

Previous programmes

Capacity Building has been a strong focus of the previous programmes, something that has resulted in a large number of Member States and Associated Countries making a commitment to them.

In both EMRP and EMPIR there was a commitment from a new state during the life of the programme, following their involvement in these activities and similar moves are expected during the Partnership.

In addition, the Capacity Building activities have never been limited to those states that make a commitment, participation in Joint Research Projects as external partners has been possible for all Euramet members as has the eligibility for the support measures such as Mobility Grants and training activities.

These activities in current programmes have included

Joint Research Projects in the “Research Potential” topic

In EMPIR the main Capacity Building contribution from the EU funds has been the “Research Potential” stream of JRPs. These have been successful in growing the engagement of those states that joined EMPIR since the EMRP. Several members developed the skills to act as project coordinators through these projects and that would not have happened without this stream. Many capabilities were developed by these projects that were relevant to these states that would not have happened without these specific calls.

Researcher Mobility Grants

Researcher Mobility Grants (RMGs) were jointly funded from the EU contribution and the National Contribution in the EMRP. In EMPIR the EU Contribution ceased and Euramet has continued to fund them from the National cash contribution alone. This will continue in the Partnership.

Human and Institutional Capacity Building training activities

The support actions in EMPIR related to “Human and Institutional Capacity Building” include funding a member of staff in the Euramet secretariat to coordinate these actions. That person organises a series of training events including specific technical skills, general metrology topics such as the Mutual Recognition Arrangement and uncertainty calculations, and some courses on general management and communication skills. They also provide a partner matching service for JRP proposals and Mobility Grant proposals. These services will continue and be developed further.

In 2020 the EMPIR programme will pilot two new schemes funded from the National cash contribution that, if successful, will be implemented in the Partnership:

A mentoring scheme

Following a successful proposal to the BoD Working Group on Capacity Building, the secretariat will fund the direct additional costs of a mentoring arrangement where training and personal development in a specific area is provided from a named staff member of an NMI/DI to a named staff member of another NMI/DI. The funding will not include staff costs. The scheme is considered as supplementing the current mobility scheme.

Small collaborative projects

These will be based on Coordination and Support Action principles and be funded from the National cash contribution. The projects will be sharply targeted, ideally with one specific objective (e.g. an activity aimed at smart-specialisation by developing a mechanism to support the coordination and sharing of resources and services across national borders), with a clear work and budget plan to achieve it and well-defined, objective-oriented deliverables. The proposals will be evaluated by the Sub-Committee for Capacity Building of the EMPIR Committee and formally approved by the full EMPIR Committee. The evaluation criteria will be those used for the Support for Impact projects (which follow Horizon 2020 CSA rules). Funding will be on the same basis as Internal Funded Partners in EMPIR projects, including staff costs.

The Partnership

Euramet considers that a necessary part of the Partnership is a supporting programme of capacity building activities, similar to those in EMPIR, funded from the national contributions. In addition, new mechanisms for implementing capacity building should be developed.

Capacity Building will continue in the Partnership. The Partnership will include activities designed to help bridge the gap between emerging and well-developed members, thus developing a balanced and integrated metrology system.

This also reflects one of the conclusions of the mid-term evaluation of the EMPIR, indicating that the gap has not yet been bridged.

The activities in current programmes will continue in the Partnership, i.e.

- Joint Research Projects, separate calls similar to the “Research Potential” calls of EMPIR focussed on building research capabilities in emerging NMIs (especially for those that join the Partnership that were not participating in EMPIR), but with topics linked to the main calls of the year and informed by those stakeholder consultations (including inputs from emerging NMIs’ countries). The aim is to ensure closer alignment between the capacity building activities funded by the EU with the strategic agenda of the programme, and the synergy between the projects would be more effective at “closing the gap” between the more research intensive NMIs and the emerging NMIs. These calls will be under Research and Innovation Action rules.
- Researcher Mobility Grants,
- Human and Institutional Capacity Building training activities. Including the funding of a member of staff in the Euramet secretariat to coordinate these actions.

If successful in 2020, the following activities will also be implemented in the Partnership:

- the mentoring scheme, and
- Small collaborative projects, based on Coordination and Support Action principles. The projects will be sharply targeted, ideally with one specific objective (e.g. an activity aimed at smart-specialisation by developing a mechanism to support the coordination and sharing of resources and services across national borders).

3.1.4 Funding structure

The proposed funding structure for the Partnership reflects both the Specific Objectives and the key contributions brought by the partners.

The national contributions build the long-term infrastructure foreseen in the first objective. The Member States own the assets that will be shared in the infrastructures. They employ and develop the staff that will contribute to the networking activities. They benefit from the efficiencies resulting from the collaboration. At the end of the Partnership they will continue to develop the European metrology system in its new way of working – building a common resource that delivers services to traders, innovators and regulators from a Europe wide infrastructure and knowledge base at a local level – access points that understand local requirements and deliver at the point of need.

The Union contribution brings additional funding and additional purpose to the activities. By aligning the decisions on what to fund with the Horizon Europe priorities it provides a steer to where cross boarder co-operation will have greatest impact. The top-level priorities have been agreed at a political level. Identifying how metrology can support those priorities is still challenging but at least starts from the position that there is a European consensus that those outcomes are desired. Aligning processes with the Horizon Europe Rules for Participation also brings benefits – objective processes for making the funding decisions which are accepted as “fair” by all.

The proposed funding structure can be summarised by Figure 5. The Union contribution that will be allocated to the European Partnership on Metrology will only be defined by the co-legislators at a later stage, and will depend on the outcome of the negotiations on the Multi Annual Financial Framework 2021-27.

National Contribution (350 M€)	Union Contribution (350 M€)
90 % as in-kind contributions, demonstrated by Horizon Europe style finance statements, covering activities that:	20 % as funding to Joint Research Project calls in fundamental scientific metrology. Developing new capacity in measurement that drives innovation. About 45 % of this funding would be aimed at external partners so the best academic research can be brought in and applied to metrology.
<ul style="list-style-type: none"> • Develop and support the networks • Contribute research outputs aligned with the Strategic Agenda’s of the European Metrology Networks and Euramet’s Technical Committees • Maintain confidence in the services offered by the European Metrology System • Build capacity in the distributed system and train metrologists to ensure they can deliver at the local level. 	70 % as funding to Joint Research Project calls in applied metrology. Developing new capacity in measurement responding to the priorities of Horizon Europe. About 40 % of this funding would be aimed at external partners so the early adopters in industry and public services can participate and shape the outputs to meet their needs.
10 % as cash contributions. 8 % for the administration of the partnership and 2 % for supplementary activities such as Mobility Grants	10 % as funding to Joint Research Project calls in to support Standardisation and Regulation. Developing new capacity in measurement following identified needs from Standardisation Bodies and Regulators.

Figure 5: Funding structure of the Partnership

3.2 Resources

Euramet proposes that the Partnership should have total resources of 700 M€. 350 M€ of EU funding into the Joint Research Projects and 350 M€ of Member State funding into the Institutional activities including the administration of the Partnership, support actions and in-kind funding to research activities aligned with the Partnership strategic agenda.

Of the 350 M€ National funding, 10 % would be a financial contribution paid by the Member States to Euramet. This would pay for the implementation of the partnership, the staff and additional costs of running the call process, administering the running projects, the consultations to define call scopes and promotion activities to communicate and demonstrate the impact of the Partnership. This would also pay for a range of support actions such as the Researcher Mobility Grants funded under EMPIR. 90 % of the national funding would be in-kind. This would be demonstrated by financial statements, giving the costs of national work in the NMIs and DIs aligned with the Partnership strategic agenda calculated according to Horizon Europe rules.

