COUNCIL OF THE EUROPEAN UNION

Brussels, 8 December 2008

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RECH 376
COMPET 498

COVER NOTE

from:	Secretary-General of the European Commission, signed by Mr Jordi AYET PUIGARNAU, Director
date of receipt:	4 December 2008
to:	Mr Javier SOLANA, Secretary-General/High Representative
Subject:	Commission staff working document accompanying document to the Decision of the European Parliament and of the Council on the participation by the community in a European metrology research programme undertaken by several member states - Annexes to the Impact assessment report

Delegations will find attached Commission document SEC(2008)2949/2.

Encl.: SEC(2008)2949/2

ANNEXES

Annex 1

Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty

Analysis and responses to the online survey

– FINAL –

The nature of the consultation

As part of the stakeholder consultation regarding the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty, an online survey was conducted by DG Research between 7 May and 8 July 2008.

A total of 162 responses to the online survey were recorded, with 64% (104 responses) replying on behalf of an organisation and 36% in an individual capacity. Of those replying on behalf of an organisation, the majority were from commercial organisations with less than 250 employees (26%), commercial organisations with more than 250 employees (21%) and higher education institutions (18%). The survey respondents were mainly involved in metrology research (54%) or in the take-up and use of metrology (28%). While the vast majority of the survey respondents were resident in Europe (the largest group being resident in Germany (49%) followed by United Kingdom (8%) and Switzerland (8%)), replies were also received from outside the EU, notably from USA, Singapore and Korea.

In addition to the online survey, a stakeholder consultation workshop was organised on 25 June 2008. The conclusions of this workshop are reported in a separate document.

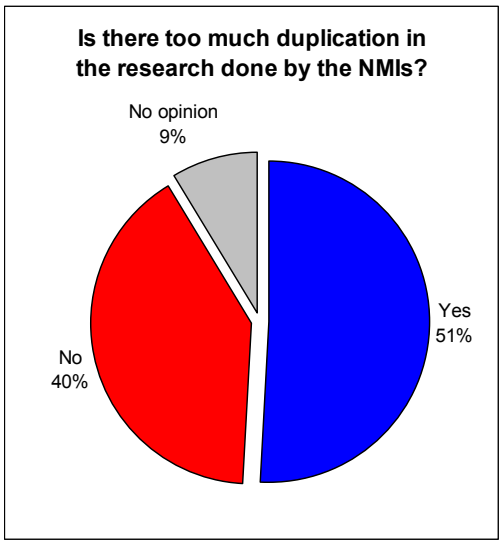
Summary of the results

A full statistical report on the responses to each of the questions is attached. Only the most significant outcomes of this survey are highlighted in this section.

- The effectiveness of metrology research as implemented by the National Metrology Institutes (NMIs) can be improved

About half of the survey respondents (51%) agree that under today's circumstances there is too much duplication in the research conducted by the NMIs (Figure 1a).

A much more outspoken majority (82%) is of the opinion that metrology research would benefit from a better coordination of the national metrology research programmes as implemented by the NMIs (Figure 1b).



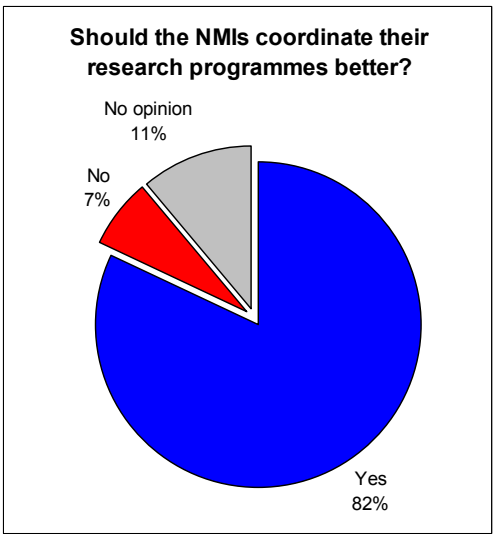


Figure 1a **Figure 1b**

From those survey respondents in favour of more coordination between the national metrology programmes, about two thirds (65%) find that this should be organised at European level, whereas about one third (34%) prefers such coordination to be planned at a global scale.

– *Need for trans-national priority setting in metrology*

A vast majority of the survey respondents (84%) are of the opinion that the National Metrology Institutes (NMIs) should work together on joint priorities such as a single joint metrology research programme in order to tackle major European challenges (Figure 2).

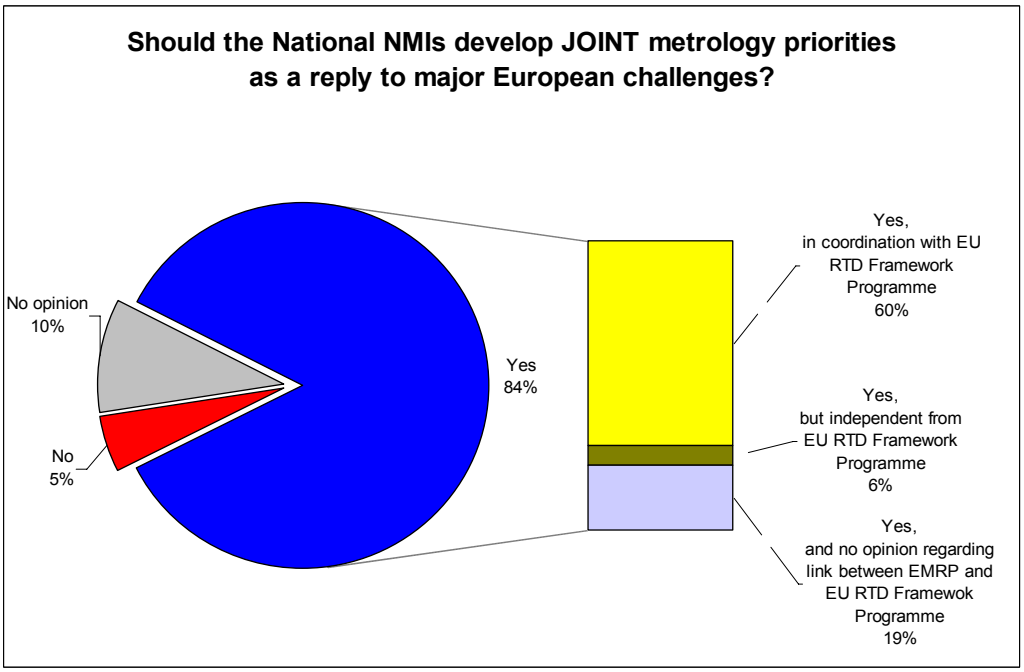


Figure 2

– *Joint priority setting in collaboration with EU RTD Framework Programme*

From those survey respondents in favour of such a joint priority setting, most are of the opinion that this should be organised in coordination with the EU RTD Framework Programme. This represents 60% of all survey respondents (Figure 2).

– *Issues relevant for EMRP*

The cooperation with specialised science actors (universities and RTD centres) is mentioned by the survey respondents as the most relevant issue (66%) to be taken up by EMRP (Figure 3). The other proposed issues also attain significant attention (39% for staff mobility to 59% for technology transfer).

