INTRODUCTION TO EURAMET AND THE EMRP

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Rezumat. *Lucrarea prezintă sintetic etapele principale ale dezvoltării ştiinţei şi tehnicii măsurării precum şi rolul acesteia în cercetarea şi dezvoltarea aplicativă. De asemenea, este descris drumul parcurs pentru promovarea, lansarea şi aprobarea Programului European de Cercetare în Metrologie (EMRP). Lucrarea a fost prezentată în faţa Comitetului pentru Industrie, Cercetare şi Energie, ITRE, cu ocazia întâlnirii care a avut loc în data de 10 septembrie 2008 la Brussels între reprezentaţii EURAMET şi membrii acestui Comitet al Parlamentului European.*

Cuvinte cheie: *metrologie, Programul European de Cercetare în Metrologie.*

Abstract: *The paper presents in short the main steps in the development of science and practice of measurement and its role in the applicative research and development. Also, it is described the road towards the promotion, launching and approval of the European Metrology Research Programme (EMRP). The paper was presented to the Committee on Industry, Research and Energy, ITRE during the meeting of the representatives of EURAMET and the members of this Committee of the European Parliament, taking place in Brussels, on September 10, 2008.*

Key words: *Metrology, European Metrology Research Programme.*

1. INTRODUCTION[1]

Measurement underpins virtually every aspects of our daily lives. The food we eat, the air we breathe and the ability to understand climate change, the water we drink and the goods we buy all require many measurements to ensure quality and safety, and to keep us healthy. Should we fall ill we rely on important measurements associated with our health care, in both diagnosis and therapy. In industry measurements are crucial, in manufacturing, process control, telecommunications, transport and many other sectors. Our ability to measures defines the boundary of possibility, what we cannot measure, we generally do not understand properly and we cannot make nor control reliably. Thus advances in the science of measurement – metrology – have a profound impact on understanding.

Practically all governments in advanced technological countries support a measurement infrastructure because of the benefits it brings. In many countries national research programmes and activities respond to the demand for measurement standards of ever increasing accuracy, range of diversity, striving to improve the measurement capability. Although there are differences broadly all have the same core objectives: to drive innovation, to support sound policy and regulation (and thus to protect us, the citizen) and to provide ever better tools for other scientific disciplines. The measurement infrastructure and the associated research are managed and delivered via the National Metrology Institutes (INM)… In modern global economy comparability of measurements and interoperability is crucial.

Based on the outcomes of the iMERA project, the stakeholder consultation and roadmapping exercise, a dedicated work programme – the European Metrology Research Programme (EMRP) was developed specifically with Article 169 in mind.

Recognizing both the need for the initiative and the successful preparatory work, the European Commission identified the EMRP as one of just four priority topics for Article 169 in the FP7, three of them for the Specific Programme 'Cooperation' and one for 'Capacities', although crucially no specific budget line was allocated for any of the Article 169 initiatives.

In the 54/79 Annex IV Joint Technology Initiatives of Non-Community Research Programmes – corrigendum to Council Decision 2006/971/EC of 19 December 2006 it is stated:

"Article 169 initiative in the field of Metrology

The aim will be to launch and implement a cohesive joint metrology R&D programme integrating a number of national programmes, which will enable Europe to respond to the growing demands for cutting-edge metrology as a tool for innovation

[1] Selected from "*Towards a European Metrology Research Programme under Article 169"*, Position Document adopted by the Core Group in the discussions with the Commission Services.

supporting scientific research and policy. The initiative will support, in particular, the objectives of the European National Measurement Systems delivered via the National Metrology Laboratory networks".

Also, in the Annex IV of the 2007 'Cooperation' Work Programme, section A4.2.2.2 Activity: ERA-NET Plus actions, page 13, under the title 'Special Cases: ERA-NET Plus in the field [sic] of Metrology and Baltic Sea Research', available on ftp://ftp.cordis.europa.eu/pub/fp7/docs/com2005_0440en01.pdf it is stated that:

"The Commission will provide its financial support to EURAMET e.V. (the legal entity to be set up for the implementation of an ERA-NET Plus action in the field of Metrology) in order to bridge the gap between the iMERA ERA-NET project and a joint European research and development programme in the field of Metrology (the science of measurement) to be implemented on the basis of Article 169 of the Treaty."