National ministries would make a commitment before the Partnership started, indicating their share of the 350 M€ national contribution. This commitment would be firm and binding for the life of the Partnership. Current indications of the commitment to be made by each of the Euramet members is shown in Figure 6. Some countries are still discussing the size of their commitment with their ministries, but no current participant in EMPIR has indicated that it will not participate in the Partnership. Some additional countries are also considering a commitment but are waiting for further details on the funding arrangements before providing a number.

Figure 6 demonstrates that there is sufficient national commitment offered to meet the proposed financial size of the Partnership even if the UK and Switzerland are not associated to Horizon Europe (a current possibility). The share by country assuming that the UK and Switzerland are associated is shown in Figure 7, if the 350 M€ is shared between only the EU and EEA states then the share would be as shown in Figure 8. The total commitment from just the EU and EEA states is 358 M€.

If the UK and Switzerland are associated to Horizon Europe, then there would be a greater than 40 % over subscription to the Partnership. Euramet asks the Commission to consider how more EU resources could be made available in this case to match the stronger interest expressed by the Member States.

Country	Member	Commitment to EMPIR k€	Commitment to the Partnership k€
Albania	DPM		
Austria	BEV	840	1 050
Belgium	SMD	1 200	2 000
Bosnia-Herzeg.	IMBiH	920	2 700
Bulgaria	BIM	840	1 168
Croatia	DZM	700	1 050
Cyprus	MCIT		
Czech Republic	CMI	8 600	23 900
Denmark	DFM	4 750	14 000
Estonia	Metrosert	910	1 750
Finland	MIKES	16 200	26 000
France	LNE	27 000	58 000
Germany	PTB	88 000	90 000
Greece	EIM	150	150
Hungary	BFKH	1 050	1 500
Iceland	NEST		
Ireland	NSAI-NML	600	1 250
Italy	INRIM	24 000	48 000
Latvia	LATMB		
Lithuania	FTMC		
Luxembourg	ILNAS		
Malta	MCCAA-SMI		
Moldova	INM-Md		
Montenegro	MBM		
Netherlands	VSL	16 500	35 000
North Macedonia	BoM		
Norway	JV	3 750	10 000
Poland	GUM	2 500	5 250
Portugal	IPQ	840	7 000
Romania	INM	2 000	2 800
Serbia	DMDM	700	
Slovakia	SMU	200	2 000
Slovenia	MIRS	2 249	13 783
Spain	CEM	6 000	12 000
Sweden	RISE	5 131	10 000
Switzerland	METAS	6 593	24 000
Turkey	UME	12 000	18 500
United Kingdom	NPL	83 000	80 000
		317 223	492 851

