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Case Study No.2- The Article 185 European Metrology Research Programme (EMRP)

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ABSTRACT

This case study examines the key features, outputs and overall strengths and weaknesses of a specific modality that facilitates alignment of research across countries, namely the European Metrology Research Programme (EMRP, 2009-2017), which was launched under the **Article 185** of the Treaty on the Functioning of the European Union. This “Article 185 Initiative” promotes long-term collaboration and alignment amongst European metrology institutes via the submission of joint research project proposals that target specific economic sectors to which metrology is essential. While focussing on the specific experience of EMRP, the case also provides lessons for other public-to-public research partnerships wishing to develop a similar approach to facilitate the establishment of a **strategic, long-term and integrated European research programme**, and promote alignment more generally. The case study does however not aim to provide an in-depth assessment of EMRP nor Article 185.

The study highlights the Article 185’s many benefits. EMRP has enabled participating countries to achieve strong alignment at strategic, operational and financial levels, thanks to:

- (i) The elaboration of a Common Vision and a joint Strategic Research Agenda, which has been facilitated by the European Association of National Metrology Institutes, EURAMET;
- (ii) Strong transnational programme integration, with a centralised management structure and reporting system;
- (iii) EMRP has achieved results that would have been more difficult to reach at national levels, such as effectively contributing to international standardisation activities. More generally, EMRP has resulted in enhanced research capacity and excellence across Europe thanks to the development of new metrology-related expertise, the sharing of national metrology infrastructures and staff exchanges between participating institutes;
- (iv) In addition, the use of the Article 185 has enabled to mobilise substantial national resources (mostly in-kind) over an 8 year period, leading to strong financial alignment at the European level. Indeed, about **50% of national resources** dedicated to metrology research in Europe have been engaged towards the EMRP.
- (v) EMRP has also allowed increasing the visibility of European metrology research at the global level. EMRP is considered as the principal European actor in the metrology research field.
- (vi) Longer-term sustainability thanks to the important share of EC co-funding (50% of the total budget, or €200M). Furthermore, partnerships built through EMRP projects have been long-lasting after the end of the project.

Yet, EMRP has also suffered from: (i) complex and time-consuming grant application procedures, (ii) limited use of EMRP grants by non-EMRP researchers, which hindered the expansion of research collaboration *beyond* the EMRP membership (yet this issue has been addressed since), (iii) limitations to the EMRP trans-disciplinary approach, due to the organisational structure of some National Metrology Institutes (which sometimes have few interactions with other disciplines); (iv) Insufficient tools for knowledge dissemination and transfer, which could support the development of new policy regulations and industry-led innovation (this problem has been addressed in the EMRP follow-up programme, EMPIR); and (v) relatively low involvement of less-advanced National Metrology Institutes participating in EMRP.

The case study builds on the ERALEARN2020 Task 4.1 (“Definition and Typology of Alignment”), and relies on a review of existing literature and targeted interviews with the EMRP Project Manager and national representatives participating in the programme. The case is part of a series of nine short case studies that form the basis of the ERA-LEARN2020 Task 4.2 “Assessment of Current Approaches to Alignment”. The nine case studies that have been selected for this Task each rely on a different instrument (Member-State instrument or EC instrument, e.g. ERA-NET), cooperation mode (e.g. networking amongst researchers, programme integration, institutional cooperation, etc.) and approach (strategic, operational and/or financial) and are often put in place at different stages of the research programming cycle (planning, strategy, implementation, etc.).

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1. Introduction

This case study examines the key features, outputs and overall strengths and weaknesses of a specific alignment modality, namely the Article 185 Initiative/European Metrology Research Programme (EMRP, 2009-17) of the European Association of National Metrology Institutes (EURAMET). The study also assesses in what context such a tool is best used for promoting greater alignment of national research programmes and activities in a European context. While the case study focuses on the specific experience of the EMRP, it attempts to draw **lessons** for other European public-to-public research networks wishing to develop a similar approach to promote European research excellence and a greater efficiency of national research funding.

According to the Typology of Alignment, the Article 185 instrument is used during the research implementation phase in view of establishing a **strategic, long-term and integrated European research programme**. It is an ambitious modality that allows for “deep” alignment¹ at strategic, operational and financial levels, and involves many actors in the research programming cycle (policymakers, research funding and performing organisations, and individual researchers).

2. Key features of the Article 185 European Metrology Research Programme

2.1 Overview

The EMRP was established in 2009 by EURAMET as a **multi-annual joint research programme**. The Programme relied on five annual project calls that were launched between 2009 and 2013. It promotes collaboration amongst **European metrology institutes** through the submission of joint research project proposals that target specific sectors to which metrology is essential: energy, industry, environment, health, new technologies and the International System of Measurement Units (SI). The EMRP brings together National Metrology Institutes (NMIs) and Designated Institutes (DIs) from **23 EURAMET Member-States**, as well as from other European and non-European countries.² It was launched under the Article 185 of the Treaty on the Functioning of the European Union (ex-Article 169 of the EU Treaty), allowing for the coordination and alignment of national research programmes on a long-term basis (eight years). As is further explained below (section 2.4), participating countries contribute to 50% of the total budget for EMRP, mainly in the form of **institutional (in-kind) funding**.

The European Union has recognised metrology as “a cross-disciplinary scientific field which is a vital component of a modern knowledge-based society” and which has “a significant impact on the economy and quality of life within Europe”.³ It has agreed to support the EMRP Article 185 initiative as there was a lack of coordination among European Member-States in the field of metrology research, diminishing its critical mass and societal impact, and the EMRP was considered the most suitable instrument to address such a problem. In light of the EMRP’s success, the EU decided in May 2014 to launch a follow-up Article 185 research programme in the metrology area, the European Metrology Programme for Innovation and Research (EMPIR, 2014-2020, see Box 1 below).⁴

2.2 Mission and activities

The main objective of the EMRP is to “support scientific development and innovation by providing the necessary legal and organisational framework for large-scale European cooperation between Member States on metrology research in any technological or industrial field.”⁵ It seeks to **advance research in the science of measurement** by improving existing measurement techniques, developing new ones and increasing the quality of measured data in order to support science research, innovation and new regulations in Europe. EMRP aims to benefit European industry and policymakers, as well as researchers whose activities rely on the advancements in the field of metrology (e.g., measuring water pollution, developing the SI measuring units). Furthermore, the EMRP aims to

¹ Refers to the level of intensity, see Typology of Alignment.