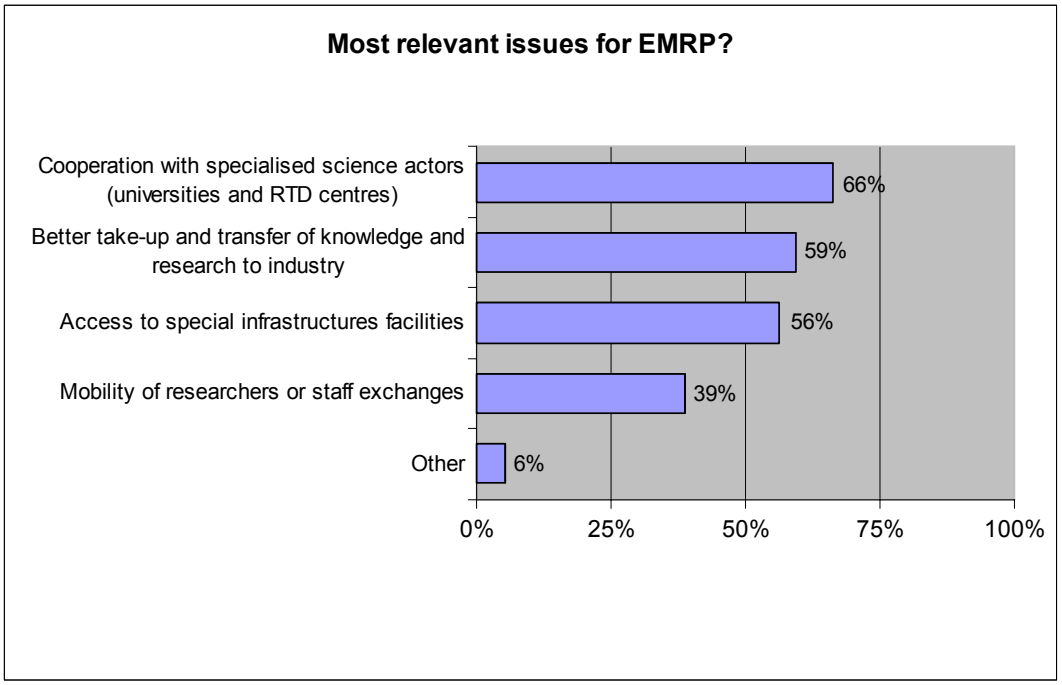


Figure 3

– *How open should EMRP be?*

Regarding the openness of the EMRP programme, half of the survey respondents (50%) prefers to limit it to European research performers in the field of metrology. It has to be noted however, that the survey respondents who want a more open EMRP (openness to any European RTD performer independent of activity and status, or openness to any global metrology RTD performer) together represent also 44%.

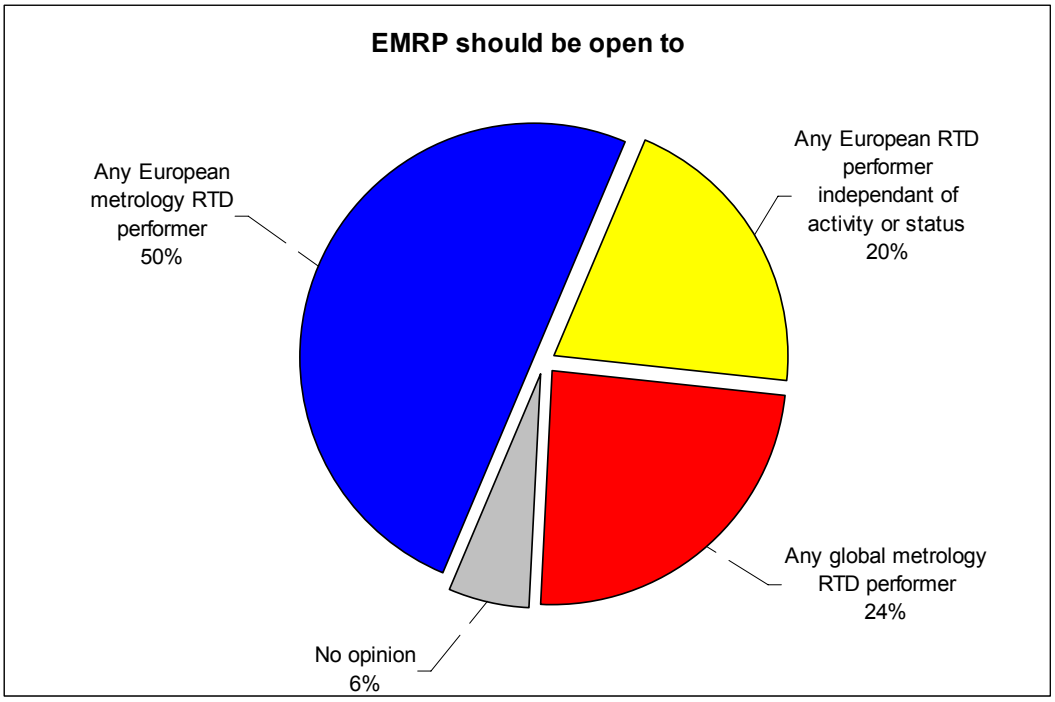


Figure 4

17 July 2008

Annex 1.1:

Response statistics for "Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty" online survey

Response statistics for 'Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty'

Current search:

Query definition

All data requested

Result pages

There are 162 responses matching your criteria of a total of 162 records in the current set of data.

Expand all - Collapse all

Your profile

Please answer the following questions about your profile

You respond to this questionnaire as? -single choice reply- (compulsory)

	Number of requested records	Requested records (162)	% of total number records (162)
A representative of an organisation	104	(64.2%)	(64.2%)
An individual person	58	(35.8%)	(35.8%)

What is the nature of the organisation you represent? -single choice reply- (compulsory)

	Number of requested records	Requested records (104)	% of total number records (162)
Commercial organisation (including consultancy) fewer than 250 employees	27	(26%)	(16.7%)
Commercial organisation (including consultancy) more than 250 employees	22	(21.2%)	(13.6%)
Higher Education Institution (University, University College, Polytechnic, etc.)	19	(18.3%)	(11.7%)
Governmental body	12	(11.5%)	(7.4%)
Public sector research performer other than Higher Education Institution	10	(9.6%)	(6.2%)
Non-Governmental, not for profit, not representing commercial interest organisation	7	(6.7%)	(4.3%)
Other	3	(2.9%)	(1.9%)
Research funding organisation	2	(1.9%)	(1.2%)
Association representing commercial interests / Chamber of commerce	2	(1.9%)	(1.2%)
Charity / Foundation	0	(0%)	(0%)

What is your country of residence / the country of establishment of your organisation? -single choice reply- (compulsory)

	Number of requested	Requested records	% of total number records

	records	(162)	(162)
Germany	80	(49.4%)	(49.4%)
Switzerland	13	(8%)	(8%)
United Kingdom	13	(8%)	(8%)
Italy	9	(5.6%)	(5.6%)
Spain	9	(5.6%)	(5.6%)
France	6	(3.7%)	(3.7%)
Belgium	4	(2.5%)	(2.5%)
Turkey	4	(2.5%)	(2.5%)
Finland	3	(1.9%)	(1.9%)
France	3	(1.9%)	(1.9%)
Hungary	3	(1.9%)	(1.9%)
Iceland	3	(1.9%)	(1.9%)
Sweden	3	(1.9%)	(1.9%)
Other	3	(1.9%)	(1.9%)
Austria	2	(1.2%)	(1.2%)
Netherlands	2	(1.2%)	(1.2%)
Denmark	1	(0.6%)	(0.6%)
Greece	1	(0.6%)	(0.6%)
Albania	0	(0%)	(0%)
Bosnia-Herzegovina	0	(0%)	(0%)
Bulgaria	0	(0%)	(0%)
Croatia	0	(0%)	(0%)
Cyprus	0	(0%)	(0%)
Czech Republic	0	(0%)	(0%)
Estonia	0	(0%)	(0%)
FYR Macedonia	0	(0%)	(0%)
Ireland	0	(0%)	(0%)
Israel	0	(0%)	(0%)
Latvia	0	(0%)	(0%)
Lithuania	0	(0%)	(0%)
Luxembourg	0	(0%)	(0%)
Malta	0	(0%)	(0%)
Montenegro	0	(0%)	(0%)
Norway	0	(0%)	(0%)
Poland	0	(0%)	(0%)
Portugal	0	(0%)	(0%)
Romania	0	(0%)	(0%)
Serbia	0	(0%)	(0%)
Slovakia	0	(0%)	(0%)
Slovenia	0	(0%)	(0%)

What aspect of metrology are you / is your organisation involved in? -single choice reply- (compulsory)

	Number of	Requested	% of total

	requested records	records (162)	number records (162)
Metrology research	88	(54.3%)	(54.3%)
Take-up / use of metrology	45	(27.8%)	(27.8%)
Other	16	(9.9%)	(9.9%)
Standardization	13	(8%)	(8%)

Your views on the need for action

As you may know today the research done in the field of metrology is concentrated in "single" National Metrology Institutes (NMIs) and related designated institutes. Do you believe that there might be too much duplication in the research done via these national NMIs? -single choice reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Yes	82	(50.6%)	(50.6%)
No	65	(40.1%)	(40.1%)
No opinion	14	(8.6%)	(8.6%)