Figure 6: Expected National Commitments to the Partnership

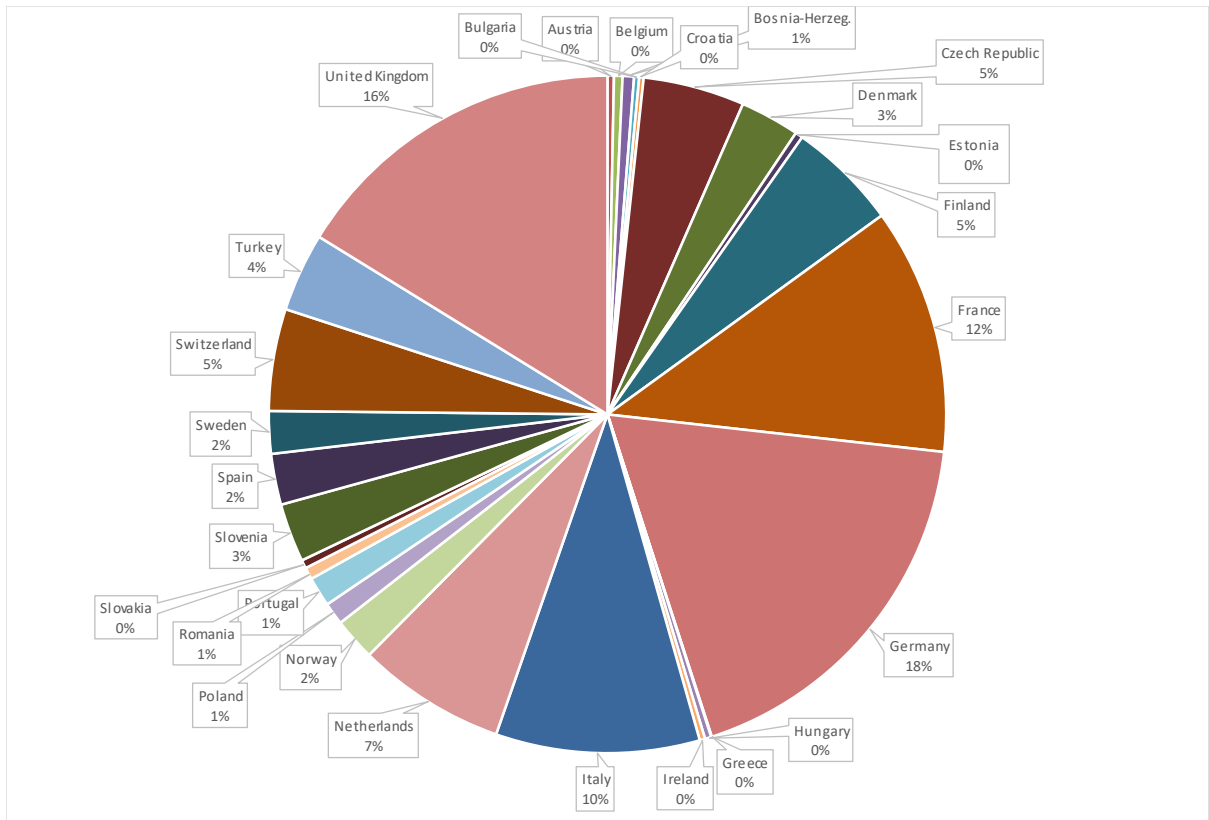


Figure 7: Share of National Commitment if the UK and Switzerland are associated

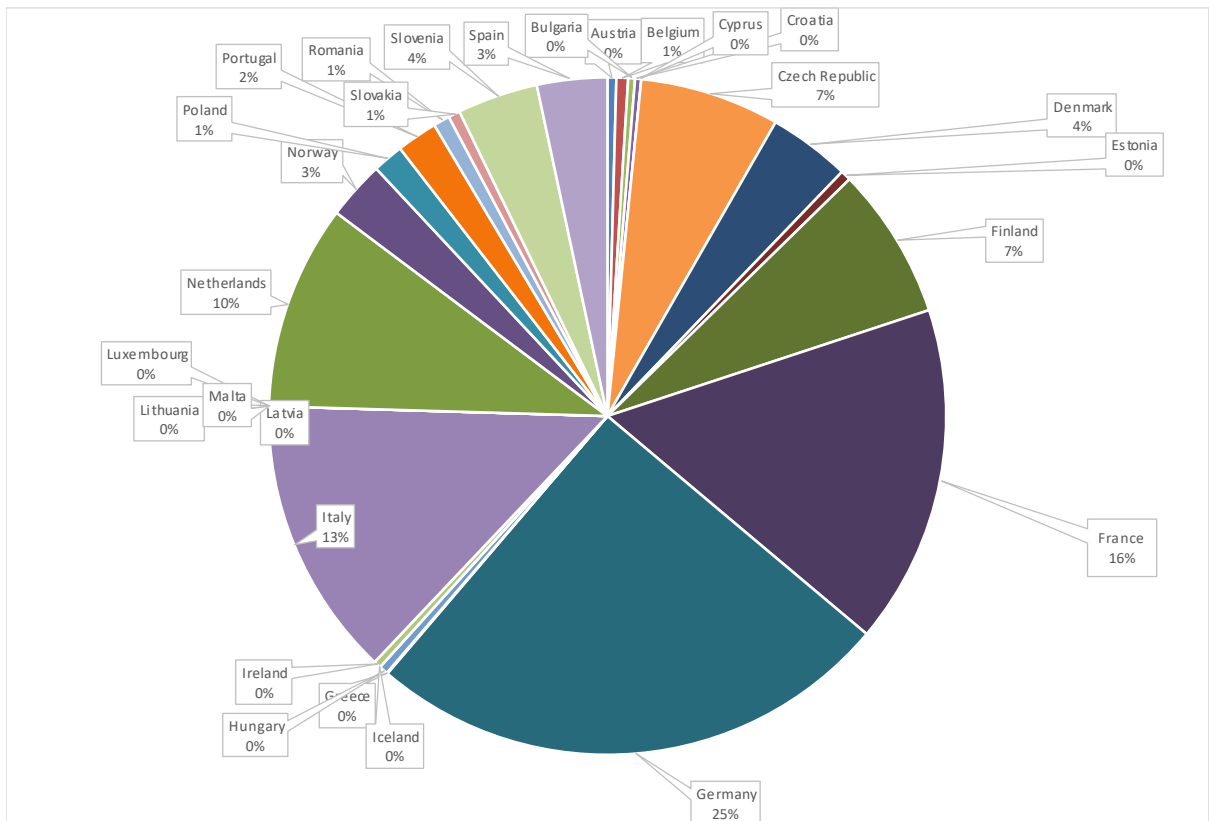


Figure 8: Share of National Commitment amongst the EU and EEA states

The 350 M€ EU contribution should fund Joint Research Projects according to standard Horizon Europe finance rules. 210 M€ of the EU funds would be intended for the NMI and DI participants in the projects, while 140 M€ would be intended for the non-NMI/DI participants. (The equivalent figures in EMPIR are 210 M€ and 90 M€).

As the Partnership is intended to be the last A185 for metrology the call budgets should decrease towards the end to encourage the participants to identify alternative sources of research funds over the Partnership lifetime. The first call should also be smaller than all the others as the call process will be done ahead of contract, at Euramet’s risk, and with the overhead of adapting the existing call processes to the new requirements. The proposed profile is shown in Figure 9.

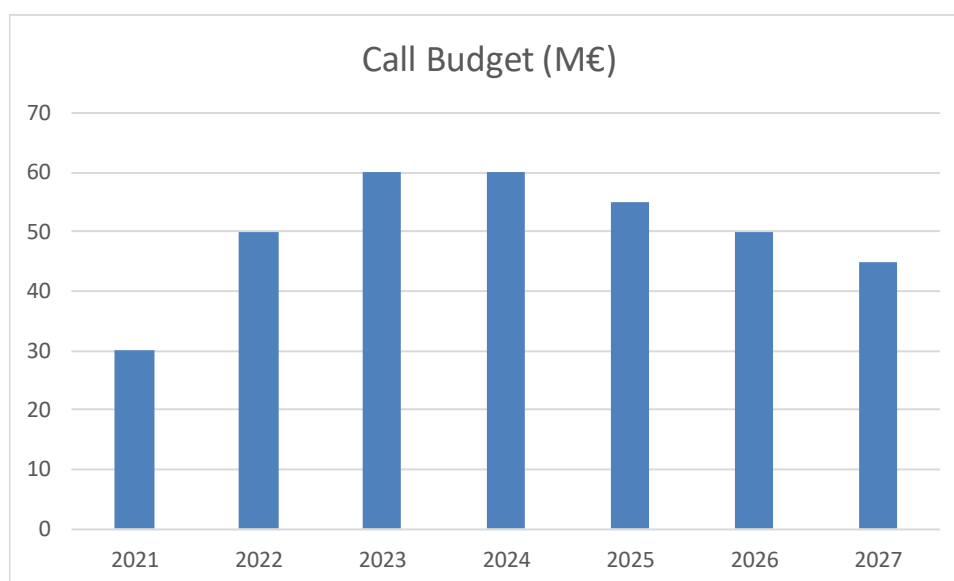


Figure 9: Proposed call budget profile over the life of the Partnership

3.3 Governance

3.3.1 EURAMET e.V.

The dedicated implementation structure for the Partnership shall be Euramet e.V., a non-profit association according to German civil law (eingetragener Verein, e.V. §§ 21 – 79 German Civil Code (BGB)). This legal entity has a scope beyond the implementation of a joint research programme; it encompasses tasks and obligations related to the wider European and global harmonisation of metrology. Consequently, membership of Euramet e.V. is open to all European countries through their National Metrology Institutes (NMI), independent of the existence of national metrology research programmes. Membership of Euramet e.V. is - besides the NMIs - also open to so-called Designated Institutes (DI) as Associate Members (Associates), from Member States of the European Union and of the European Free Trade Association, and from other European States. The European Commission’s Joint Research Centre Institute for Reference Materials and Measurements of the European Commission is also an Associate. Currently, Euramet has 116 Members and Associates from thirty-eight countries. (See Figure 10).

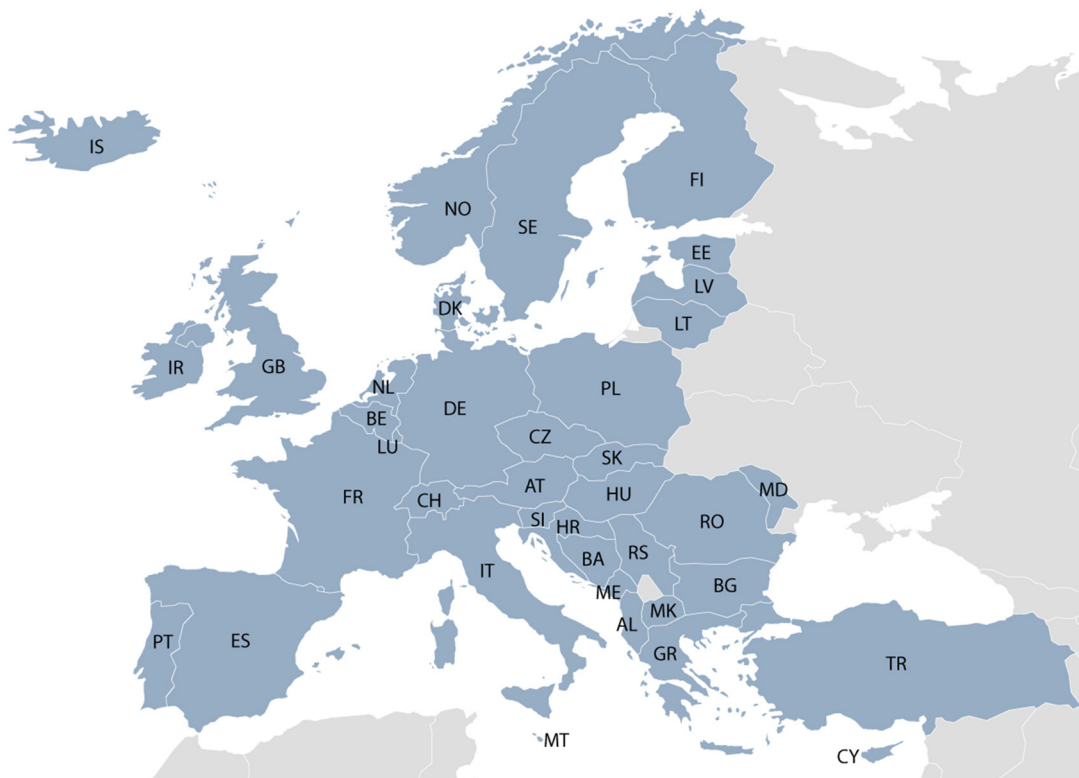


Figure 10: Euramet member countries

Euramet will responsively implement all activities of the Partnership. Tasks include the full call cycle management including the organisation of calls for proposals and the evaluation and ranking of proposals, as well as the contract and budget management.