The core group (Michael Kühne, Luc Erard and Andy Henson) - mandated by the EMRP Committee to negotiate with the European Commission the basis of the Programme prepared and gave the presentation 'Introduction to EURAMET and the EMRP' to the Committee on Industry, Research and Energy, ITRE, on September 10, 2008.

2. INTRODUCTION TO EURAMET AND THE EMRP

The presentation of the state-of art of EURAMET and EMRP was given as '.ppt' to the Committee on Industry, Research and Energy, ITRE during the meeting of the representatives of EURAMET and the members of this Committee of the European Parliament, taking place on Brussels, on September 10, 2008, as presented in slide 1 (Fig. 1).

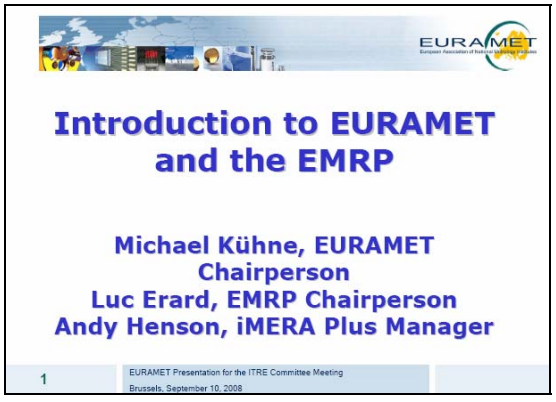

Fig. 1

Main topics of the presentations, as presented in slide 2 (Fig. 2), are:

- **What is Metrology?**
- **The Role of the National Metrology Institute**
- **The Importance of Research and Development**
- **The European Metrology Infrastructure**
- **The Road to Coordinated European Research in Metrology**
- **The European Metrology Research Programme (EMRP)**
- **The Initiative for an Article 169 based EMRP**
- **Conclusions**

Fig. 2

What is Metrology?

Metrology [www.bipm.org] is the science of measurement, embracing both experimental and theoretical determinations at any level of uncertainty in any field of science and technology.

Examples of historical measurement standards are given in slide 3 (Fig. 3) for length and time.

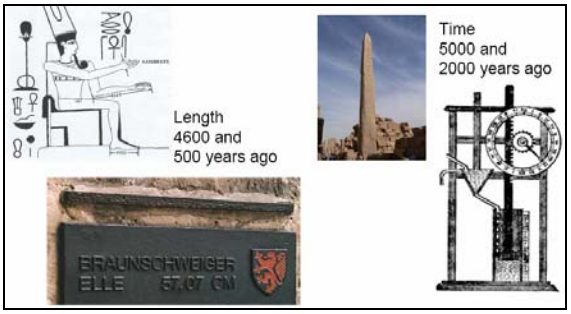

Fig. 3

The Role of the National Metrology Institute

Foundation of National Metrology Institutes is exemplified in the slide 4 (Fig. 4) with the former PTR building.

Fig. 4

Major Tasks of NMIs are

– Develop and maintain national measurement standards;

– Establish the traceability of these standards to the international system of units (SI) established by the Meter Convention;

– Disseminate the SI through calibrations to industry, society, and science;

– R&D for improving national measurement standards, development and validation of new measurement methods;

– Knowledge transfer to industry;

– Provide advice to government, society, and industry on metrological issues.

The Importance of Research and Development

The **advances in metrology through research** are exemplified in slide 6 (Fig. 5) for time measurement standards.