² Austria, Belgium, the Czech Republic, Denmark, Germany, Estonia, Finland, France, Italy, Hungary, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, the United Kingdom, Norway, Switzerland, Turkey and Bosnia and Herzegovina. The Joint Research Centre of the European Commission is also eligible to participate.

³ Decision of the European Parliament and of the Council of 16 September 2009

⁴ Decision of the European Parliament and of the Council of 15 May 2014

⁵ Decision of the European Parliament and of the Council of 16 September 2009

strengthen the European Research Area and help address societal challenges such as climate change, health and energy by focusing on seven broad fields (Targeted Programmes). Expected outcomes are detailed below for six of them (see Table 1), the 7th one (called “Open Excellence”) not having a sector-specific theme but focusing on new techniques through research excellence.

Table 1. Expected outcomes of the EMRP Targeted Programmes

Targeted Programmes	Expected outcomes
1) <i>Energy</i>	Improved measuring techniques towards a sustainable, low-carbon and secure energy supply across Europe
2) <i>Environment</i>	Improved measurements of pollution and regarding climate change for improved models and new policies
3) <i>Health</i>	Improved medical diagnosis and treatments through improved and new measuring techniques
4) <i>Industry</i>	Improved traceability of industrial processes for optimization, improvement, safety and innovation purposes
5) <i>New Technologies</i>	Improved and new measuring techniques to support innovation and improvement of new technologies
6) <i>SI Broader Scope</i>	Redefinition of the kilogram and updating of the other SI units towards their dissemination and application

Source: Brochures presenting the projects under each Targeted Programme

EMRP funds two types of activities: joint research projects (JRP) and associated researcher grant schemes within the seven Targeted Programmes (see Table 2).

Table 2. Type of activities funded by EMRP

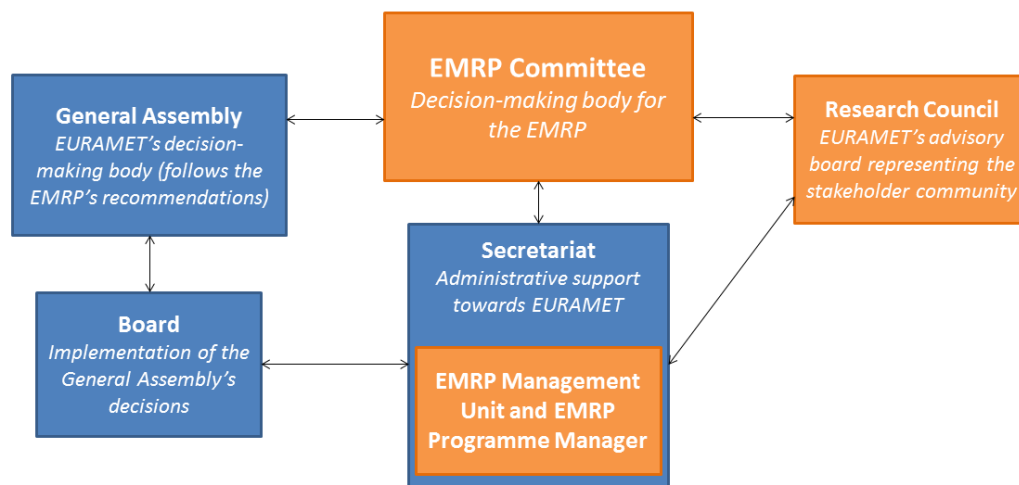
Activities	Description
1) Joint Research Projects	Core activity of the EMRP: selection of transnational projects by an independent panel from outside the NMI/DI community and execution mainly by NMIs/DIs
2) Grant Schemes	Researcher Excellence Grants: increased participation of the wider research community in JRPs
	Researcher Mobility Grants: capacity building of individual researchers
	Early-Stage Researcher Mobility Grants: support of young researchers

Source: EMRP Mid-Term Report 2012

2.3 Governance structure

EURAMET e.V., a non-profit association established in 2007 under German law, brings together all 37 European National Metrology Institutes. It is the legal entity that was in charge of the implementation of the EMRP. Strategic decisions regarding the programme were taken by the EMRP Committee (which is now the EMPIR Committee). This Committee was supported by a Secretariat and advised by a Research Council (see Fig. 1).

Figure 1. Governance model of the EMRP



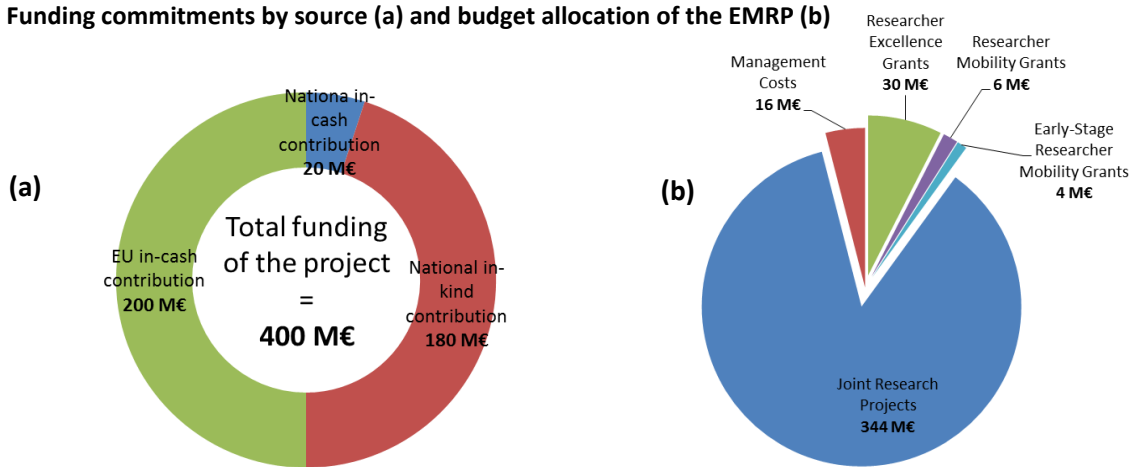
Source: EMRP website

2.4 Approximate resources and time needed for implementation

In line with the application of Article 185, each participating State committed **national resources** towards the funding of the EMRP, amounting to a collective contribution of 200 M€ over a seven-year period. In addition, another 200 M€ was **co-funded by the European Commission**, hence providing a **total budget of 400 M€**.⁶

National funding commitments include an in-cash allocation (10%, or 20 M€) towards a real common pot covering (i) the total management costs of the programme (16 M€) and (ii) a share of the researcher grants' total value (4 M€). The remaining, more substantial part of national in-kind contributions (90%, or 180 M€) are provided through **institutional funding (in-kind scientific capacity)** by National Metrology Institutes and Designated Institutes towards a virtual common pot dedicated to the Joint Research Projects' activities. The initially planned allocation of funding towards the EMRP's activities is detailed below (Fig. 2). The important divergence across national contributions is noteworthy: in particular, Germany and the UK have provided over 60% of the in-kind funding while seven countries have contributed less than €1 million.⁷ Required human resources are highlighted in Annex 2.