The EMPIR committee will be the Partnership's decision making body within Euramet. All participating countries send one delegate per country into this committee. The voting weight of the delegates is calculated from the national commitments according to a square root law. The single committee is responsible for all A185s implemented by Euramet, but the voting weight varies according to the programme.

Participation at programme level will be open throughout the programme duration to all Euramet Members and Associates who declare their commitment; at this moment, twenty-seven of the thirty-eight Euramet member countries have done so. The Partnership foresees support measures for those Euramet members with limited capabilities or with formal barriers to encourage their participation at programme level.

Participation in projects is also open to external, European and international partners who meet the eligibility criteria of participation in Horizon Europe.

Liability for EC funding is carried jointly and severally by the project participants primarily and by the participating members of Euramet subsidiary, in accordance with an agreed protocol. During the overlap period between EMPIR and the Partnership, existing liabilities related to EMPIR will continue in parallel.

The organisational structure

The following Euramet bodies and internal structures are relevant for the implementation:

1. The General Assembly is composed of the delegates of each Euramet Member (i.e. NMIs) and is the highest authority within the association. It decides on all matters

of the wider Euramet. On issues related to the execution of the Partnership, however, the General Assembly will act on the binding recommendation of the EMPIR Committee.

2. The Euramet Chairperson is elected by the General Assembly and legally represents Euramet in all matters. He/she has overall authority and supervises all of the activities of the association, consulting the EMPIR Committee on Partnership issues.
3. The Board of Directors as the governance body of Euramet is responsible for ensuring the implementation of the decisions of the General Assembly and determines the measures necessary to fulfil Euramet aims. The Board of Directors, consisting of the Euramet chairpersons and six members elected by the General Assembly, has overall responsibility for the proper operation of the Secretariat, staff matters and the Euramet Quality Management System.
4. The EMPIR Committee is the decision-making body for the Partnership. It is responsible for decisions on the strategic science agenda, the planning of calls for proposals, budgetary provisions, the proposal review process, the approval of the ranking lists of projects to be funded, and the monitoring of progress of the funded projects.

The EMPIR Committee is composed of representatives of Euramet Members participating in EMPIR and the Partnership.

The EMPIR Committee may establish subcommittees for a fast and efficient preparation of decisions to be taken by the EMPIR committee.

5. The EMPIR Chair and their deputy are elected by the EMPIR Committee. The EMPIR Chair is automatically one of the two Vice-Chairpersons of Euramet e.V. They legally represent Euramet e.V. in EMPIR and Partnership matters.
6. The Research Council is composed of high-level experts from industry, research and academia and from international stakeholder organisations, such as the BIPM, the European Commission, the European Research Council, the European Parliament, EUROLAB, CEN, and WELMEC. It provides independent strategic advice on calls for proposals.
7. The Secretariat is composed of personnel employed by or seconded to Euramet. Its structure and tasks are governed by the rules of procedure of Euramet. It is located in Braunschweig, Germany. It is managed by a Management Board consisting of the General Secretary, the Member Services Manager and the Programme Manager. Related to EMPIR, the central Secretariat has the following responsibilities:
 - keeping of the bank accounts and financial management
 - legal advice in all matters of the association
 - administrative support in various matters.
8. A Management Support Unit (MSU) is a unit of the Secretariat responsible for the implementation and day to day management of a programme. It is responsible for:
 - implementation and monitoring of calls and associated research projects
 - provision of contracts for projects

- financial control of projects, calculation of payments
- administration of independent proposal evaluators
- ensuring compliance with the contractual obligations of the EC.

Euramet may establish separate Management Support Units for separate initiatives. Some staff of an MSU may be located at the premises of a member NMI, but they operate as an integral part of the secretariat under the direct control of the Programme Manager. There is no delegation of responsibility or subcontracting of tasks from Euramet to any organisation hosting the staff of an MSU.

9. The Programme Manager is a senior manager nominated by the EMPIR Committee and employed by Euramet. The Programme Manager acts solely under the direct authority of Euramet on any matters concerning the programmes and reports to the EMPIR Chair. The Programme Manager issues instructions to the staff of an MSU on behalf of Euramet and supports the EMPIR Chair in external representation and communication of the programmes.
10. Euramet's Technical Committees support the execution of the partnership with their scientific competence in 12 core metrology areas. A Working Group of the BoD supports capacity building for Euramet Members and Associates.
11. Euramet's European Metrology Networks are established to create an efficiently coordinated and shared metrology infrastructure which goes beyond research activities. They are established by a subset of EURAMET members agreeing a Memorandum of Understanding defining the scope and operation of the EMN. The establishment of an EMN must be approved by the General Assembly.

Beyond the formal governance of Euramet described above, further bodies have a role in setting priorities for the Partnership:

3.3.2 STAIR-EMPIR

CEN and CENELEC have taken into account the numerous EU policy initiatives calling for more links between research and standardisation. To address this challenge, the CEN and CENELEC Technical Boards agreed in October 2008 to create a joint strategic Working Group to address STandardisation, Innovation and Research, in short: STAIR. The STAIR Group provides strategic advice to the two Technical Boards in order to reach an integrated approach between research, innovation and standardisation.

Within the context of metrology research, CEN and CENELEC co-operate with EURAMET by identifying metrology research needs identified during standardisation. Through the cooperation agreement between CEN-CENELEC and EURAMET, CEN and CENELEC are invited to submit metrology research needs in support of their standardisation activities to EURAMET. This practice was piloted in the context of the EMRP programme but is now intensified and formalised in the context of EMPIR.

A structure, reporting to the joint CEN-CENELEC Working Group STAIR and called STAIR-EMPIR (Chairperson Ms Maguelonne Chambon of LNE, Secretary Mr Ortwin Costenoble of NEN) was created to manage the orderly submission of relevant research needs resulting from standardisation into the EMPIR process.

3.3.3 Euramet's Liaison Organisations

Euramet has liaison arrangements with many organisations which have overlapping aims and purposes with the metrology community. These include

- The International Bureau of Weights and Measures (BIPM)
- The International Organisation of Legal Metrology (OIML)
- The European Cooperation in Legal Metrology (WELMEC)
- European Accreditation (EA)
- The European Federation of National Associations of Measurement, Testing and Analytical Laboratories (EUROLAB)
- The International Atomic Energy Agency (IAEA)
- The World Meteorological Organisation (WMO)
- The Quantum Flagship (QFLAG)
- The European Space Agency (ESA)
- The International Organisation for Standardisation (ISO)
- The International Commission on Illumination (CIE)

All these organisations have a formal route for engaging with Euramet's strategy development and will be early contributors to the stakeholder consultation processes described in Section 4.

3.3.4 The European Commission

Our expectations are that the EMNs will be the vehicles for cooperation between us and other partnerships at a technical level while secretariats cooperate at a process level. The best example of this we have at present is our relationship with the Quantum Flagship. There is a close relationship between the Quantum EMN and the Flagship on developing roadmaps and making proposals into each other's calls. While at Secretariat level we have established points of contact between the two organisations on specific topics and promote each other's activities.

Text from EC required here on their plans for their interaction with the Partnership and how they coordinate communications between the Partnerships. The text should be consistent between all partnerships.

3.4 Openness and transparency

The proposed Partnership for metrology is planned to be established between the EU and members of Euramet, which are EU member states, EFTA member states and other European states. For the states outside of the EU, the participation will depend on suitable association agreements with the said countries. All Euramet members have their national metrology systems, but with large differences in scope, size and using different organisational structure. Almost all countries have a national metrology institute (NMI) supported by one or more designated institutes (DI) for specific technical areas. In total there are 38 NMIs and 78 DIs in Euramet. In the present programme (EMPIR), the participation is already very broad, with 28 Euramet member countries participating. Now Euramet is encouraging all its members to join the proposed Partnership, to increase the number of participating countries. The Partnership will have specific activities to develop the metrology capacity in the emerging metrology institutes, to reduce the R&I divide in Europe.