In your view, should these NMIs between themselves coordinate their national research programmes better? -single choice reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Yes	132	(81.5%)	(81.5%)
No opinion	18	(11.1%)	(11.1%)
No	11	(6.8%)	(6.8%)

At what level should this coordination between the NMIs take place? -single choice reply- (optional)

	Number of requested records	Requested records (132)	% of total number records (162)
At EU level	86	(65.2%)	(53.1%)
At global level	45	(34.1%)	(27.8%)

Your views on the objectives and priority setting

Should the national NMIs develop JOINT metrology research priorities (e.g. exposed in a single joint research programme) as reply to some major European challenges (renewed Lisbon goals, societal and environmental challenges)? -single choice reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Yes	135	(83.3%)	(83.3%)
No opinion	16	(9.9%)	(9.9%)
No	8	(4.9%)	(4.9%)

Should this be done in coordination with the EU RTD Framework Programme? -single choice reply- (optional)

	Number of	Requested	% of total

	requested records	records (135)	number records (162)
Yes	96	(71.1%)	(59.3%)
No opinion	26	(19.3%)	(16%)
No	9	(6.7%)	(5.6%)

To overcome certain shortcomings of today's Metrology Research System, which reasons, concerning better cooperation and coordination, are most relevant for a single joint research programme for Metrology? (more than one answer possible) -multiple choices reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Join forces to provide a common response to common challenges	118	(72.8%)	(72.8%)
Achieving critical mass, to ensure better use of scare resources	99	(61.1%)	(61.1%)
Developing common approaches (e.g. ethics, standards)	80	(49.4%)	(49.4%)
Speaking with "one voice" to third countries - international cooperation (US, China, etc.)	78	(48.1%)	(48.1%)
Addressing global issues	61	(37.7%)	(37.7%)
Other	7	(4.3%)	(4.3%)

To overcome certain shortcomings of today's Metrology Research System, which issues are most relevant for a single joint research programme for Metrology? (more than one answer possible) - multiple choices reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Cooperation with specialised science actors (universities and RTD centres)	107	(66%)	(66%)
Better take-up and transfer of knowledge and research into industry	96	(59.3%)	(59.3%)
Access to special infrastructures facilities	91	(56.2%)	(56.2%)
Mobility of researchers or staff exchanges	63	(38.9%)	(38.9%)
Other	9	(5.6%)	(5.6%)

Your views on the implementation and governance

A potential European Metrology Research Programme should be governed: -single choice reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)
Together in partnership between the EU Member States and the European Commission	118	(72.8%)	(72.8%)
By the national programmes of the EU Member States themselves, without European Commission involvement	17	(10.5%)	(10.5%)
No opinion	12	(7.4%)	(7.4%)
Solely by the European Commission as part of the EU RTD Framework Programme	10	(6.2%)	(6.2%)
Other	2	(1.2%)	(1.2%)

A potential European Metrology Research Programme should be open to: -single choice reply- (optional)

	Number of requested records	Requested records (162)	% of total number records (162)

Any European research performer in the field of metrology	81	(50%)	(50%)
Any global research performer in the field of metrology	39	(24.1%)	(24.1%)
Any European research performer independent from his/her country, activity and status	33	(20.4%)	(20.4%)
No opinion	3	(1.9%)	(1.9%)

Further comments and suggestions

Annex 1.2

Overview of free-style comments to the online survey

Replies to EMRP stakeholder consultation questionnaire

Free style comments - FINAL

1. Scientifical and technological, administrative and budgetary issues must be considered for future integration of EMRP. 2. Project Procedures for JRPS Submission, Approvals and Monitoring must be established

2. A European action is much more realistic than a global approach as a first step.

3. A multidisciplinary approach to the critical and underpinning science of measurement is needed to tackle pan-European issues and meet policy goals including competitiveness, healthcare, security, food and energy supply, chemical safety and sustainability. Co-ordination and collaboration between EU NMIs is essential in achieving the critical mass to face the challenges of 21st century metrology, particularly to realise the benefits of rapidly developing analytical technologies. The greatest gains are possible where metrology supporting platform technologies such as microarrays or advanced mass spectrometry enables a wide range of societal applications. To remain competitive, EU industry needs the support of NMIs to translate innovation into high-value products and processes such as advanced therapies, bioprocesses and sustainable manufacturing. Knowledge sharing, consolidation and harmonisation of EU research and standardisation in these challenging areas will maximise impact. It will be essential for EMRP to remain responsive and flexible, particularly to innovative fields such as biotechnology. Given that EMRP involves 21 NMIs, EU co-ordination is a priority. However, if possible in particular areas co-ordination with other international NMIs (e.g. NIST, KRISS) should be undertaken.

4. According to the continuous change of technology NMI are (except some special applications) able to do professional Research and especially Development independent from or in addition to industrial suppliers. Metrology not in co-operation with an industrial manufacturer or main user is wasted money.

5. Global cooperation and coordination is the unique role of the Inter-Governmental Treaty of the Metre Convention; the BIPM is the Executive Bureau with its laboratories located at the Pavillon de Breteuil in Sevres (Paris) France. European cooperation is needed in order to avoid unnecessary duplication and generate sufficient resources in order to develop European capabilities and competencies in the field of metrology needed for innovation, industrial development, global trade, sustainable economy and improved quality of life (including food safety, health care, environmental conditions, forensics, etc.)

6. I support a programme on the basis of article 169

7. I would hope that a European Metrology Research Programme would seriously consider including research in areas not hitherto addressed by individual Member States programmes.

8. In Europe, there are many unresolved issues relating to standardisation, specifically, but not exclusively in the ICT sector. In a first step, those should be addressed from a purely European perspective. In order to not water down research in this area, I believe that it should be placed outside FPs.

9. Increased cooperation between the Metrology Research System, Academia and research into industry is absolutely necessary.

10. It is important that the research programme is motivated by industry need. There must be a robust process of consultation and feedback with stakeholders.

11. It is important to involve at European level the actors of all areas. Metrology is a interdisciplinary area in which all sector may be involved. To avoid fragmentation it would be better to make a joint and open work programme. Each FP Country should, at first stage, ensure the participation of its constituency to collaborate with other Member States.

12. Metrology becomes more and more important for the development and introduction of new highly sophisticated technologies, because metrology is directly involved in the manufacturing process. This means, that there is an urgent need for metrology to support these technologies.

13. Metrology means the science of measurement. Research is only tool for the innovations. The correlation between national assets owned in metrology and the attained level of national civilizations must be recognized and to be understood. The metrology is also the oldest scientific discipline and the basic of all other sciences thus plays a vital role among the national and international affairs of the worlds civilized nations. On the other hand the research in Metrology can only be carried out not by the newly established young Research Centres but by the old NMIs, those are the evolutionary expert centres. The European idea requires integrations for gaining power to compete regionally and globally. To comply with European mission the NMIs of Europe need to be integrated for sustainable JRPs for the future. This requires sustainable budgetary allocations for the EMRP to be established.

14. Metrology should also address some more relevant topics for industry, like the field of process analytics and control. These fields can only be covered if a strong interaction with industry is requested by the programme

15. Much metrology activity is too slow and we need to get things moving faster by each concentrating on aspects and then funding the work well.

16. Really important initiative

17. Redundancy is the most important thing, at least when very huge facilities are not necessary. It is the basis for ensuring the reliability of the quantity value. One single institute being specialized in and dealing about one field of research is a completely wrong approach and would lead to tremendous errors.

18. Results and work of Informatics should help to understand measurement as a dynamic process, Activities of Prof. Dr. Susanne Albers Informatik University Freiburg (albers@informatic.uni-freiburg.de)

19. Standardization and Road Mapping are critical in my view for both sides. To add funds for this into the programme would be very helpful. Transfer/cooperation for today's and future implementation of technology/state of the art with/into commercial organisation would give clear signals to the industrial players that it makes sense to offer solutions based on these standards and that than would also be adapted on a more global scale by other metrology institutes.

20. The European Metrology Research Programme should include standardization activities, as they are genuine tasks of metrology institutes.