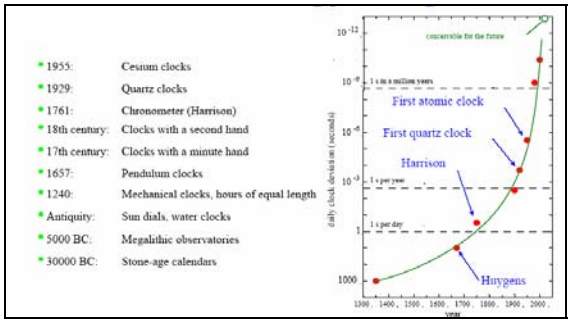

Fig. 5

Metrology R&D and Industry contributions are given in slide 7 (Fig. 6) for inline measurement of complex geometries, nanometer requirements in semiconductor industry and time on a quantum basis, e.g. for navigation.

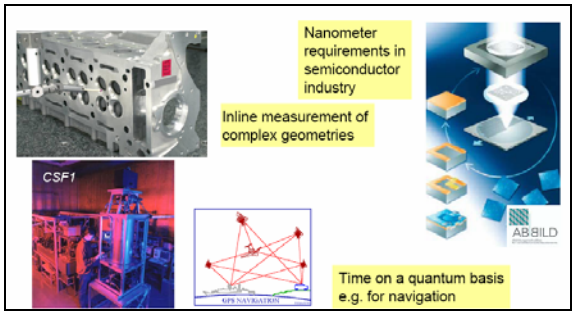

Fig. 6

An example of **solving Problems in Manufacturing** by means of metrology is given in slide 8 (Fig. 7).

Metrological Research for Society is the consequence of the European Directives specifying numerical values for certain quantities. Typical examples of are given in slide 9 (Fig. 8).

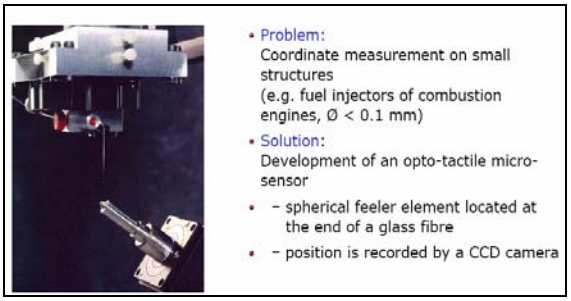

Fig. 7

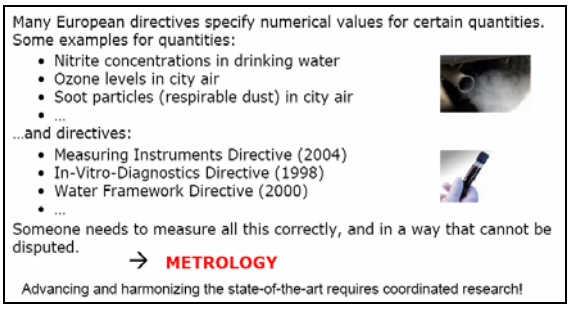

Fig. 8

The **consequences of inaccurate measurements** in clinical chemistry are given in slides 10 and 11 (Figs. 9 and 10) for cholesterol measurement.

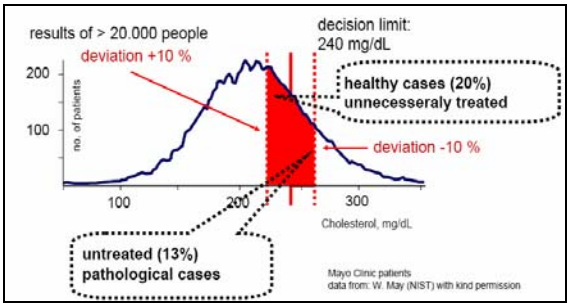

Fig. 9

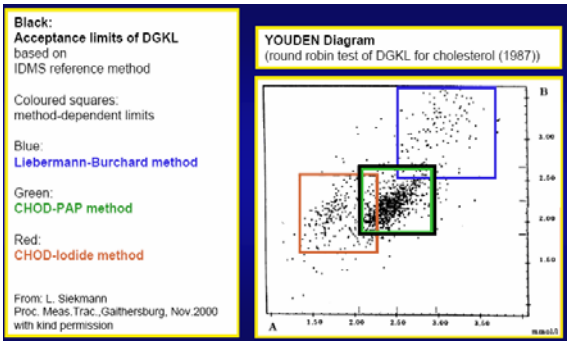

Fig. 10

Another domain of the modern society where the measurements play an important role is the **Cosmic Radiation in Airplanes.**

Natural radiation is much higher at 10 km altitude than on the ground. This is not a problem for passengers, but how about pilots and flight attendants?