The countries will be joining the Partnership through the ministries owning the national metrology programmes, and to a level related to the size of the programmes. Therefore, the NMIs and DIs will constitute the internal partners of the programme, much as in the predecessors EMRP and EMPIR. However, in order to increase the impact of the programme and to strengthen links with industry, academia and non-NMI/non-DI research institutes, the Partnership aims at providing a larger share of the EU funding for those external entities compared to EMPIR.

Metrology is a truly cross-sectorial activity, this is reflected in the proposed objectives [see section 2.2]. The Partnership will deliver metrology solutions for industry, innovation, trade, societal challenges (i.e. a selection of the UN SDGs), and will support development of regulations and written standards.

Participation in the Joint Research Projects will be fully open to all legal entities on the same terms as participation in Horizon Europe open calls. However, even though we expect the Partnership to benefit from the Participant Guarantee Fund, Euramet members will have a significant financial liability for the EU funds that Euramet handles. To mitigate against this liability, coordination of the Joint Research Projects will be restricted to the Euramet NMIs and DIs.

In the previous and ongoing partnerships, we have sought involvement of partners outside of Europe, and institutes from around the world are participating in the research projects. Metrology is global, and cooperation across the regions of the world is one of the core activities of the metrology institutes. This cooperation brings world-wide mutual trust in measurements. Including world class metrology institutes from other parts of the world enhances the scientific quality, adds to the R&I investments and increases the impact of the research projects. The proposed Partnership will be open to such participation. [Re Article 12 on third countries.] Under EMPIR 22 partners from 16 countries outside Europe have participated in 41 projects so far, most of them as unfunded partners bringing their own resources.

Euramet will continue and develop its portal to be used for information sharing and cooperation, including on surveys and planning, calls, dissemination of results and reports from the activities of the Partnership. In addition, the portal provides support for preparations, consortia building and proposals for projects. As an example, open access publishing is secured through requirements in the grant agreements and consortia agreements of the projects. The underlying research data shall also be open access, to the extent possible.

In addition to the platform, Euramet develops its cooperation with other entities and stakeholders for strategic planning, feedback and for calls. This takes place through its formal structures, meetings, ad-hoc initiatives and events. This outreach covers a broad range of interested parties: Stakeholder groups, the Horizon Europe Clusters, other partnerships, DGs of the European Commission, regulators and standardisation organisations, international organisations.

Dissemination of results comprises not only open access publication. Euramet seeks to diffuse new knowledge and stimulate innovation in products and services based on the research results. In addition, metrology solutions and competence will provide solid foundations for policy advice and decision makers, for developing regulations and written standards.

The Partnership will be open to further countries entering through its lifetime. Based on the experience of the previous and the ongoing programme such a dynamic is expected. It can

relate to the fact that association of third countries may be in place only after the start of the partnership, or that Euramet member countries previously not engaged in the partnership decides to join at a later stage. Such situations have been successfully handled previously, and Euramet is genuinely positive to include new members to the partnership. During such an extension of the membership constituency formal requirements for the said country must be laid down in accordance with Art 12 of the Regulation. Likewise, the commitment in cash and in-kind must be agreed with the country and the EMPIR Committee.

The annual work programmes, laying out call topics, call budgets etc. are developed by the EMPIR Committee, the Euramet body charged with executing its R&I programmes, for approval by the Commission. The basic structure of the call processes of the ongoing partnership will be continued. The calls are well run, but we envisage a further strengthening of the stakeholder input and external participation. In the EMPIR programme Euramet has run 3 task groups to provide links to stakeholders in health, environment and energy, and to convey input from those stakeholders into the call texts, these will be replaced by new processes in the Partnership (see section 4).

Developments will be implemented in the proposed partnership in order to strengthen links to stakeholders:

- To consult the stakeholder groups of the European Metrology Networks as sources of input to strategies and the calls
- To consult closely the clusters of Horizon Europe (and the associated DGs), in particular Digital, Industry and Space; but also Health; Climate, Energy and Mobility; Food, Bioeconomy, Natural Resources, Agriculture and Environment.
- To consult the Euramet WG on capacity building for input specifically to reduce the metrology R&I divide
- To consult other partnerships to ensure that Calls support each other where relevant and do not duplicate. (Such agreements have already been made with the Quantum Flagship to ensure a clean distinction between their calls and an EMPIR Fundamental call).
- To stimulate further the stakeholders themselves to prepare proposed research topics
- To continue the STAIR-EMPIR arrangement to stimulate input from the standardisation organisations
- To consult the Euramet Research Council
- To consult international metrology organisations

Consultations listed above are active outreach initiatives from Euramet bodies and members, continuing through the lifetime of the partnership. They come in addition to an easy access information portal.

4 Annex - SRIA

An overview of the activities planned for the Partnership has been given in Section 3.1 above. It does not refer to any specific technologies or application fields. Metrology is a generic infrastructure required by all societies for a variety of purposes. The Partnership will make small but key contributions to a wide range of scientific research and social policies. This annex describes the process by which grand themes and detailed projects will be identified and defined in the Partnership. It describes how priorities will be identified; at this stage it makes no pre-judgement on what those priorities will be. This annex is an initial plan for a strong and broad stakeholder involvement in that process, ensuring that the right connections are made to ongoing policy and strategy debates at political and implementation levels.

4.1 Preparation for the annual call

The process for defining the individual areas to be opened in a call year is shown in Figure 11. The EMPIR committee defines the call sequence such that the Programme objective are met. An annual call starts with the appointment of one or more “Guardians” for high level topics (e.g. “Climate Change” or “Clean Energy”) from the EMPIR Committee. This occurs a year before the call is planned to open²⁰. The Guardian collects and reviews the stakeholder input provided by bodies and committees for that area as described below and drafts a “scope” document that defines the area for which the call for Potential Research Topics is focussed at Stage 1. The scope is discussed, modified where required, and approved by the EMPIR Committee and then included in the draft work programme sent to the Commission. After approval by the Commission it is published by Euramet.

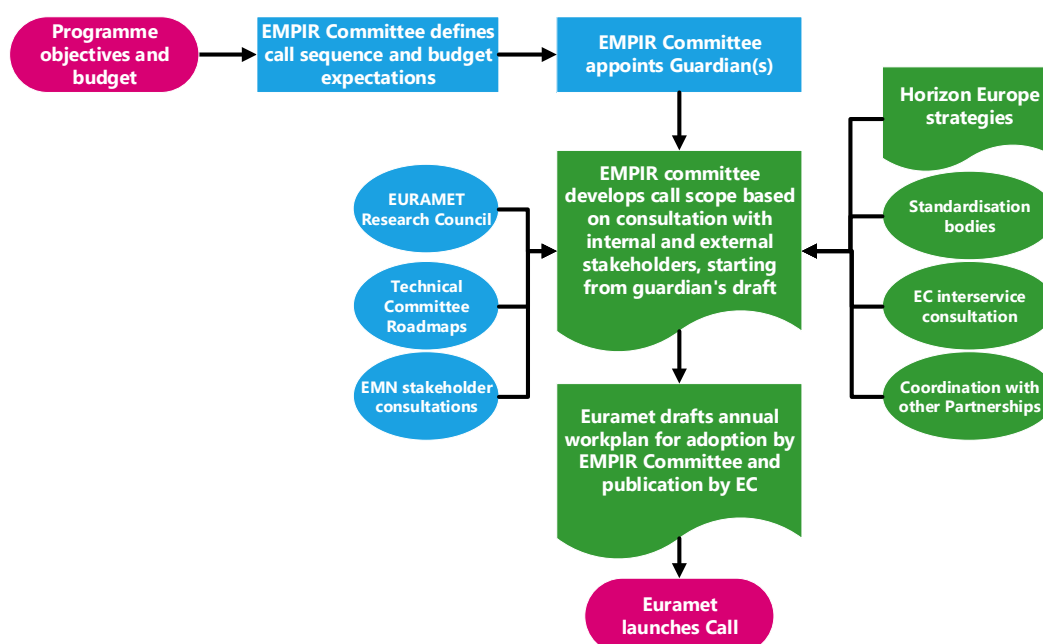


Figure 11: Process for defining the areas to be opened for an annual call

²⁰ As Euramet plan the first call of the partnership to open in 2021, even if that is ahead of any contract with the Commission, the Euramet BoD will appoint Guardians for the 2021 calls at the beginning of 2020 and start a pilot consultation process. Current thoughts are that the calls for 2021 will be related to Climate Change or Clean Energy.