21. There is a critical shortage of funding sources for non-traditional metrology institutes. For my particular field, geochemical microanalysis, the situation regarding available reference materials is poor to totally dismal. Little or no progress is ever made in this field, primarily due to the fact that no national or short-term economic benefits can be readily discerned in this activity. This lack of support and absence of funding application opportunities means that basic research in earth and environmental science is hampered and the quality of the data which are produced is not optimal.

22. There is a definite need for an extension of measurement ranges in the field of high power laser metrology. First contacts between PTB and different companies have been made.

23. There is a need for improved communication, knowledge access and sharing and co-ordination

24. There seems to be many organisations involved in metrology e.g. Euramet, Eurachem, ILAC IUPAC and so on - the co-ordination should be improved if possible so that a EU metrology programme can develop in a coherent way that avoids duplication. Most importantly users from industry, commerce and the public sector must be involved in the development of the programme - so that it is relevant to trade and scientific progress. It could become a pseudo- academic exercise - that should be avoided at all costs.

25. Universities and other research institutions should be involved much more in European research in metrology. That will have two effects: Universities act as multiplier for the new knowledge and experiences AND the metrologists of universities often are excellent experts and cover sometimes aspects/topics neglected by NMIs.

26. warum gibt es diesen Fragenkatalog nur auf Englisch?!

Annex 2:

Report of the workshop on "Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty"

25 June 2008, Brussels

– FINAL –

Introduction

The European Commission is preparing a legislative proposal to support the implementation of a joint European Research Programme in the field of Metrology (EMRP), based on Article 169 of the Treaty. In view of discussing the key principles of this initiative with the relevant stakeholders and to collect their views*, a workshop – Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty – was organised on 25 June 2008 in Brussels.

The workshop brought together 21 key stakeholders in metrology: high-level representatives of European or international organisations with an interest in measurements, standardisation or any other use and application of metrology, directors of National Metrology Institutes, officials of national Ministries and the European Commission as well as researchers in metrology.

After a brief explanation of the concept of the Article 169 and the history of EMRP so far, the various key drivers and characteristics of the initiative were presented. The subsequent sections report on the resulting discussions.

Issue 1: The "metrology dilemma" – the need for a more efficient metrology system in Europe

In view of responding to EU-wide challenges, Europe should strengthen its research capabilities. This should be done by stimulating technological developments but also by supporting the more underlying disciplines, such as metrology: “the technique/the art of measurement”.

In view of responding to EU-wide challenges, metrology itself needs to deal with “new” research topics such as health, biotechnology as well as inter-disciplinary topics such as nanotechnologies. This requires a step-change in terms of investment and an adaptation of the way the NMIs are organised.

At the same time, traditional research topics also need more investments because of the ever smaller dimensions (e.g. electronics) and required precisions (e.g. fuel injection systems).

Only by an increase in investment and a better organisation of metrology research in Europe, Europe will be able to take on the competition with USA and Asia.

Issue 2: What are the benefits of a joint European metrology research programme?

The increasing scope of metrology makes that national metrology research policies and organisations are more and more selective on what areas to focus on. A collaboration between the metrology actors (NMIs and other research organisations) in Europe would allow

specialised research capabilities to be fully exploited and the resulting new knowledge to remain in Europe. This justifies the need for a single European Research Programme, EMRP. All NMIs are favourable to join.

In view of responding to specific requests from metrology users or from technical/standardisation committees, a good cooperation between metrology, standardisation and accreditation is essential. EMRP could be of added value here also if it provides a way to take into account such specific requests within or alongside its research programme.

Issue 3: Metrology research and industry needs

Everyone agreed that the NMIs - due to their mandate of long term research (incl. traceability and calibration) and capacity building - are operating in market failure. This is the reason why the NMIs are in the public domain and why industry interests lie more in exploitable end-results of metrology and in manufacturing metrology instruments.

The setting-up of an EMRP will not change industry's role or interest.

However, industry and standardisation bodies have to have the possibility for their topics of interest to be considered.

Issue 4: Openness of the system – cooperation between National Metrology Institutes and other research organisations

Most investment in metrology is spent via the NMI and DI in Europe, whereas only less than 10% is subcontracted outside these institutes (approx. 5% in case of Finland, less than 10% in case of France). The statement that the NMIs and DIs are "a closed shop" is therefore confirmed.

It was felt that much more cooperation with other institutes (also institutes whose core activity is not metrology as such) is needed. EMRP should include European money to catalyse a more open structure.

The key areas for metrology to focus on are the emerging and multi-disciplinary areas (e.g. health, biotechnology, environment, etc.). Today's NMI programmes are not focusing enough on these areas, although this is slowly changing in some (large) countries (e.g. case of restructuring of UK NMI).

Issue 5: Mobility of young researchers in National Metrology Institutes and Designated Institutes and beyond – future human potential

There was a consensus that mobility of personnel leads to an enormous gain of experience mainly for the NMIs but also for the researchers themselves. This was illustrated by the testimonies of several participants citing their own personal experience of their mobility and by the positive effect of an increase of the number of mobile staff in the JRC.

There are some barriers to mobility, but these are of human nature (statute, family, language). It is therefore essential that mobility is built into EMRP.

Issue 6: International dimension – cooperation at global level needed?

Standardisation is a global issue, so is metrology. There is already a lot of interaction between the different world regions (e.g. through the different scientific advisory committees). As for metrology research, some level of international cooperation is welcome, but not too much. Different developments and a small degree of duplication can be stimulating. Furthermore, a full cooperation at global level is not realistic due to the supporting effect metrology has on the local industry.

It is essential that Europe speaks with 1 voice in this global arena. Several positive experiences were cited in favour of harmonisation: a recent cooperation agreement between Euramet and NIST (through a MoU) and the positive effect of the European cooperation in the field of accreditation.

Issue 7: What could be the role of the European Commission?

Because of the structural needs faced by the NMIs, the EC should provide the funding for EMRP. The additional EU funding can be a leverage factor to impose a level of ambition and a structure for the initiative which otherwise would not be able to be realised without EU funding.

The JRC should be part of EMRP.

Other issues raised by the attendants

CECIP read out a prepared statement with their views. It is included in this report as Annex 3.

17 July 2008

Annex 2.1:

Agenda of the workshop

Workshop on

"Stakeholder consultation on the preparation of a European Metrology Research Programme (EMRP) via a potential Article 169 of the Treaty"

_____

25 June 2008, 15:00 to 17:30

European Commission

CDMA Building, Rooms SDR1&2, Rue du Champs de Mars 21,
B-1050 Brussels

AGENDA

Chair: Markku Warras, Unit RTD.B1 – Coordination of national research programmes – Relations with European research organisations

(1) Welcome, rationale and operational objectives for the Article 169 on metrology (EMRP) *Markku Warras*	15:00
(2) Presentation and discussion on the main drivers and characteristics of the initiative, in particular: – The "Metrology dilemma" - the need for a more efficient Metrology system in Europe – What are the benefits of a joint European metrology research programme? – Metrology research and industry needs. – Openness of the system – Cooperation between National Metrology Institutes and other research organisations? – Mobility of young researchers in National Metrology Institutes and Designated Institutes – Future human potential – International dimension – cooperation at global level needed? – What could be the role of the European Commission? – Any other issue *Introduction by Wolfgang Wittke, Unit RTD.B1 – Coordination of national*	15:20

research programmes – Relations with European research organisations *Moderation by Markku Warras*	
(3) Closing remarks *Robert-Jan Smits, Directorate B – European Research Area: Research Programmes and Capacity, DG Research, European Commission*	17:15
Coffee & Close	17:30

Annex 2.2

List of participants

EMRP Stakeholder workshop 25 July 2008 Brussels

List of Participants

Name	Institute	Country
Prof. Elio Bava	INRIM - National Institute for the Research in Metrology	Italy
Ms. Martine Blum	EA - European cooperation for Accreditation	France
Dr. Theresa Burke	EUSPEN - European Society for Precision Engineering and Nanotechnology	United Kingdom
Dr. Chainarong Cherdchu	NIMT - National Institute of Metrology Thailand	Thailand
Mr. Luc Erard	LNE - Laboratoire Nationale de Métrologié et d'Essais	France
Mr. Daniel Estève	CEA - Commissariat à l'Energie Atomique	France
Mr. Doris Florian	JRC - Institute for Reference Materials and Measurements	Belgium
Mr. Andy Henson	NPL - National Physical Laboratory	United Kingdom
Mr. Christopher John Hull	EARTO - European Association of Research Technology Organisations	Belgium
Mr. Erkki Ikonen	MIKES - Centre for Metrology and Accreditation	Finland