This situation is presented in slide 12 (Fig. 11).

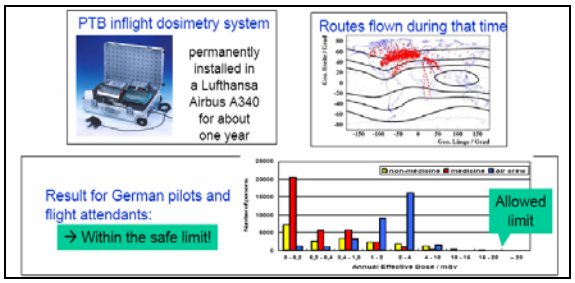

Fig. 11

Metrology for Fair Trade / Legal Metrology represents another important area for action.

Fair trade requires correct measurements. This statement is illustrated for the case of natural gas in slide 13 (Fig. 12).

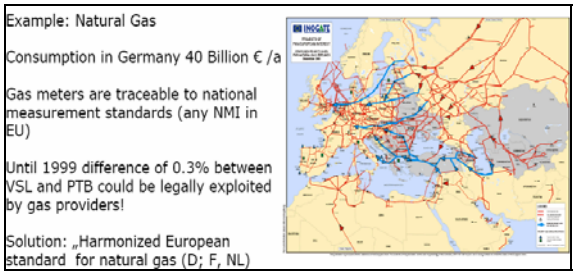

Fig. 12

All the examples presented so far show the **Increasing impact** of the metrology. This impact was also concluded in the Report of DG-Research GROWTH Programme Contract No: G6MA-2000-2002 as following:

"Our main finding is that this area of activity is extremely important in economic terms both because of the absolute size of measurement activity and because of the significant and wide ranging benefits it produces in underpinning technological innovation, growth, industry, trade and social programmes. Europe spends more than €83 billion per year, or nearly 1% of EU GDP, on measurement activity from directly quantifiable sources alone. Adding in social spending on health, environmental regulation, safety testing, anti-fraud projects and normal day-to-day activity raises this figure considerably. By comparing these costs with estimates of the benefits of measurement, we can see that this money is well spent. Our econometric estimates of the economic impact of measurement activity show that this spending generates almost €230 billion of directly estimable benefits through application and from the impact measurement knowledge has on technology driven growth. This is equivalent to 2.7% of EU GDP. Put another way, **for every euro devoted to measurement activity nearly three euros are generated by way of directly estimable benefits alone**. This is true even without taking into account the very large benefits to society in terms of health, safety and the environment, which would raise the benefit to cost ratios even further."

DG-Research GROWTH Programme Contract No: G6MA-2000-2002; Geoffrey Williams et al., Pembroke College, Oxford, 2002

"Measurement, testing and the definition of common standards, are essential elements in the establishment of a knowledge-based economy that the European Union is striving to build. In this context, a powerful European metrology infrastructure is crucial to ensure the proper functioning of the European single market and to strengthen the competitive position of European enterprises in the global marketplace."

P Busquin, 2002

The European Metrology Infrastructure

Until June 30, 2007: the Regional Metrology Organisation in the CIPM multilateral agreement on the recognition of national measurement standards was **EUROMET**, established by Memorandum of Understanding (MoU) in 1987. NMIs from 33 countries and JRC-IRMM of the CEC were the members of EUROMET.

Since July 1, 2007: The European Association of National Metrology Institutes, **EURAMET** took over the responsibilities as RMO as the successor of EUROMET. EURAMET [**http://www.euramet.org**] was inaugurated on January 2007 and registered as "not for profit" Association (e.V.) in Germany (on April 2007). EURAMET e.V is a legal entity including 32 NMIs as Members, IRMM as Associate and 4 Corresponding Applicants, as shown in the map of the association.