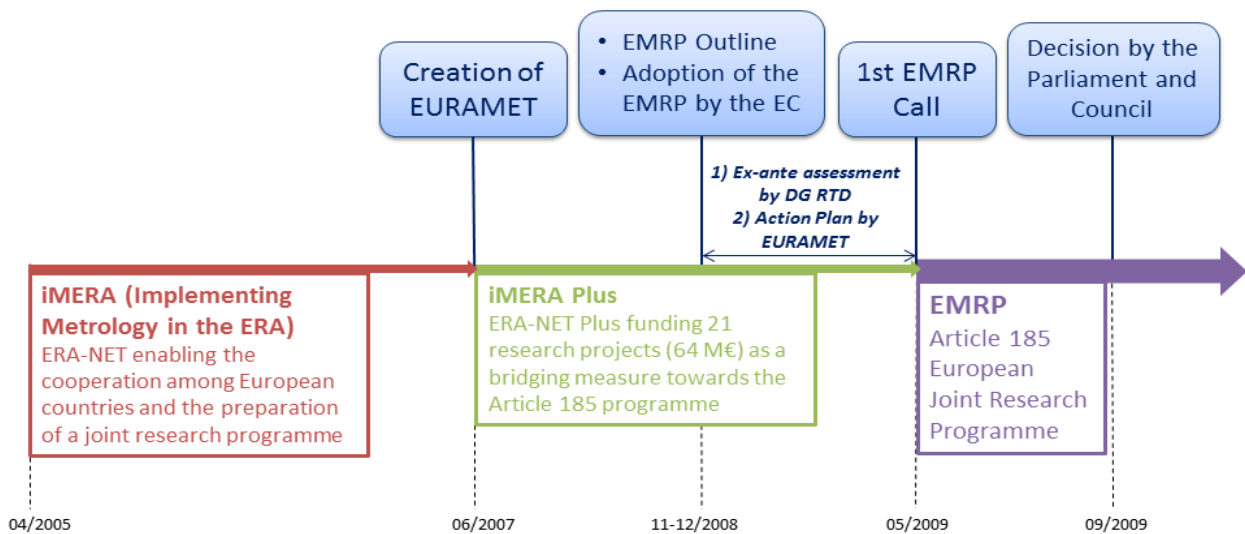
Figure 2. Funding commitments by source (a) and budget allocation of the EMRP (b)



Source: EMRP Outline 2008

In terms of the time needed for implementation, it is important to note that a **preparation phase of 4 years was necessary** in order to strengthen coordination among European countries and launch the EMRP (see Fig. 3).

Figure 3. Timeline for implementation



Source: EMRP Mid-term Report 2012

⁶ Member-states with lower national resources were able to tap into a reserve in order to ensure the funding of their selected researchers within EMRP projects if the national contribution was insufficient. 19 M€ were used out of this reserve during the EMRP funding period.

⁷ EMRP Mid-term Report 2012

3. Principal outputs to date

The EMRP has, via its seven Targeted Programmes (TP), greatly contributed to advancing European knowledge and techniques in metrology. The Targeted Programme on Energy is the most advanced one (see Box 2, Annex 2). Two-thirds of the EMRP projects are still on-going. So far, the EMRP has allowed to finance and support:⁸

- 119 research projects involving 59 NMIs and DIs from 23 EMRP member-states as well as NMIs and DIs in other European countries and globally, over 350 academic groups and over 300 industrial participants
- An average participation of more than 10 organisations⁹ from 8 different countries¹⁰ within each Joint Research Project
- 377 associated researcher grants with a total value almost equal to the planned budget (40 M€)
- 998 peer-reviewed publications, a third of which are co-publications
- Almost 4000 conference presentations, over 1600 other dissemination activities and nearly 800 trainings
- Contributions to 739 standards developing committees (such as CEN, CENELEC, ISO)
- 36 patent applications
- €9 million sales of innovative products and services to date associated with the projects from the 2009 Energy Call (figures for more recent calls are not yet available)

4. Overall strengths of this tool, including key achievements

The Article 185 instrument/ EMRP offers many benefits as it allows to deepen alignment at strategic, operational and financial levels amongst participating countries.

4.1 *Strong alignment at strategic level via the elaboration of a common European vision and research agenda*

Firstly, the EMRP has helped participating countries develop a common vision for the development of European metrology research by encouraging regular interaction and meetings between NMIs, e.g., to prepare jointly strategic documents, such as the EMRP Outline. The elaboration of this Common Vision has also been facilitated thanks to the fact that EMRP could build on a historical network in the metrology community¹¹: NMIs are part of the infrastructure of states as they hold national standards. They have similar core missions, objectives and needs. In particular, they contribute to the international harmonisation of standards, which makes it easier for them to cooperate and align their work at an international level.

The EMRP has also had a positive impact on the alignment of diverse national strategic research priorities in the area of metrology, thanks to effective discussions aimed at identifying common research priorities and the development of a joint strategic research agenda. The EMRP has also subsequently allowed participating countries to align their own national metrology-related programmes with the EMRP (joint) priorities. In this regard, the EMRP Mid-Term Report 2012 states that *“there are some indications of alignment between larger countries and smaller countries that have scientific excellence in niche areas”*.