Mrs. Radka Jekova	European Commission	Belgium
Dr. Robert Kaarls	CIPM - International Committee of Weights and Measures of the BIPM - Bureau International des Poids et Mesures	The Netherlands
Mr. Michael Kühne	PTB - Physikalisch- Technische Bundesanstalt	Germany
Mrs. Veronika Martens	CECIP - Comité Européen des Constructeurs d´instruments de Pesage	France
Mrs. Valentina Mauri	ORGALIME - European Federation of the European mechanical, electrical, electronic and metal articles industries	Belgium
Miss Junpen Meka-Apiruk	Office of Science and Technology of the Royal Thai Embassy	Thailand
Prof. Mikko Paalanen	Helsinki University of Technology	Finland
Ir. André Pirlet	CEN - European Committee for Standardisation	Belgium
Mr. Joseph Prieur	CLORA - Club des Organismes de Recherche Associés	Belgium
Prof. P.P.L. Regtien	University of Twente	Netherlands
Mr. Christophe Sarraf	ENSAM - Ecole nationale supérieure d'Arts et Métiers	France
Mrs. Pascale Semmler	European Commission	Belgium
Mr. Robert-Jan Smits	European Commission	Belgium
Mr. Marc Van Achter	European Commission	Belgium

Prof. Leo Van Biesen	IMEKO - International Measurement Confederation	Belgium
Mr. Vincent van der Wel	CECIP - Comité Européen des Constructeurs d´instruments de Pesage	France
Mrs. Anneke Van Spronssen	MINEZ - Dutch ministry of Economic affairs	The Netherlands
Mrs. Nathalie Wackenier	European Commission	Belgium
Mr. Markku Warras	European Commission	Belgium
Dr. Friederike Weritz	BMWI - Federal Ministry of Economics and Technology	Germany
Mr. Wolfgang Wittke	European Commission	Belgium
Dr. Charun Yafa	NIMT - National Institute of Metrology Thailand	Thailand

Annex 2.3 Written statement by CECIP

CECIP

COMITE EUROPEEN DES CONSTRUCTEURS D'INSTRUMENTS DE PESAGE

CECIP.2008.06.18 19 June 2008

Subject:
Statement of CECIP on occasion of the EU stakeholder consultation 25 June 2008

CECIP is the European association of weighing instrument manufacturers. It is composed of federations from 15 European countries. We have a market share of more than 50% of the global weighing instrument market. CECIP is active in the field of metrology and participates in the work of the OIML (International Organisation of Legal Metrology) and in WELMEC (European Organisation of Legal Metrology). Our members are in close contact with their national NMIs. Contact exists with EURAMET, but no cooperation as yet.

Both a high technological level and high export rate depend on and greatly profit from a strong metrological infrastructure.

CECIP supports European specialism and cooperation in the field of metrology for 3 reasons:

1. Efficiency
2. Costs
3. Knowledge sharing

It is our opinion that we need a future-oriented European concept that is flexible, customer friendly, transparent and not burdened by additional bureaucracy. The system must have the chance to promote metrology in line with the rapidly changing technological developments. But in spite of specialism, the formation of monopoles must be avoided. That means that there must always be more than one NMI involved in each specific type of metrology.

We support the concept laid down in the EMRP of EURAMET.

1. A programme designed and operated by the NMIs themselves will be far more sustainable than a programme governed by the Commission. The well-established structures of the Euramet are best suited and sufficient to conduct the EMRP.

2. The manufacturers of European weighing instruments support the intention that only NMIs and DIs, which are nationally responsible for the metrology infrastructure inside of Europe, are eligible institutes for the bulk part of the resources. However, a certain fraction of the resources should be available for the involvement of experts from external European institutes.

3. It is our opinion that a new concept like the one discussed here will, in the future, have a large influence in all decisions concerning metrology and specialism of NMIs as well and will affect the industry greatly. Therefore, it is necessary to find a realistic way to involve stakeholders in specific decisions. Examples may be decisions concerning the topics for development and specialism of certain NMIs. Of special importance is the question whether an NMI stays in a special field of metrology or stops working in that field. For a balanced metrology system, it is important to involve customers and users in discussion as well.

The CECIP would like to thank the European Commission for this invitation and for the possibility to give our opinion at this workshop.

On behalf of the CECIP
Vincent van der Wel

President

DOMAINE D'ARMAINVILLIERS - 4 IMPASSE FRANCOIS COLI - 77330 OZOIR LA FERRIERE - FRANCE
TELEPHONE : 33 - 1 - 60 02 89 58 TELECOPIE / FAX : 33 - 1 - 60 02 89 58

Annex 3:

iMERA Task report 1.1 – Deliverable on the national landscaping in metrology research

Implementing the Metrology European Research Area – iMERA
ERA-NET Coordinating Action, Contract number: 016220
Contract Start Date April 2005, Duration 3 Years

WP1 - Systematic exchange of information and best practices

T1.1 - National programme landscaping

D1.1 Overview of the Metrology Landscape
Deliverable Due Date: October 2005, extended to April 2006
Date of Issue: April 2006

Task participants :
LNE (FR) as task leader and IMGC (IT) as partner, plus input from all partners

Authors:
Maguelonne Chambon & Luc Erard (LNE)

EC Project Officer:
Wolfgang Wittke

Short description of work :
This task expanded the generic metrology R&D landscape described in the MERA study and provided a systematic overview of the methodologies, known strengths and weaknesses of the various approaches. Opportunities for programme managers to share knowledge to improve national programmes had been identified. The output is pivotal to a number of subsequent tasks.

REPORT STATUS : PU (Public)

Structuring the European Research Area

The partners wish to acknowledge and thank the European Commission for supporting this project as an ERA-NET Coordinating Action under "Coordination of Research Activities" of the 6th Framework Specific Programme "Integrating and Strengthening the European Research Area".

Explanation of Report status (one of the following):

PU = Public
PP = Restricted to other programme participants (including the Commission Services)
RE = Restricted to a group specified by the consortium (including the Commission Services)
CO = Confidential, only for members of the consortium (including the Commission Services)

1 – EXECUTIVE SUMMARY

To get an overview of the generic metrology R&D landscape within Europe, and to have a strong basis to elaborate the European Metrology and Research Programme (ERMP) - task 5.1, one of the first task of the iMERA project was a study of the resources devoted to Research and Development activities (R&D) for the whole National Metrology Institutes (NMIs). This study has been done by the elaboration and analysis of a questionnaire sent to all NMIs and not only iMERA partners.

The analysis of the questionnaire permitted to have an overview of the budget dedicated to R&D metrology activities, and interesting and relevant information has been also collected on the number of persons working per "metrological fields" and in new research areas, on R&D subjects developed at the present time in the different NMIs, and on dissemination of the results.

In summary, the analysis showed a global resource of about **190 M€,** representing about **1 500 FTEs** (Full Time Equivalent), dedicated to the metrology research and developments activities within Europe. It should be noted that this total budget is concentrated on four NMIs, e.g. Germany, United Kingdom, Italy and France, with 80 % of the resources.
Nevertheless, contribution from other countries are quite important. At the present time the financial support to R&D activities in metrology of Denmark, The Netherlands, Finland and Switzerland, is between 3 M€ to 5,5 M€, and for Czech Republic, Portugal, Sweden and Turkey, the contribution between 1,1 M€ to 1,8 M€.

Considering the global metrology R&D budget, between 60 % to 65 % of financial resources are dedicated to improve the calibration and measurement capabilities (CMC), and can be considered as answer to urgent industrial - user needs, and 35 % to 40 % of the resources are dedicated to new or long term researches.

New research areas represent more than 10 % of the Euromet R&D total budget, dedicated to information technology, software, materials, and studies mainly for applications in healthcare, medicine, biotechnology and food sectors. A large part of resources is devoted to nano-reference (including nanometrology, nanoforce, nanostructure, nanotechnology, etc…).
Chemistry is also a field with an increasing activity and seems to represent now about 10 % of the global European R&D resources in metrology.