The association serves the promotion of science and research and European co-operation in the field of metrology. Additionally, the aim of the association will be realized by the development, regular updating and implementation of an European Metrology Research Programme (EMRP). EURAMET byelaws].

Fig. 13. Map of the EURAMET e.V (slide 15).

EURAMET Research in Numbers is:

– 32 EURAMET members employ about 4000 persons;

– About 2000 persons work on R&D activities;

– The EURAMET members spend about 200 M€ per year (50% of total budget) on R&D activities.

The Road to Coordinated European Research in Metrology

The background for coordinated research in metrology is represented by MERA Study, as illustrated in slide 17 (Fig. 14).

Fig. 14

Within the EU 5th Framework Programme EUROMET conducted a study "Metrology for the European Research Area" (MERA) [**CONTRACT N°:** G6MA-CT-2002-04012], which analysed the metrological needs for Europe at the beginning of the 21st century. MERA was a first cut "no holds barred" look at what the future. The follow up, iMERA focuses on implementing what is achievable and that pivots around collaborative R&D.

iMERA - Implementing the Metrology European Research Area in brief is given in slide 18 (Fig. 15).

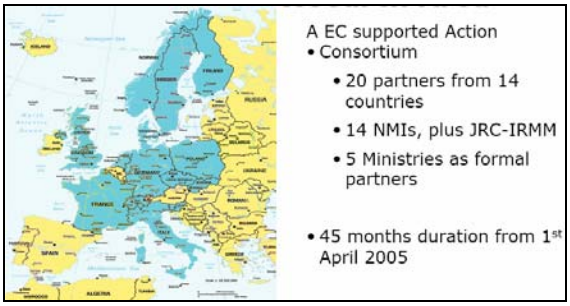

Fig. 15

The **Potential for more NMI:NMI R&D Collaboration** is summarised in slide 19 (Fig. 16).

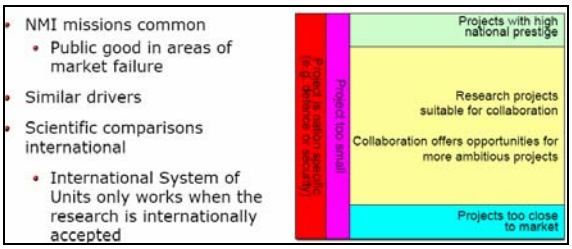

Fig. 16

The iMERA work programme consisted of 6 Work packages with over 30 tasks. The key elements of these tasks were:

- Develop the structures for joint coordinated research;
- Develop the roadmaps for joint research
- Consult stakeholders;
- Develop the European Metrology Research Programme;
- Explore the possibility for European co-funding.

Main workshops organized and focused on different tasks of iMERA are illustrated in slide 21 (Fig. 17).

Fig. 17

The European Metrology Research Programme (EMRP)

Developing the EMRP meant more than 2 years of consultation. Main input contributions are presented in slide 22 (Fig. 18).

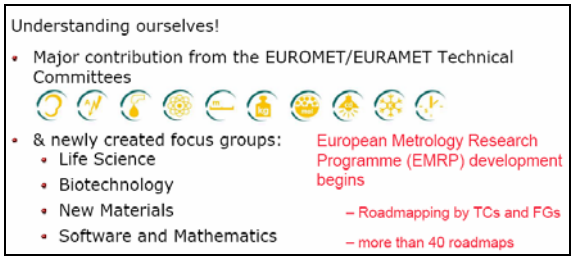

Fig. 18

More than 40 roadmaps have been developed. The Roadmap developed in dimensional metrology is presented in slide 23 (Fig. 19).