This annual high-level process allows Euramet flexibility in the call topics as the Partnership progresses, it enables the Partnership to respond to current political drivers while maximising the impact annually and ensuring that the objectives outlined in Section 2.2 are met at the end of the Partnership. The call scopes will focus on the programme objectives but be generic enough to avoid exclusion of valuable project proposals. The call scopes describe higher-level objectives, but not specific research topics. Research topics are proposed by individuals or groups of authors at Stage 1 and are subject to a competitive selection process before the Selected Research Topics are published at the start of Stage 2. In addition, the EMPIR Committee will ensure that the sequence of annual calls is sound and that calls build on each other where appropriate.

Stakeholder interaction is relevant both in defining the call scopes and at project proposal level. Euramet will ensure that the information for the scope definition is collected from the stakeholders with the help of different bodies and committees as comprehensively as possible and made available to project proposers as they prepare their proposals at both Stage 1 and Stage 2. This already happens to some extent in EMPIR calls where the “Orientation” pages contain priorities and needs written by stakeholders at Stage 1 and the SRTs at Stage 2 define the objectives to be met in the proposals based on the stakeholder input at Stage 1.

This annual call cycle is the overall process to define the research agenda including a comprehensive stakeholder involvement and including the workplan approval process by the Commission.

4.2 Stakeholder interaction

Metrology is a horizontal and multidisciplinary field. Metrology institutes operate a metrology infrastructure that is needed wherever stakeholders rely on accurate, reliable and correct measurements. They serve a broad stakeholder community from industry, society and academia, and do research and development responding to specific needs.

In many cases regulation, accreditation and standardisation requires metrology. For example, consumers rely on correct measurements of what they pay for, and patients must be sure that radiation does not exceed specified limits and that a diagnosis is the correct one. Highest-precision measurements are essential for high-quality industrial production (e.g. in reducing waste) and enable technological innovation. Thus, virtually everybody relies on metrology as most fundamental part of the so-called quality infrastructure – from legal metrology to industrial innovation and quality assurance of production. The common factor is the metrological methodology, measurements technologies at the frontiers.

Advances in science also arise with new higher-level measurements (“new physics begins at the next digit of precision”). By nature, metrology is in a unique position to combine cutting edge research, industry needs and regulatory requirements. All these characteristics require multiple ways of stakeholder interaction and identification of objectives and call scopes.

The stakeholder interaction includes bodies under Euramet like the Research Council, and the Technical Committees and it includes the manifold individual stakeholder interactions by the more than 5000 metrologists in Europe.

The Research Council of EURAMET was created to receive advice from high-level experts representing academia, industry and key stakeholders like WMO, CEN/CENELEC, BIPM, WELMEC and EUROLAB. The personal members include a Nobel laureate. Regular meetings of the Research Council are organised between the General Assembly and the EMPIR Committee during their meeting week in the spring. This enables a close and direct interaction

between Research Council, delegates and EMPIR Committee. The Research Council may also meet at other times in the year for specific purposes.

EURAMET’s Technical Committees, which have existed for many years, have traditionally had an intensive stakeholder interaction through their members. They have formed working groups to discuss their stakeholder inputs, develop technical roadmaps for their areas and provide inputs to the call scopes.

A major new element in the Partnership to enhance stakeholder interaction and strategic planning are the European Metrology Networks, EMNs. They play a key role for stakeholder interaction. Indeed, they were created, or are in the process of establishment, to build a challenge-driven link to the (higher-level) key stakeholders. Some EMNs will also be able to input to the Horizon Europe missions. The scopes of the EMNs are defined around fundamental challenges (including those defined in the UN SDGs) related to health, energy, environmental challenges, comprehensive European regulation or industrial challenges with clearly defined stakeholder communities. Through the EMNs the metrology community will interact with stakeholders more systematically and comprehensively.

Figure 12 illustrates how EMNs interact with and deliver to stakeholders.

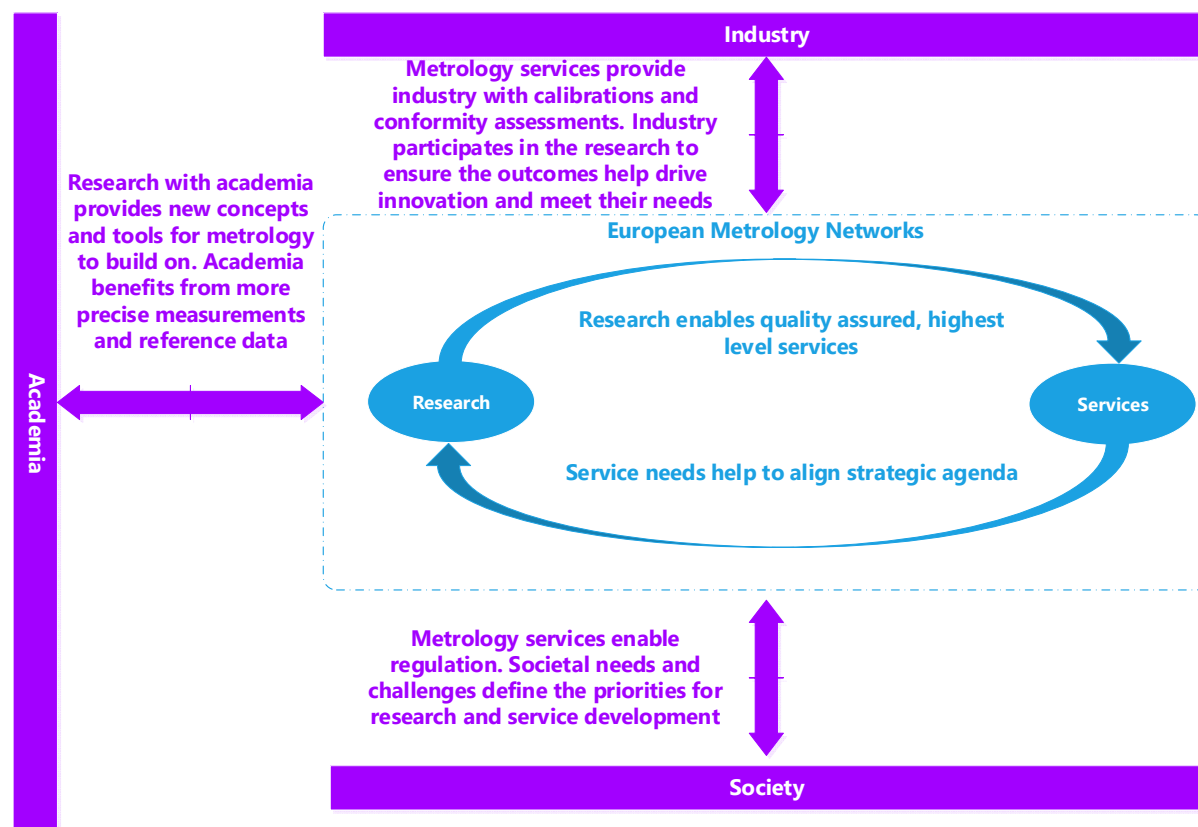


Figure 12: EMN alignment with stakeholder communities and challenges

The EMNs bring manifold benefits with respect to stakeholder interaction:

- By pooling European metrology capabilities EMNs provide access to a broader stakeholder community and higher-level stakeholder organisations like European or international associations. Single institutes or individuals cannot achieve this.