Globally, two third of persons involved in R&D metrology are PhD or engineers, and one third technicians. Women represents only 22 % of the global scientific and technical staff, but this is quite a high rate considering the number of women graduated in the science field.

2 – INTRODUCTION

The task 1.1 is included in the work-package 1 dealing with exchange of information and best practices. This first part represents the preliminary task devoted to the elaboration of the EMRP (European Metrology Research Programme). The main goal of this task is to get an overview of the means dedicated to the research activity in metrology in the European countries, mainly within EUROMET, as full time equivalent (FTE) and capital investment, but also in term of dissemination of research activity as publication, co-operation activities and/or knowledge transfer.
The task leader is the *Laboratoire National de Métrologie et d'Essais* (LNE) with *the Istituto di Metrologia « G. Colonnetti »* (IMGC) as partner. The inputs had to come from all the EUROMET countries and not only from iMERA participants.

The information concerning the effort of R&D of each country will contribute to the elaboration of the European Metrology Research programme (EMRP). It will also be used as a basis for the implementation of Article 169 in terms of the funding to be combined with the European contribution.

3 - METROLOGY R&D LANDSCAPE

To get an overview of European R&D metrology activity, each European National Metrology Institute (NMI) has been required to give some information on their financial resources, the way they are collaborating with other NMIs in Europe, and how they disseminate their R&D metrology knowledge.

3.1 - Questionnaire

To establish a landscaping for R&D metrology activities, IMGC and LNE proposed a questionnaire to all EUROMET countries, to NMIs and Designated Institutes. The questionnaire is given ***in appendix 1***. This questionnaire has been sent beginning of July 2005.

The main information required concerned the overall budget of the institute and the number on Full Time Equivalent (FTE) dedicated to R&D in metrology. It was necessary to get both information, the cost of a FTE being sometimes strongly different from a country to another.
For the financial support of R&D in metrology it has been asked the following information : repartition in man power and investment, resources detailed by metrology fields and by categories (as improvement of existing facilities, long term underpinning research, new research area ad support to calibration), the category of personnel employed (PhD, engineer, technician, administrative, male, female, etc.), the co-operation with other NMIs for R&D and the dissemination of results (e.g. publications).

It was important to point out, in the NMI's activities, the part dedicated to R&D in metrology and the part dedicated to traceability to the SI and/or support to routine calibration activities, which can be considered more as maintenance of the references than concrete R&D activities.
Considering the dispersion of some answers received, complementary information was necessary for clarification.

Majority of the answers were received in September 2005. And with complementary information it was possible to get an idea on the global R&D budget dedicated to metrology in Europe in November 2005.

At the present time EUROMET represents 34 members, e.g. 33 countries plus the Commission of the European Communities (CEC). 22 countries (Austria, CEC, Croatia, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Serbia and Montenegro, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom) over 34

answered to the questionnaire. Nevertheless, some of the answers were not exploitable, this is the reason why some countries are not mentioned in the analysis and/or in figures.

3.2 - Analysis of questionnaire

The questionnaire provided a great number of information on the resources dedicated to metrology R&D activities, but also some information related to : the number of FTEs by different metrology fields, the number of countries performing measurements per fields (which can give an idea on the national needs in some sectors), the dissemination of R&D results, the participation to national and international activities (standardisation, accreditation, Euromet projects, etc.).

It should be noted that **many countries in Europe have a distributed metrology system**. In theory; the answers concerned the National Metrology System in a country and not only data from the main NMI in the given country, even it is not indicated for each country in the corresponding tables. The main countries indicated the name of laboratories contacted for answering to the questionnaire.
The complete list of National Metrology Institutes and Designated Institutes is available on the EUROMET website (www.euromet.org).

The analysis is split in five parts : the approximate budget dedicated to metrology R&D activities, the potential resources per field and for the development of new areas, personnel data, the R&D topics developed, and the last part dedicated to dissemination of results.

The inquiry was sent to all the Euromet countries, and not only to participants to the iMERA project. A main difficulty was the fact that some countries did not answer, and/or answers sometimes were not exploitable. Whatever, we can consider the result as Euromet potential R&D resources considering that some answers were sent by countries not participating to iMERA project (6 other countries non iMERA participants).

Nevertheless, we should keep in mind that the present figures represent data from 13 to 20 Euromet countries (depending on the questions), and even if a majority of NMIs answered, the analysis is not completed and can be sometimes subjective.

In the whole document, countries are identified by they ISO code and the laboratory of the Commission of the European Communities, IRMM, is identify as CEC.

3.2.1 - Euromet R&D global budget

The potential budget dedicated to metrology R&D activities has been evaluated from different manners to get consolidated figures : resources by fields or by different activities, and/or considering the number of FTEs per activity / field when data where not available.

Globally, a budget of **190 M€** is dedicated to R&D for metrology within Euromet countries. It should be noted that **four countries only concentrate 80 %** of this global metrology R&D budget : Germany (~ 80 M€), United Kingdom (~ 47 M€), Italy (~ 16 M€) and France (~ 22 M€), with **40 % of the global budget from Germany**.

Way of elaboration of this global budget is given in the § 3.2.2- a).

For the other countries, we can point out that for Denmark, the Netherlands, Finland and Switzerland, the financial support dedicated to R&D is between 3 M€ to 5,5 M€, and that for Czech Republic, Portugal, Sweden and Turkey, this budget is around 1,1 M€ to 1,8 M€.

About 82 % of the global budget concerns man power budget (including the different costs related to the man power overhead: salaries, travel, subsistence, consumables, minor equipments, etc., normally not including capital investment), and 18 % for capital investment.
It is clear that the budget repartition between manpower and investment can be really different from a country to another, mainly because of the discrepancy of salaries and overhead within Euromet countries. With two exceptions, Spain and Poland (with a manpower budget - with overhead - lower than 55 %), and depending on the country and on the available data, the percentage of manpower budget is at the moment between 65 % to 99 %.

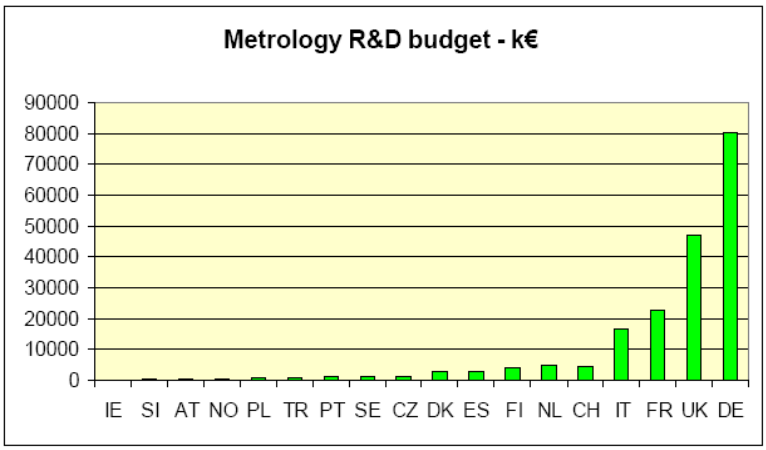


Fig.1. - *Metrology R&D budget within Euromet - Country mentioned by ISO code.*

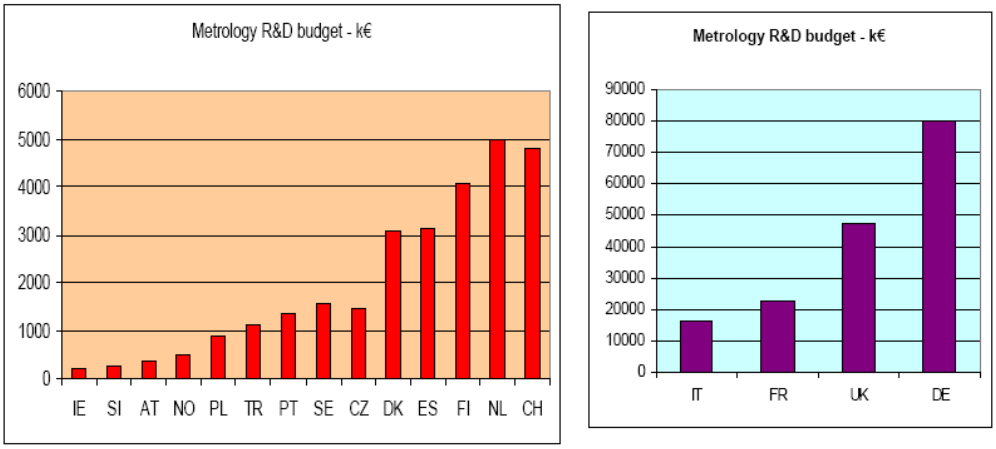


Fig.2.- a & b- *Details of figure 1.*

The table with corresponding data is given ***in appendix 2***.