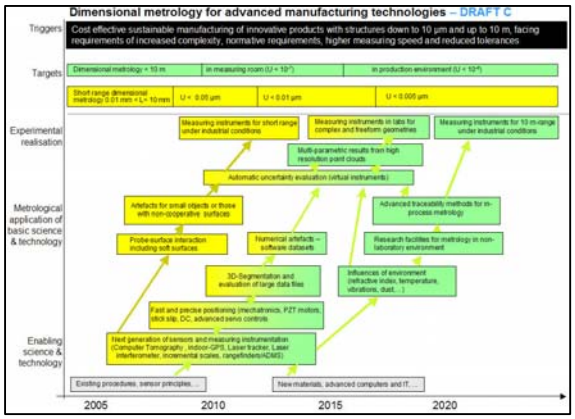

Fig. 19

Also, several **EMRP Stakeholder Workshops** were organized in the sectors specified in slide 24 (Fig. 20).

Fig. 20

EMRP is structured in two main axes, presented in the slide 25 (fig. 21) together with the document issued on March 2007 and available on the EURAMET website [www.euramet.org].

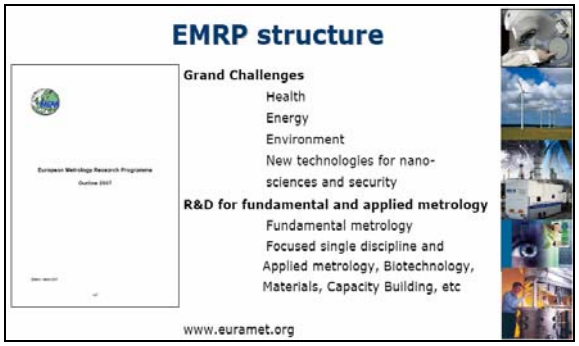

Fig. 21

The key **Grand Challenges in Metrology** are:

Health	• virtual human (modelling system biology) • reference measurements and materials (JCTLM) • quantitative diagnostics (imaging, microscopy, etc.) • diagnostic and therapeutic instrumentation (NMR, ultrasound, etc.)
Energy	• new and renewable energy resources • conventional energy system • smart energy networks
Environment	• detecting change and monitoring climate • flow and concentration of substances under regulation • carbon dioxide sequestration • environmental noise
New Technologies	• nanotechnology • security related metrology

One of the main aims of EURAMET is the execution of a coordinated European Metrology Research Programme. To meet this, several steps were taken:

January 2007:
– Inauguration of EURAMET
– Inauguration of EMRP Committee
http://www.euramet.org

April 2007:
– Registration as a "not for profit" Association (e.V.) – Germany

July 2007:
– EURAMET became the European Regional Metrology Organisation under the Metre Convention.

The organisational chart of the EURAMET e.V is given on the right side of the slide 27 (Fig. 22).

Note that to strengthen the importance of the EMRP, the Chairperson of the EMRP-Committee is one of the two Vice-Chairpersons of EURAMET.

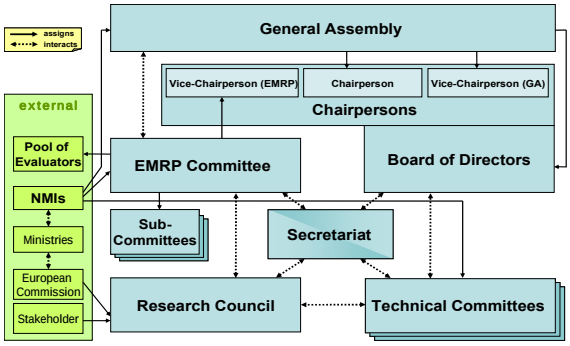

Fig. 22

Piloting EMRP in iMERA-Plus is presented in slide 28 (Fig. 23).

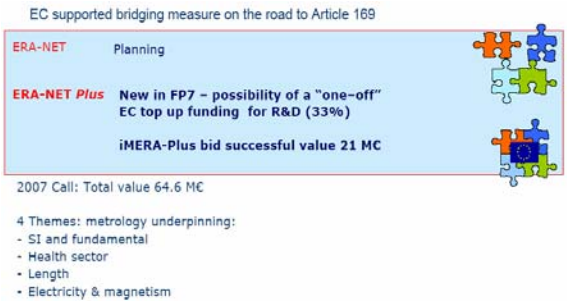

Fig. 23

The process of **R&D Call & Selection** within the **iMERA-Plus 2007** is described in slide 29 (Fig. 24).