4.2 *Strong operational alignment thanks to programme integration*

Strategic alignment through the EMRP has in turn helped reduce fragmentation and duplication and has fostered critical mass: this large-scale and long-term joint research programme has created a broad, structured and strong core for the European Research Area in the metrology field. The joint efforts of participating NMIs and the large diversity of topics addressed by the EMRP have enabled participating countries to achieve results that would have been out of reach at the level of individual NMIs (see Sections 2.2 and 3). For example, their contribution towards international standardisation activities and patent registrations would not have been as significant without this large-scale cooperation.

⁸ EMRP Data Summary (January 2016)

⁹ Impact Assessment Report 2013

¹⁰ EMRP Mid-term report 2012

¹¹ The international Metre Convention signed in 1875 created the International Bureau of Weights and Measures (BIPM), allowing member states to discuss and agree on common issues related to measurement units.

The EMRP has also facilitated alignment at operational level thanks to the establishment of a **central management structure** for the research programme with an integrated reporting system, the joint programming and implementation of research projects and the set-up of a central evaluation and selection process (an independent panel assesses the project proposals; see Annual Call Process in Annex 3). For instance, reporting requirements associated with national EMRP funding contracts were often simplified compared to other research projects. National in-kind funding for the EMRP did not trigger additional reporting requirements at national level. Moreover, EC reporting procedures were taken care of by EURAMET and not at the level of individual research projects. Effective knowledge-sharing among partners during Joint Research Projects and a greater collective openness to the wider scientific community through the joint selection of external experts and scientists (i.e. academia and industry) have also led to a strong added value of the EMRP for operational alignment.

4.3 Strong financial alignment amongst EU/Associated Member-States

The use of the Article 185 has enabled **long-term and substantial national funding commitments**, leading to strong financial alignment. Indeed, **about 50%** of national resources dedicated to metrology research in European countries have been engaged towards the EMRP. This is a significant amount bearing in mind that national in-kind contributions generally originate from the national budget for NMIs and not from larger national research funds.¹²

4.4 Increased research capacity and excellence across Europe

European research capacity and excellence in the field of metrology have increased through the EMRP thanks to:

- The development of **new expertise** and strengthened existing expertise through the adoption of a transnational and multi-disciplinary approach: for instance in the field of health, less advanced NMIs have benefited from joint collaboration on EMRP research projects and thereby increased their knowledge and research capacity; also, new metrology options were developed, in particular related to the fields of biology and chemistry while measurement techniques were mainly oriented towards physics in the past.
- The participation of external researchers and experts through EMRP Researcher Excellence grants;
- A better coordination and sharing of the use of NMI infrastructures; and
- Staff exchanges between participating NMIs, thanks to EMRP mobility grants.

4.5 Enhanced interaction with end-users

The EMRP seeks to respond to the needs and requirements of end-users (e.g., industry, policymakers, standards developing organisations) by involving them in the selection of research topics and projects and the elaboration of calls: for example, EURAMET invited relevant Standards Developing Organisations to express their requests on the occasion of the EMRP Energy and Environment calls of 2013, leading to the funding of ten Joint Research Projects responding to those needs.¹³ Similarly, this co-selection and prioritisation process with end-user communities triggered the shifting of €3 million from the Environment call to the Industry call in 2010 and €2.5 million from SI to Health in 2011.¹⁴

Likewise, NMI metrologists have been encouraged to get involved in end-user organisms (e.g., by becoming members of institutions and committees dealing with regulatory and standardisation issues) in order to ensure an efficient dissemination of results and quick uptake of new techniques and technologies.

4.6 Increased visibility on the European and international scene

The EMRP network – and more broadly the EURAMET network – is often considered as the principal **European actor** in the metrology research field and can in turn collaborate more easily with other metrology communities globally, as opposed to individual European countries/ institutes. Indeed, EURAMET has been defined as the Regional Metrology Organisation of Europe.¹⁵ The involvement of 48 countries worldwide¹⁶, and more specifically

¹² As the EMRP has chosen to focus on a specific scientific community, namely NMIs, possibilities for further increasing financial integration may have been limited.

¹³ EURAMET Strategic Research Agenda (March 2016)

¹⁴ EMRP Mid-term report 2012

¹⁵ <http://www.euramet.org/about-euramet/>; see Annex 1.

of non-European countries as *unfunded* partners or collaborators, demonstrates the added value of participating in such an internationally recognised programme and increases the international visibility of the EMRP.

4.7 Proven sustainability

The EMRP is a long-term initiative which can demonstrate its advantages in integrating large funding resources over time (eight years). The EC has supported the programme through a significant financial contribution, and has agreed to support its successor programme (EMPIR) by an even more important contribution (300 M€) which ensures the renewal of national funding commitments required for such a centralised joint programme over an even longer period of time (300 M€ over 10 years, compared to 243 M€ of national commitments over 9 years for the iMERA-Plus and EMRP). Furthermore, the EMRP has facilitated collaboration amongst (past, existing, future) project partners through its annual call procedure, which consists in (i) jointly setting research priorities through submitted research topics, then (ii) selecting research project proposals through a centralised evaluation procedure and finally (iii) awarding researcher grants (see Annex 3). The joint preparation of proposals for research topics (i) starts long before the official selection of research projects: potential research topics to be submitted are carefully agreed on at national level (within the research implementing organisation) and can be combined with other research topics identified by other countries in order to submit a proposal for a research topic co-authored by several European partners (i.e. NMIs, academia and stakeholders). Thus, strong European coordination is already observed at an early-stage within the metrology community. Similarly, the partnerships built through EMRP projects are **long-lasting after the end of the project** as the timeframe of the EMRP calls and projects allow to design follow-up projects and hence build on existing partnerships.

5. Overall limitations with this tool, including difficulties encountered during implementation

The weaknesses listed below¹⁷ were partially addressed by the new Article 185 EMPIR (see Box 1, below).

5.1 Complex and time-consuming grant application procedures

As expected for such a research programme, grant application procedures are often considered to be too cumbersome and time-consuming. Two reasons can explain this weakness: firstly, while having a beneficial structuring effect, the elaborate 3-step annual joint programming procedure involves the submission of three proposals for each annual call (one for the research topic, one for the project proposal and one for researcher grants); secondly, the EU co-funding has implied the application of additional EU Framework Programme 7-related procedures. The heavy administrative procedures of the EMRP hence represent a significant hidden cost for NMIs.