- They provide a forum for discussing stakeholder needs and converting that into proposals for the SRIA and other actions (including the development of regulation).
- They facilitate better stakeholder access across borders and for small countries/institutes.

Euramet has strategically analysed the spectrum of EMNs needed and steered their establishment with a focus on the EU priority areas and objectives as expressed in the clusters of Horizon Europe and in EU regulation. The EU regulation was analysed comprehensively and more than 70 regulations were identified as relevant for metrology. In addition to the “classical” Measurement Instruments Directive (MID) and Non-Automatic Weighing Instruments Directive (NAWID), the In-vitro-Diagnostics Regulation, Medical Devices Regulation, and EURATOM Basic Safety Standards Directive were identified as priorities. In addition, an EMN on Quantum Technologies is explicitly aligned with the Quantum Technology Flagship (the latest EMPIR calls have already been aligned with the flagship which made significant contributions to the orientation pages at call launch).

EMNs will make an increasing contribution to the draft work programme based on the inputs they receive from their stakeholder interactions as they develop their Strategic Agendas.

4.2.1 Interaction with industrial stakeholders and standardisation bodies

Participation of industry has grown under EMRP and EMPIR via direct involvement in projects and by the participation in specific workshops. In many cases, industrial participation has led to the development of new, advanced measurement capabilities in the metrology institutes that are used for services after a project ends²¹.

In addition, metrologists contribute to many standardisation committees on national, European and international level. This provides strong links to industrial partners.

Standardisation is recognised by the EC as a great tool for research development and a key channel for dissemination of innovations.

Euramet considers it important to get some potential needs from industries and society via the standardisation organisations. To enable that discussion, a common platform between Euramet and CEN-CENELEC was created, the platform STAIR-EMPIR (STAndards Innovation & Research). A person, in the Euramet secretariat, is dedicated to help the NMIs and DIs to elaborate normative R&D projects based on these consultations, and since 2014 the CEN-CENELEC has consulted its Technical Committees about the emerging research and measurement needs related to standardisation. This process will be continued to inform the Partnership calls.

4.2.2 Interaction with societal stakeholders and regulatory bodies

Metrology with a regulatory background was not a focus of EMRP. EMPIR introduced a third strand with its prenormative scheme to address standardisation as an intermediate link to regulation but it did not establish good links with regulators. Under the Partnership regulation will increase as a driver. Several EMNs are or will be constructed with a scope aligned to major European regulation. EMNs aligned with major European regulation will seek strong communication with the Commission units that are responsible for the specific regulation.

²¹ <https://www.euramet.org/metrology-for-societys-challenges/metrology-for-industry/>

Furthermore, the metrologists contributing to the EMNs will strengthen the communication with the associated national ministries.

One already well-established mechanism is the cooperation of Euramet with WELMEC, which covers the MID and NAWID. On an individual basis metrologists and ministry representatives of the member states have contributed to WELMEC for more than 30 years. Recently, WELMEC became a legal entity similar to Euramet e.V. Both their secretariats cooperate directly on the joint Braunschweig premises, which is the starting point for a more comprehensive and strategic development of this cooperation.

4.2.3 Interaction with stakeholders from academia

A big step achieved in going from EMRP to EMPIR was a stronger involvement of academia in the programme. In EMRP academia participated through Researcher Excellence Grants which were based on Marie Skłodowska-Curie rules, In EMPIR they joined the projects as funded partners. So, EMRP and EMPIR have helped develop a broad and deep cooperation between the metrology community and numerous universities. The metrology community has become much more visible, and the participation of academic partners in joint research projects has been appreciated widely. The Partnership will build on this. Interaction with academia will mostly rely on individual experts.

4.3 Stage 1 process (identifying metrological challenges)

The first part of a call is formally announced in early January, covering the launch of Stage 1 “Call for potential metrology research topics (PRTs)” and advance notification of the launch of Stage 2 “Call for proposals for Joint Research Projects (JRPs)”. It is announced on the Euramet website and through various other electronic media. Stage 1 of the call usually closes in late February.

The aim of Stage 1 is to identify challenges and problems and provide ideas to help the EMPIR Committee best prioritise the most important topics to address and make best use of the resources available in the NMI and DI community. This stage is open to any person or organisation from anywhere. The process²² is web based and provides a simple WORD template to ensure ideas are expressed in an appropriate way. Proposers provide administrative information online, and upload their idea as a WORD file. All submissions are automatically acknowledged by e-mail. The process for Stage 1 of the call is illustrated in Figure 13.

Submissions undergo a simple eligibility check to ensure that they can be prioritised (e.g. submission in English, all required sections of the form complete etc) and to remove any submissions that were superseded by the submitters.

Any EMPIR committee member is invited to review the PRTs and provide a recommendation based on a scoring scheme and written comments. In a two-days meeting the sub-committee agrees a joint, anonymised recommendation and drafts the titles and objectives for the Selected Research Topics for subsequent approval by the full EMPIR Committee. This list is not a ranked list but rather the set of PRTs that are recommended to pass this stage. There may be PRTs for which the sub-committee cannot see a clear recommendation. These PRTs are subject to a formal voting by the full EMPIR committee.

²² https://msu.euramet.org/downloads/documents/Guide2_Submitting_PRTs_and_PNTs.pdf