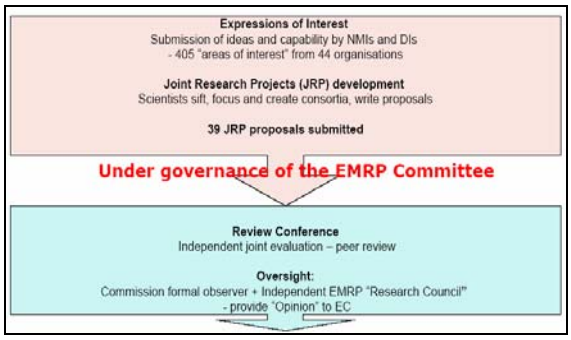

Fig. 24

The call and selection of the project implies a 2 stage process: I - Submission of Expression of Interests and II - Referees review the JRPs at a review conference and create one ranking list. The EMRP Committee decides on the basis of the ranking list the projects to be submitted for funding.

Main outcomes of **iMERA Plus Call** and the members of the **Research Council** are presented in slide 30 (Fig. 25).

The 21 Joint Research Projects (JRPs) recommended for funding starting 2008, are summarised in slide 31 (Fig. 26).

Fig. 25

Fig. 26

Main **characteristics of iMERA-Plus Projects** are:

- Collaborative projects selected by independent experts based on excellence criteria;
- Coordinated research to avoid unnecessary duplication;
- Create critical mass beyond the capabilities of a single NMI;
- Should lead to „Centers of Excellence" and help to distribute workload among European NMIs.

The Initiative for an Article 169 based EMRP

The EMRP is one of four Article 169 research initiatives under consideration by the European Commission.

The in favour or against arguments towards an article 169 based EMRP are summarised in slide 33 (Fig. 27).

The progress towards Article 169 is concluded in slide 34 (Fig. 28).

In parallel to iMERA-Plus, lots for us to do!

Main pillows in **Preparing EMRP via Article 169 of the Treaty** are illustrated in slide 35 (Fig. 29).

A possible scenario of **Article 169 - how might the programme look**, is presented in slide 36 (Fig. 30).

	Pros	Cons	Comments
Do nothing	• Simple	• Current performance at European level inadequate • Current mechanism(s) are being overwhelmed • No opportunities in newcomer countries	Risk of seriously compromising European science, innovation and industrial competitiveness **"Slow decline"**
Further "Bottom up" ERANET + continuation	• Simple • Uses existing mechanisms • Some coordination • Brings modest resource	• No strategic planning option • No realistic "package" solution • Does not contribute to ERA	One offs - Undermined by the difficulty of planning across sectors and technologies and over time **"Stop Gap"**
A metrology theme in FP	• Simple – but requires substantive change to FP • Enables horizontal topic to be addressed • Brings resource	• Tried and dropped • Does not deliver any coordination of national Programmes • Requires detailed & complex Commission management	SMT & MTI in FP4 & FP5 **"Funding, but not shaping"**
Article 169	• Integrates national activities • Brings significant needed additional resource • Attracts new players • Allows "package" solution	• Heavy approval mechanism	**ERA in metrology places Europe at the forefront**