5.2 Limited use of EMRP grants by the wider scientific community and end-users

The desire to broaden the orientation of EMRP projects to the wider scientific community and hence increase the potential scope of operational alignment in the metrology field initially faced a structural barrier during the first two years of the EMRP in that external researchers had to participate as individuals (researchers had to quit their job within their organisation to be able to fully dedicate their time to the EMRP). To offset this weakness, the EMRP redesigned its researcher grant scheme: a new form of Research Excellence Grant (REG) was put in place, allowing not only individual researchers but also organisations (e.g., firms, universities) to apply for REGs and receive funding for their contribution towards the EMRP. This resulted in a significant increase of the use of REGs and hence an enhanced openness to external researchers and experts.

5.3 Hindered transdisciplinary approach due to the organisational structure of National Metrology Institutes

The EMRP's desire to adopt a transdisciplinary approach ("Grand Challenges") was hindered by the historical organisation of research implementing agencies and consortia with limited interaction with other research fields. Moreover, a lack of inter-ministerial coordination and engagement with the NMI/DI community has been observed in some countries and impacted the interdisciplinary evolution of the EMRP, although ministries do not usually play a direct role as the funding for the EMRP comes from NMIs.

¹⁶ EMRP Data Summary (January 2016)

¹⁷ EMRP Mid-term report 2012

5.4 **Insufficient instruments for knowledge dissemination and transfer**

Although a majority of EMRP projects engage with end-user communities, specific instruments aimed at supporting the elaboration of new regulations and standards and the adoption of industry-led innovations have not been developed through the EMRP, thus diminishing the potential societal impact of EMRP project outcomes. The EMPIR nevertheless seeks to better address the issue of knowledge transfer (see Box 1 below).

5.5 **Relatively low involvement of less-advanced National Metrology Institutes**

EMRP grant schemes did not take account of the fact that less advanced NMIs often have few experts in a specific field and cannot afford sending them abroad (via an EMRP grant) for a long period of time. In the rare cases where such experts could be released, they could often not apply the skills and knowledge gained in the more advanced NMI due to a lack of facilities in their own NMI. Also, there was no dedicated EMRP mechanism to address the issue of low funding resources of smaller NMIs, for instance by facilitating their access to external funds and to leading NMIs' infrastructures. This hindered the participation of less advanced NMIs in the programme and contributed to widening the research gap between research intensive and less research intensive countries in the metrology area. This issue highlights the importance of encouraging infrastructure-sharing and joint training – issues which have been addressed in the EMPIR and more broadly by EURAMET.

Box 1. Focus on the European Metrology Programme for Innovation and Research (EMPIR), 2014-2020

The EMPIR Programme, launched in 2014, is a larger and more complex programme that is fully integrated in the EU Horizon 2020 Framework Programme and that takes account of the lessons learned from the EMRP experience. This renewed Article 185 initiative benefits from an increased total budget of 600 M€, including national commitments amounting to 300 M€ and a 300 M€ contribution from the European Commission.

As its predecessor, the EMPIR will continue to develop the “Grand Challenge” approach with annual calls addressing Targeted Programmes on Health, Energy, Environment and Industry, while also keeping one on Fundamental Metrology. A stronger focus has been put on **capacity building through specific tools**:

- the Targeted Programme “Research Potential” is specifically dedicated to capacity building within the NMI/DI community (e.g. through knowledge transfer to emerging members and smart specialisation);
- increased openness to external centres of excellence and 3rd parties and to the international metrology community will be fostered through their enhanced participation in EMPIR research projects (to be doubled compared to their participation in EMRP projects).

In addition, EURAMET will greatly support capacity building and networking activities when not directly associated with an EMPIR Joint Research Project through training courses and material, technical guides, and facilitated access to other funding sources such as EU Structural Funds.

Also, dedicated instruments for more **efficient dissemination and higher impact** have been put in place: Support for Impact Projects enable the further exploitation of outputs of Joint Research Projects (through new standards and regulations as well as knowledge transfer to businesses) and the pre- and co-normative Targeted Programme focuses specifically on standardisation activities to address the needs of the European and International Standards Developing Organisations for metrology.

Source: EURAMET Strategic Research Agenda (March 2016); EURAMET website; EMPIR Legislative Financial Statement

6. Conclusions: Suitability and key factors of success

The implementation of a long-term joint European research programme under Article 185 is most suited to respond to large-scale and common European challenges that require the mobilisation of a specific scientific community. This **political tool, which promotes “deep” alignment at strategic, financial and operational levels**, is relevant when there is a need for transnational uniform processes, standards and applications in a scientific field that is key to underpin advances in other scientific areas, as is the case for metrology. Thanks to its long-term duration and substantial budget, the Article 185 instrument allows for greater sustainability than other existing alignment modalities.

Key factors of success:

1) At strategic level:

- **Build on a pre-existing network:** A long history of collaboration among key research partners is crucial in enabling the transition towards a massive alignment initiative such as an Article 185 research programme.
- **Develop a common strategic research agenda**, which implies that strategic research priorities are defined in consultation with all relevant national representatives and with stakeholders and end-users to ensure relevance in addressing societal issues.
- **Establish a strong, centralised, clearly defined and legally binding governance model** through clear voting procedures and allocation of responsibilities, and a good balance between EC and national contributions (i.e., permanent staff and national representatives), which allows for joint discussion and effective agreement on and implementation of joint decisions.

2) At financial level:

- **Willingness to pool (significant) amounts of national resources over time:** The use of the Article 185 instrument is best suited for achieving this goal as it relies on high and multi-annual national funding commitments as well as a significant contribution from the EC. A **virtual common pot** for funding research is required when applying an Article 185 initiative as countries cannot risk losing such significant committed resources if the proposal selection does not lead to their participation in joint research projects. However, national contributions towards a real common pot are also of great added value in being independent from national funding rules, for instance, to cover for coordination and management costs.

3) At operational level:

- **Establish a central programme management** structure, supported by an integrated system for grant application and reporting activities.
- **Set up a centralised and independent evaluation system**, which engages with the wider scientific community to ensure research excellence, and with the end-user communities to ensure research relevance and societal impact.
- **Develop dedicated dissemination instruments for effective impact on end-users:** Enhanced interaction with stakeholders and end-user communities will facilitate effective dissemination and application of EMRP results by (i) involving them in joint research projects and (ii) involving project participants in end-user communities' activities.
- **Development of dedicated instruments for capacity building**, focusing on (i) involving the wider scientific community in order to benefit from their expertise and equipment; (ii) facilitating knowledge transfer and access to external funds and infrastructure for countries with lower national financial and human resources; and (iii) implementing training and networking activities and encouraging effective researchers' mobility.