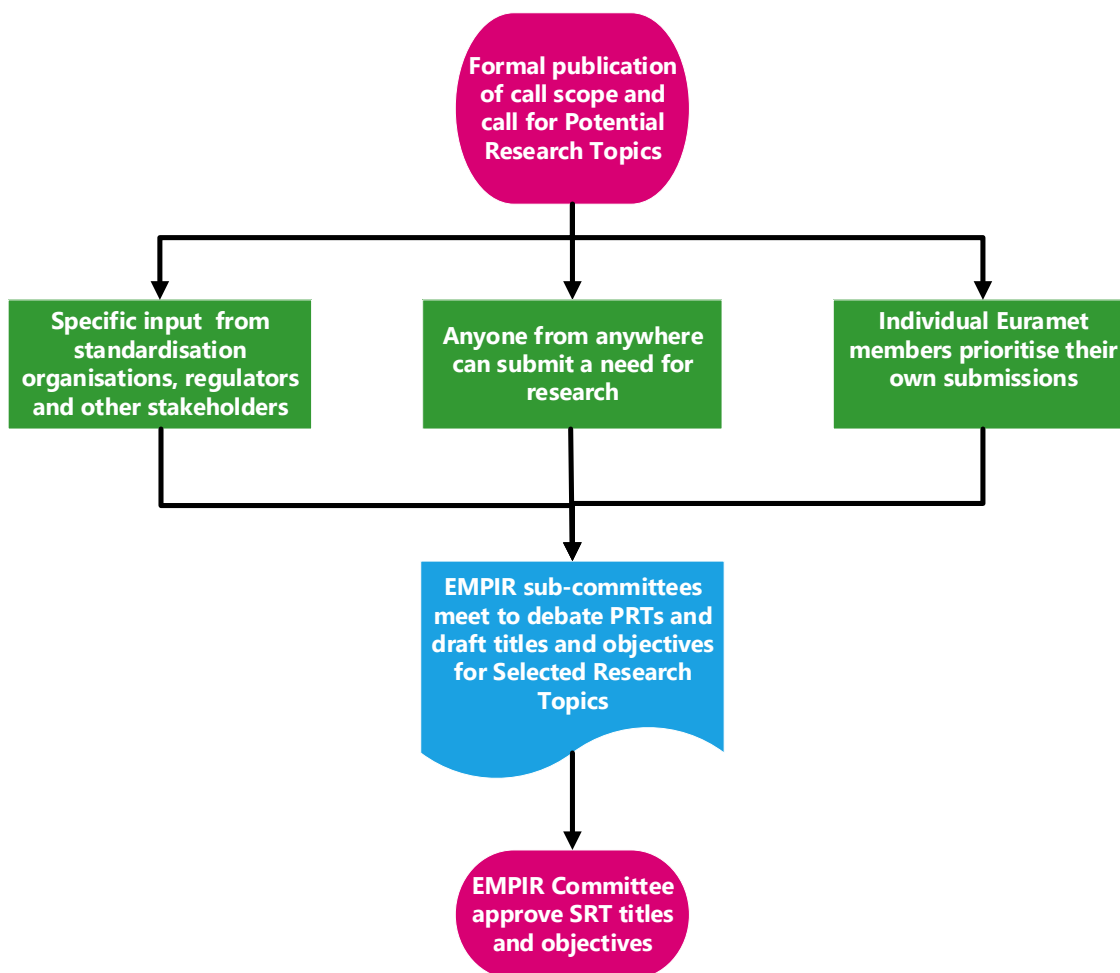


Figure 13: Process for stage 1 of a call

Following the full EMPIR Committee meeting a list of the titles of the SRTs is placed on the call website along with information on partnering meetings to be held immediately following the launch of Stage 2. The first drafts of the “Supporting Documents” are prepared by the MSU, a short document for each topic describing the background, objectives and potential impact. The information and much of the text for the supporting documents is drawn from the relevant PRTs. These drafts are then reviewed by the sub-committee and iterated until deemed acceptable.

When considering the above process it would be rather misleading to imagine the process as one of prioritising one PRT over another. Rather it is a case of reviewing all PRTs in a given area, establishing a list of all of the needs, scientific and technological objectives and potential impacts expressed, and then identifying which of those ideas could be addressed most effectively by the metrology research community. Thus in each area all of the objectives from all relevant PRTs are assembled, and prioritised. The process is better thought of as a prioritisation of ideas rather than prioritisation of particular PRTs, although the “genealogy” of all Stage 2 topics is carefully captured ensuring the traceability of each of the Stage 2 topics to its “parent” contributing PRTs. This approach ensures efforts can be focused most appropriately, but makes the preparation of the supporting documents challenging (as it is not simply a case of choosing PRT X over PRT Y and then editing the text of PRT X). The topics are assembled not only to bring the best resources from Euramet to bear on the identified needs, but also to promote closer working between different Euramet members and across

technical disciplines by combining objectives in single topics that can only be addressed through collaboration.

4.4 Stage 2 process (selecting Joint Research Projects)

The second stage, the dedicated call for joint research projects²³ usually launches in late June and closes in early October. This call opens the Selected Research Topics, each with a supporting document identifying the need or opportunity, the scientific objectives and likely impact. The overall process at Stage 2 of the Call is illustrated in Figure 14.

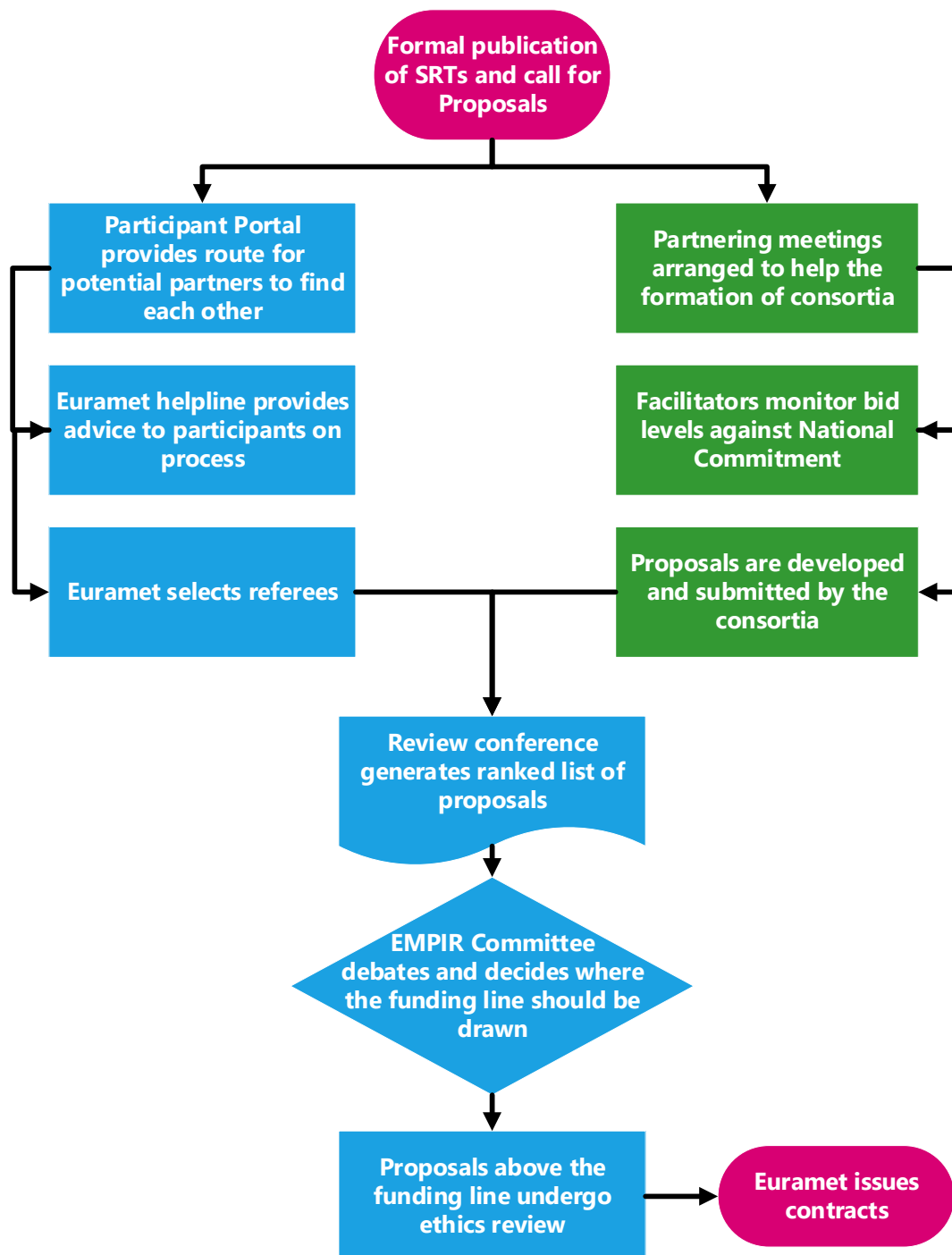


Figure 14: Process for stage 2 of a call

²³ <https://msu.euramet.org/downloads/documents/Guide4.pdf>

Euramet selects the independent referees to evaluate the proposals from its own database²⁴. At the Review Conference²⁵ a representative of the proposers meets the referees around a poster and then answers specific questions posed to them. The Review Conference gives the referees the opportunity to deepen their understanding of the proposal and it helps to reduce the risk of misunderstandings. EURAMET's experience is that the decisions are accepted better when the proposers have had the chance to defend their proposals in face to face discussions at such a conference. The process is explained fully in the report of the independent observers from past calls available on the call website.²⁶

²⁴ https://msu.euramet.org/ref_register.html

²⁵ <https://msu.euramet.org/downloads/documents/Guide6.pdf>

²⁶ https://msu.euramet.org/previous_calls/index.html