Fig. 27

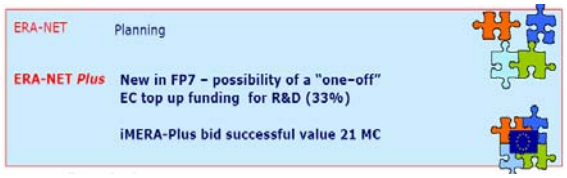

Fig. 28

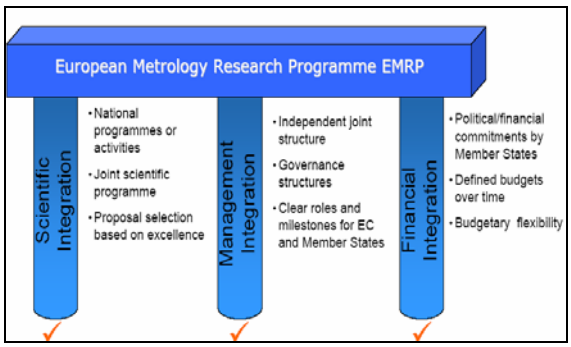

Fig. 29

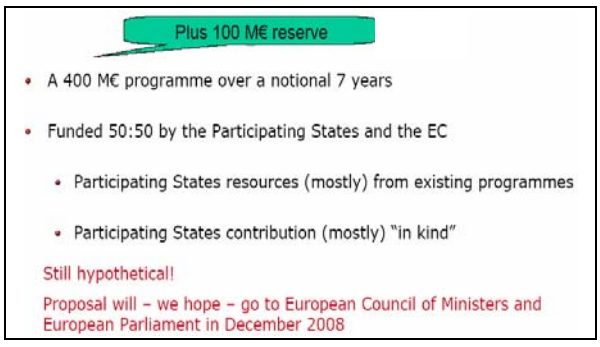

Fig. 30

State of the Play with Article 169 (slide 37 – Fig. 31) is:

	Current offering:		
	Total	***EC***	***MS***
Research			
Projects	344 M€	164	180
Grants	40 M€	36	4
Running costs	16 M€	0	16
Total	400 M€	200	200

Fig. 31

Call planning & mechanisms (slide 38 – Fig. 32) is as followings:

- **5 Call cycles at approximately 12 month intervals**
- **Core JRP calls are 2 stage;**
- **Call for topics**
- **Call for Joint Research Projects NMI/DI community**
- **External Researcher Grants**
- **With JRP submission**
- **Added value grants "after the fact"**
- **Mobility grants**

Fig. 32

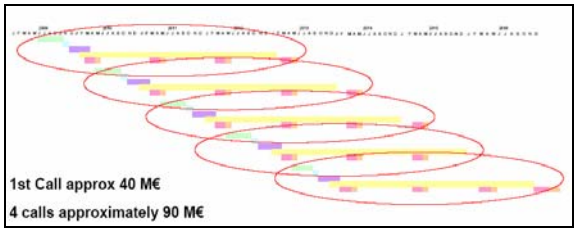

Fig. 33

The Road Towards Article 169 describing the principles, type of programme and the participating countries is presented in slide 40 (Fig. 34).

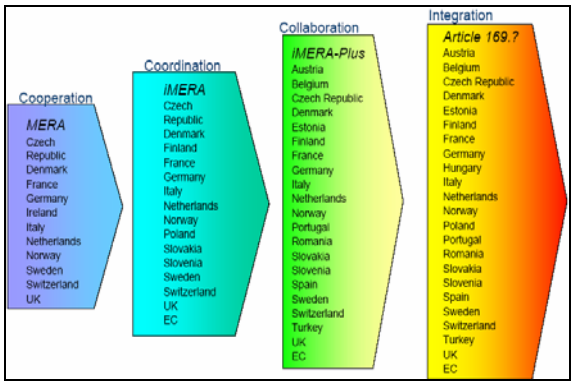

Fig. 34

3. CONCLUSIONS

- EURAMET e.V. has created the structures for coordinated European research in metrology;
- The iMERA-Plus programme has shown the ability of EURAMET e.V. to plan and execute such a coordinated research program;
- Independent referees and the High Level Experts of the Research Council have confirmed the excellence of the approved collaborative research projects;
- EURAMET e.V. is ready to launch an integrated metrology R&D programme for Europe.

In order to keep or improve its role as a competitive player in the global market, Europe must:

- Coordinate its national metrology research programmes to create critical mass for sufficient impact in Europe;
- Improve the research capabilities of medium sized NMIs;
- Address the great challenges of metrology in the fields of Health, Energy, Environment and New Technologies.

These goals can be only achieved through a joint European effort, an article 169 based European Metrology Research Programme.

Having the permission of prof. Michael Kühne to publish the presentation 'Introduction to EURAMET and EMRP', the material was slightly adjusted for editing in accordance with the requirements for publication in the Metrologie Revue.

Revizia ştiinţifică a articolului:
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