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EMPIR Participant Portal: <http://msu.euramet.org/>

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Interviews

Dr. Erkki Ikonen: EMPIR Committee Chair, Aalto University, Metrology Research Institute, Finland

Dr. Duncan Jarvis: EMRP Programme Manager

Dr. Jörn Stenger: National representative for Germany on the EMPIR Committee and former EMRP Committee Chair, Physikalisch-Technische Bundesanstalt (PTB), Germany

ANNEX 1. EURAMET¹⁸

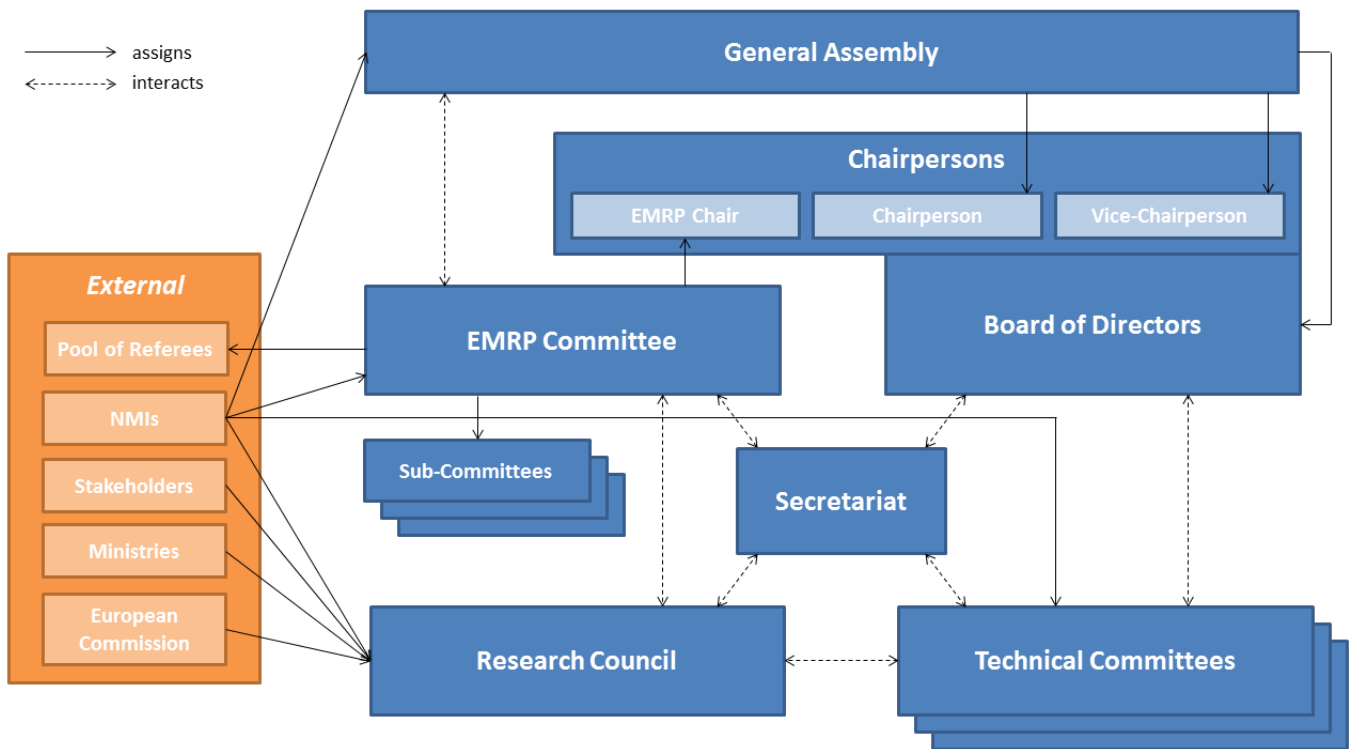
EURAMET e.V., the European Association of National Metrology Institutes, is a non-profit association under German law which was established on 11th January 2007 in Berlin. The association is the successor of EUROMET (European Collaboration on Measurement Standards), the former Regional Metrology Organisation of Europe, which included all EU NMIs and also NMIs from non-EU member countries and was dissolved in June 2007 after having transferred all its activities to EURAMET.

In order to foster knowledge transfer, support policy- and innovation-relevant research, encourage the alignment of national research programmes and enhance the development of national metrology infrastructures, EURAMET brings together and coordinates the cooperation of all 37 European NMIs on metrology issues such as research in metrology, traceability of measurements to the SI units, international recognition of national measurement standards and related Calibration and Measurement Capabilities.

EURAMET is the legal entity in charge of the implementation of the European Metrology Research Programmes, the EMRP and the EMPIR, which are the main tools developed in order to achieve EURAMET’s mission.

The structure of the association has been carefully designed and implemented in order to fully achieve an efficient coordination among EURAMET members (Fig. 1). In particular, Technical Committees have been put into place in order to effectively address scientific and technical issues in the metrology area.

Figure 1. Structure of EURAMET e.V.



Source: *La métrologie française*¹⁹

EURAMET seeks to fulfil five strategic objectives²⁰:

1. Engage with key stakeholders: this goal should be achieved by developing key partnerships, understanding stakeholder needs, increasing the impact of EURAMET’s own work and anticipating market and needs trends based on foresight analysis.

¹⁸ <http://www.euramet.org/>

¹⁹ <http://www.metrologie-francaise.fr/fr/activites-internationales/europe/euramet.asp>

²⁰ EURAMET Strategy 2020; <http://www.euramet.org/about-euramet/>

2. Increase its influence with European policy makers and National Governments: EURAMET is responsible for providing support for policy-making, especially where measurement has an important role in setting and/or implementing the policy.
3. Further develop co-operation in R&D: this is especially achieved through the development of the EMRP and the EMPIR and the associated implementation of Joint Research Projects.
4. Deliver high value to members and associates: EURAMET seeks to support all its members in achieving their own objectives by integrating them to overall European metrological needs and fostering cooperation, joint sharing of resources and infrastructure and involvement of key metrology players.
5. Support quality infrastructure in Europe and internationally: EURAMET aims at an increased cooperation with other relevant metrology organisms such as the CIPM MRA (Mutual Recognition Scheme supported by the Comité International des Poids et Mesures), the European Co-operation for Accreditation and other Regional Metrology Organisations.