3.2.2 - Euromet R&D budget per field and per activity.

When the questionnaire has been elaborated, it seemed important to get different views on the budget:
- which part is dedicated to long term R&D activity (to implement research for new SI definition, realisations of new references, developments of references in new fields, etc.);
- what could be the budget considering the necessity to improve the present references (development);
- the part dedicated to the maintain of metrological references;
- and finally, what could be the repartition of the budget per fields within Euromet to get an view of the present global activity in each domain.
Complete data are given in ***appendix 3.***

In metrology, generally the fields are related to the base units of the SI, plus some specific units like for ionising radiation. Nevertheless, it was also interesting to get a view on the R&D budget taking into account the emergence of new technologies and also the needs in term of metrology in some particular domains like medicine, biotechnology, software, analysis, etc.

a)- Activity repartition

National Metrology Institutes (NMIs) have the heavy task to develop and realise new references to answer to the future needs of users, laboratories and industries (needs sometimes are still not well known), to improve their capabilities, to participate to comparisons and to maintain the present references. As NMIs work at the highest level of uncertainties, what could be the activities to be considered as R&D were not so obvious. Four categories to detail resources have been established:

i)- development of existing capabilities (clearly improvement of capabilities);
ii)- long term underpinning res earch;
iii)- new research areas;
iv)- support to calibration activities (including high level traceability and support to "*Calibration and Measurement Capabilities*" - CMC).

Even if the forth category (iv - support to calibration activities including high level traceability) is much closer to development (a form of R&D specific to NMIs) rather than to current maintenance activities or to routine work, after discussions between some partners and looking into the given figures, **we considered that it should more appropriate not to take into account this category as R&D in the present report, just in view to establish a EMRP.** The metrology R&D budget has been established on this basis. The distribution between the different activities, in term of FTE and for each country, is given in figure 3.

Then, the global R&D budget for metrology has been calculated on the basis of the sum of resources given for items i), ii) and iii).
This represents a Euromet financial effort for R&D in metrology of about **190 M€.**

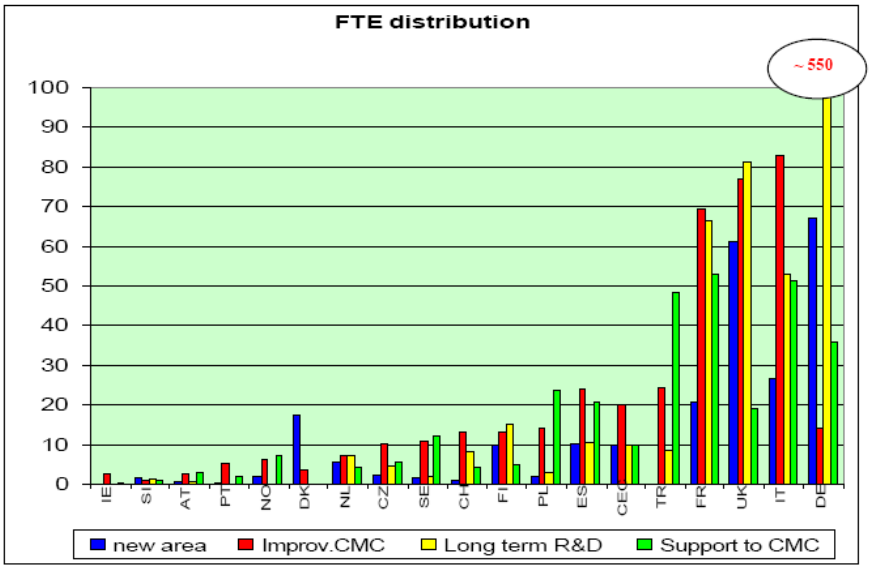


Fig.3.- *Distribution of FTE depending on the activities.*
It should be noted that, and to be coherent with other countries, data for Turkey has been modified (from original data) taking into account the number of persons working in the administration.

On the global metrology resources, the support to CMCs represents about 12,75 %.
15,8 % are invested in new research areas, 18,45 % on long term research, and the majority of the budget is dedicated to the improvement of CMCs, which seems logical, because necessary to answer to the urgent needs of users.

It is really interesting to point out that a lot of different countries are developing R&D in new research areas and have also planned long term research activities, demonstrating a real R&D dynamism within Euromet countries.

Finally, considering R&D resources only, it can be noted that 60 % to 65 % of financial resources are dedicated to improve the CMCs, and 35 % to 40 % for new or long term researches.

b)- Overview of the distribution between the different technical fields

Whether looking at the FTE data (Full Time Equivalent*) or direct budget data, we get an overview of the effort dedicated to the different metrology fields quite representative of the volume of activity in each field. It is important to note that the FTE data includes the permanent scientific and technical staff, but also PhD, guest workers, etc. **It is also important to note that the figures give only an idea of the percentage dedicated to each field, but does not represent the complete reality**, taking into account that not all the countries gave the necessary data.

A first comment is that looking at the global figures, a discrepancy exists on the non listed activities (named others) between data from FTE and data from direct budget ; this is by the fact that not all countries fulfilled the questionnaire on the number of persons working in those fields.

The first outcome of enquiry is the following : ionising radiation and electricity and magnetism, represent about 30 % of the R&D activity in metrology within Euromet (figure 5).
Considering the financial data, budget for new areas represents more than 10 % of the Euromet R&D total budget, mainly for medicine, information technology, software and materials. The financial contribution dedicated to length and dimensional metrology is still quite wide representing more than

10 % : some countries considered nanometrology as "nanometry" and did not split the figures in the different categories as it has been asked, and included nanometrology in the field of length.

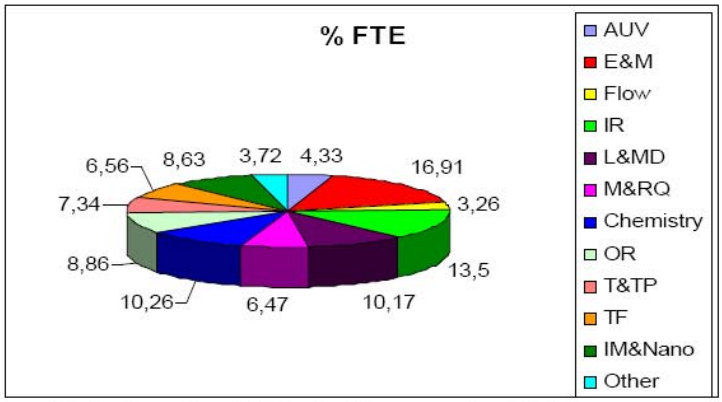
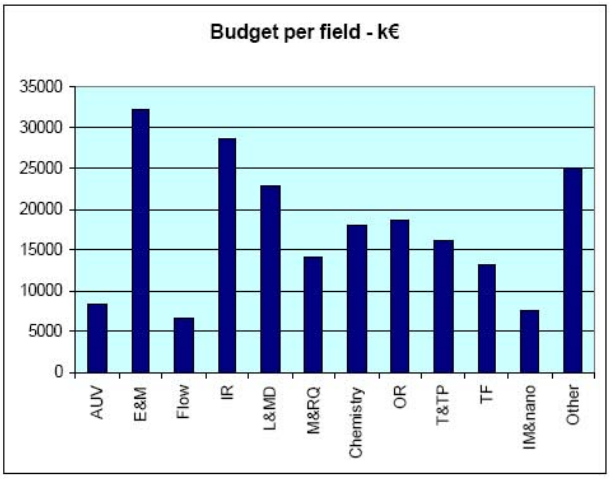


Fig.4.- *Repartition of FTE in the different metrology fields.*

Then, it can be pointed out the great activity in the field of chemistry. For this domain, the financial figures are not totally representative, because not included the part from IRMM (data not available in term of budget). What seems quite clear is that chemistry is a field with an increased activity for the last ten years and represents now about 10 % of the global Euromet R&D in metrology (figure 4).