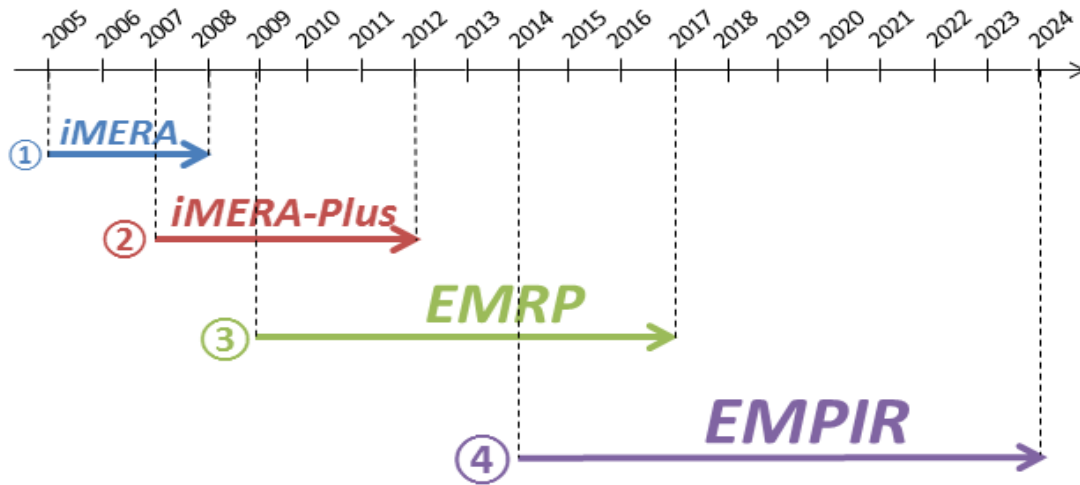
EURAMET VISION: *to ensure Europe has a world-leading metrology capability, based on robust and high quality science, and an effective and inclusive network based infrastructure to meet the rapidly advancing needs of end users.*

EURAMET MISSION: *(i) Develop and disseminate an integrated, cost effective and internationally competitive measurement infrastructure for Europe taking into account the needs of end users in industry, business and governments; (ii) Support members in meeting their own national requirements through collaboration and establishing a balanced European measurement infrastructure.*²¹

²¹ EURAMET Strategic Research Agenda.

ANNEX 2. STEPS INVOLVED IN THE IMPLEMENTATION AND EVOLUTION OF THE EMRP AND THE EMPIR

EURAMET e.V. was established in 2007 as the dedicated structure for the elaboration and implementation of a future European joint research programme on metrology, resulting from a pre-existing collaboration among EU countries and their associated NMIs.



① iMERA (Implementing Metrology in the European Research Area)

After the “Metrology in the European Research Area” study which examined the potential for top-level metrology in Europe, the ERA-NET iMERA was established in order to respond to the main outcome of this study, i.e. the need to increase collaboration amongst NMIs. It enabled a higher and more structured cooperation among European countries and the preparation of a joint metrology research programme.

② iMERA-Plus (Implementing Metrology in the European Research Area-Plus)

This ERA-NET Plus is considered to be the first phase of the European Metrology Research Programme (EMRP) before the actual implementation of the latter. It launched a call for joint research projects under the EU 7th Framework Programme, leading to the selection and execution of 21 3-year research projects with a total value of 64 M€. Funding resources from 19 EU countries were committed in order to finance these projects.

③ EMRP (European Metrology Research Programme)

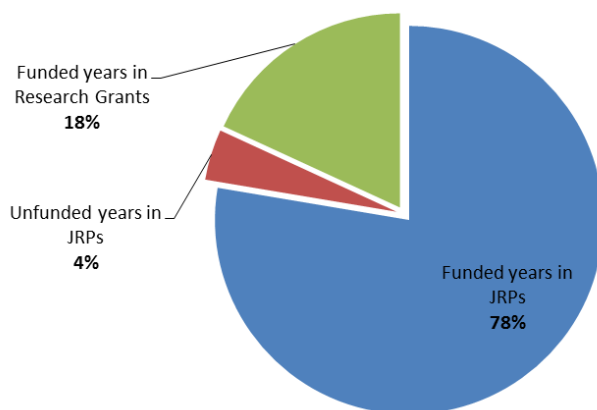
The EMRP was implemented by EURAMET as an Article 185 initiative and launched its first annual in 2009, which was followed by four other annual calls, facilitating the execution of 119 selected Joint Research Projects throughout Europe, each of them running for three years. The final projects from the 2013 Call are expected to report in 2017.

Each annual call addressed up to 3 different Targeted Programmes (see table below). Targeted Programmes such as the ones on Energy and Industry were associated to more than one annual call in order to enable the implementation of follow-up projects which could either deepen the results of the first project or facilitate their dissemination and application.

Year of Call	2009	2010	2011	2012	2013
Associated Targeted Programmes	<ul style="list-style-type: none"> • Energy 	<ul style="list-style-type: none"> • Industry • Environment 	<ul style="list-style-type: none"> • Health • SI Broader Scope • New Technologies 	<ul style="list-style-type: none"> • Industry • SI Broader Scope • Open Excellence 	<ul style="list-style-type: none"> • Energy • Environment

Researcher grants were allocated in order to contribute to the EMRP Joint Research Projects and allowed a high exploitation of **human resources** (see Fig. 1.) as funded person-years in research grants amounted to almost 20% of the total number of person-years needed for the implementation of the EMRP (i.e. 2725 person-years).

Figure 1. Human resources used during the EMRP



Source: EMRP Data Summary (extracted on January 26th 2016)

Box 2. Focus on the Targeted Programme Energy

The Targeted Programme on Energy, whose overall objective is to “establish the measurement infrastructure necessary to support Europe’s sustainable energy goals”, involved nine Joint Research Projects with a total investment of €32 million through its 2009 Annual Call. The projects were executed by 39 NMIs and DIs from 23 European countries as well as the NMIs from USA, Japan, Korea, Brazil and Australia: three projects were on sustainable energy, two on low carbon technologies and four on modernizing the electricity infrastructure. Strong engagement with end-users has been emphasized through these projects.

Key achievements	Key figures
<ul style="list-style-type: none"> • Supporting innovation in measurement technology by: <ul style="list-style-type: none"> - Future-proofing Europe’s gas networks - Developing next-generation nuclear energy - Supporting energy savings through the improved monitoring of power plant processes - Developing smart electrical grids by providing new calibration techniques and stability monitoring - Supporting energy harvesting in the automotive industry • Supporting standardisation for sustainable energy thanks to: <ul style="list-style-type: none"> - New regulations supporting the adoption of Liquefied Natural Gas - New standards on LED lighting guaranteeing a safer and more efficient electricity supply - A new standard supporting the biofuel-ready vehicles - New standards for cost-effectiveness of biogas - New standards for digital data in the nuclear industry 	<ul style="list-style-type: none"> • 15 academic research groups involved • 20 businesses from the energy and instrumentation sectors • 164 articles in peer-reviewed journals • 504 presentations at conferences and 28 presentations at workshops and seminars • 71 articles in the trade and popular press and 6 media interviews • 43 published newsletters and popular press releases, EURAMET website • 127 contributions into 67 technical committee and working groups • 2 patent applications • €9 million sales of innovative products and services to date • 8 contributions to standards

Source: Energy Impact Report (2016)

④ EMPIR (European Metrology Programme for Innovation and Research)

The EMPIR is the successor of the EMRP and focuses on enhancing interactions with centres of excellence and end-users to increase the impact of its work. Capacity building is also an EMPIR priority for better involving less research intensive countries. The Targeted Programmes covered by the annual EMPIR calls are given below.

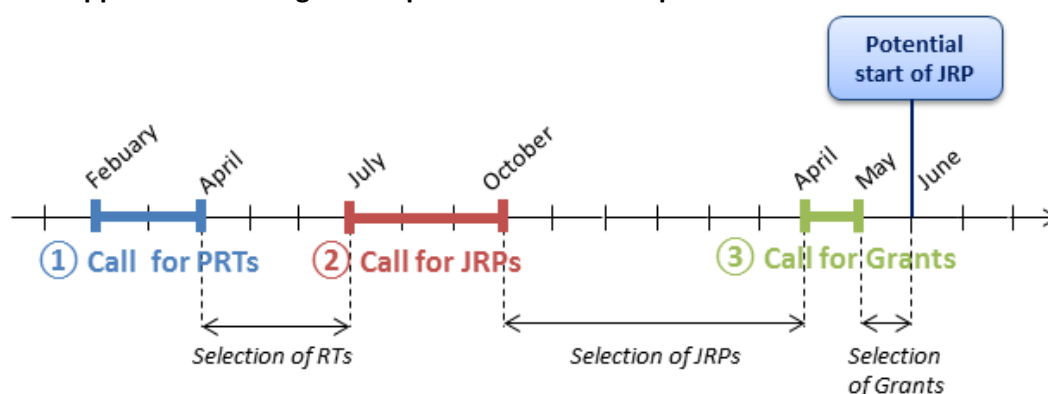
2014	2015	2016	2017	2018	2019	2020
<ul style="list-style-type: none"> • Industry • Research Potential 	<ul style="list-style-type: none"> • Health • SI 	<ul style="list-style-type: none"> • Energy • Environment 	<ul style="list-style-type: none"> • Fundamental • Industry 	<ul style="list-style-type: none"> • Health • SI 	<ul style="list-style-type: none"> • Energy • Environment 	<ul style="list-style-type: none"> • Fundamental • Industry

ANNEX 3. EMRP ANNUAL CALL PROCESS²²

The five annual calls of the EMRP were all implemented through a 3-stage procedure.

Stages	Description
<p>Call preparation <i>Defining the call scope</i></p>	<p>The scope of the call is defined on the basis of the EMRP Outline and thanks to consultations with different stakeholders (European Commission, European Standards Organisations, Industry, etc.). It is approved by the EMRP Committee.</p>
<p>Stage 1 <i>Identifying metrological challenges</i></p>	<p>This first stage is a call for Potential Research Topics (PRTs) which allows the EMRP Committee to identify and prioritize the most important research topics and analyze the available resources to address these topics. Any person or organisation can submit a PRT; its selection relies on its relevance regarding the scope of the call and societal needs, and on its demonstration of available expertise and infrastructure. The EMRP Committee approves a list of selected research topics which serve as a basis for the following call for proposals for Joint Research Projects.</p>
<p>Stage 2 <i>Selecting Joint Research Projects</i></p>	<p>Proposals for Joint Research Projects (JRPs) are evaluated by a group of independent referees selected from the EU 7th Framework Programme according to the following criteria: (i) scientific and/or technical excellence, (ii) relevance to EMRP objectives, (iii) potential impact and (iv) quality of management. A Review Conference gathers all referees and potential JRP-coordinators, enabling a common scoring procedure by referees and resulting in the approval of a single ranked list of projects. Researcher Excellence Grants (REG) can be directly associated to a JRP proposal during this stage.</p>
<p>Stage 3 <i>Selecting Researcher Grants</i></p>	<p>Researcher Excellence Grants and Researcher Mobility Grants (RMG) can be provided once the selected JRPs are known and are necessarily associated to a specific JRP. JRP-coordinators provide the EMRP with adverts for specific desired researcher grants, which are then published as the call is launched. REGs can only be attributed within the wider non NMI/DI research community while both EMRP participating and non-participating countries can benefit from RMGs to increase capacity building within their metrology research activities and expertise. Researcher Grants are also evaluated by the group of independent referees.</p>
<p>Open Call <i>Supporting young researchers</i></p>	<p>This Early-Stage Researcher Grant (ESRMG) scheme seeks to support early-stage researchers in travelling from one JRP-partner to another and encourage them to carry out additional research activities complimenting the considered JRP (contribution towards travelling fees, accommodation, etc.). It is open during the entire period covered by the EMRP Programme.</p>

Figure 1. Approximate timing and steps involved in the implementation of an annual EMRP call



²² EMRP Call Process (2011); http://www.emrponline.eu/downloads/emrp_background.pdf