AUV : acoustics, ultrasound and vibration
E&M : electricity and magnetism
FLOW : liquid and gas flow
IR : ionising radiation
L&MD : length and dimensional metrology
Chemistry : metrology in chemistry
OR : optical radiation (photometry, radiometry)
T&TP : temperature and thermal properties
IM & nano : Interdisciplinary metrology activities and nanometrology
Others : materials, software, medicine, information technology, safety, etc.

Fig.5.- *Global Euromet R&D budget per field*

** FTE = Full Time Equivalent, corresponding to a person working at full time on the specific activity concerned .*

c)- Summary

The potential resources in term of FTE working on metrology R&D is about 1500 FTEs (non including the maintenance of reference standards), and 35 % to 40 % of financial resources are dedicated to long term R&D and development of new research areas. **The global budget in metrology R&D represents an amount of about 190 M€.**

3.2.3 - Personnel data

General inquiry on the personnel employed by each NMI has been done to get information on the global distribution male/female on one hand, and scientist/technician/administration, on the other hand.

The given figures considered the total employees of NMIs, including administration activities. Nevertheless, looking at the detailed data, the percentage distribution male/female is also representative for R&D distribution, if we remove the administrative part.

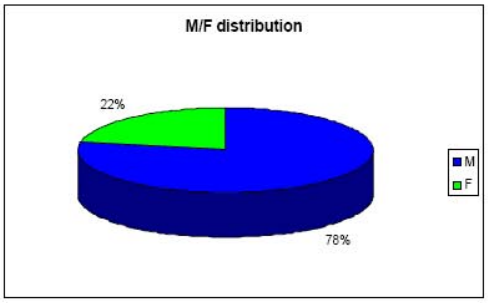


Fig.6.- *Distribution male/female*

22 % of women, approximately, are working in metrology R&D activities in Europe (scientists and technicians). However, considering information on high education from an European report on "women and science", these figures seem at a little higher level than number of women working as professor, postgraduate or as assistant in the major European Universities in scientific fields.

On the total NMI employees, more than 60 % are scientists, and about 20 % technicians. Of course those figures are relative to a country from another, and we should keep in mind that these figures give only a general view of the personnel distribution. However, the percentage of scientists is quite high and means that metrology R&D needs a high education level.
NMIs can add that long practice of metrology is also necessary ….

3.2.4 - Analysis of the R&D developed subjects in metrology

Since the creation of Euromet in 1987, the collaboration in metrology between European countries increased year after year with more than 250 on-going projects at the present time. After the elaboration of the Mutual Recognition Arrangement (MRA), edited in 1998 by the *Comité International des Poids et Mesures* (CIPM), topics of collaboration were more focus on international comparisons.
In 2005, each country participated from 50 to 150 Euromet projects, and acted as coordinator for 10 to 30 Euromet projects, depending mainly (but not in a general way) of the size of the NMI. Available data can be seen on the Euromet website (www.euromet.org).

For the last few years, NMIs showed willingness to collaborate more on R&D projects in metrology, and this has been clearly identified in the answers of the questionnaire. More than 85 % of countries declared to have R&D collaboration with a European country (e.g., member or associate member to Euromet). This R&D metrology collaboration is also important with countries out of Euromet, even not at the same level (about 50 % declared to have a consequent number of R&D collaborations). Whatever the real "volume" of active collaboration is difficult to quantify.
NMIs try to develop strong partnership with Universities and research institutions, and also engaged cooperation in R&D with industries.

In this part we present an analysis on the different country participation on R&D activities within Euromet. It does not represent an exhaustive list but raises some specific points. The whole collected answers for the R&D subject developed in each NMI (and the number of countries working in the different fields) are given in ***appendix 5***.

a)- Mechanics

In this chapter we considered the activities in the fields of "Acoustics", "Length and dimensional metrology", "Flow", and "Mass and related quantities".

ACOUSTICS

Four categories were listed : sound in air, underwater acoustics, ultrasound, acceleration and vibration.

Many countries are working in sound in air, and one of relevant R&D topic concerns the development of ear simulation. Research is also performed in ultrasound for applications on medical devices (as power measurement, for example). Specific activities can be linked to fundamental R&D in thermometry (in the range of cryogenic temperatures) with studies on speed of sound, research connected to studies on the Boltzman constant. It should be noted that only one country performed R&D in underwater acoustic with the development of hydrophone calibration bench, acoustic field characterisation or simulated ocean conditions.

The resources dedicated to this field represent about **4 % of the total R&D activity** in Europe.

MASS and RELATED QUANTITIES

Five categories were listed : mass, pressure, force, torque and viscosimetry.

Practically all the NMIs declared having R&D activities in the field of mass, and many of them are working also on developing pressure capabilities. New topics have been added as gravimetry and hardness.

In the mass field, a major research activity is related to the new definition of the kilogramme, or speaking more generally, on new determinations of value of some constants like h (Planck constant) or N_A (Avogadro constant). At the present time, different experiences are developed as "watt balance", "realisation of N_A" with Si solid state standard (sphere), "ion accumulation" and all studies connected to those experiences (Si density standard, X-ray interferometry on Si, surface analysis, etc.).

A new research area which seems to appear is the absolute gravimetry connected or not to the watt balance project.

Many other realisations concern new references for force and torque in different ranges depending on the needs of the country (and also dynamic periodic force).

New pressure facilities have been developed in very low and very high pressure ranges (below 1 kPa and in vacuum, and up to 1,6 GPa).

Some studies are dedicated to hardness and on porous and non-materials for determination of mass and density.

The resources dedicated to this field represent about **4 % of the total R&D activity** in Europe.

LENGTH

Three categories were listed : wavelength, nanometrology and dimensional metrology.

It should be noted that in the topic called "other" in the questionnaire, an item "nanotechnology" was listed ; in this chapter we consider only nanometrology e.g. all measurements of distance at a nanometric level.

A wide number of NMIs are developing R&D activities in the field of length for the three listed items.

With the femtosecond laser developments in the last few years, strong changes appeared in the traceability to the SI for wavelength sources. A lot of NMIs implemented or are implementing frequency comb systems. So, a lot of the recent developments on wavelength are dedicated to implementation of frequency comb instrumentations.

Nanometrology is a quite recent R&D topic, nevertheless a large number of NMIs invested in this activity mainly on nano- positioning, AFM, surface topography and nano- scale structure.

Of course, there is many other kinds of researches which are developed such as transfer of the length unit via optical fibre nanometric standard, imaging systems, angle measurement or spherical interferometry to support studies on N_A.
The resources dedicated to this field represent about **10,5 % of the total R&D activity** in Europe.

FLOW
This field was divided in two categories : gas flow and liquid flow.
A majority of NMIs have developed research activities in flow, for gas and/or liquid. Nevertheless, it seems that new large developments are performed in gas flow like optical gas flow, flow nozzle at high Reynolds number, gaseous emission, ultrasonic flowmeter, etc.
It appears that some NMIs are realising some specific benches in anemometry (category not mentioned in the questionnaire).
The resources dedicated to this field represent about **3,2 % of the total R&D activity** in Europe.

OTHER
A relevant number of NMIs mentioned some studies for the development of a reference in absolute gravimetry and hardness.

b)- Time and frequency and electricity - magnetism

TIME AND FREQUENCY
This field was divided in two categories : time scale and frequency.
It has been taken into account some items registered in the length activity because more connected to new frequency standards than wavelength references ; this to be homogeneous with descriptions of other countries.
A majority of NMIs have developed activity in frequency and time scale.
Nevertheless the major R&D researches concerns new generation of frequency standards, and performed by a few number of NMIs, mainly Switzerland, Germany, United Kingdom, Italy and France. The fundamental researches are on continuous or non continuous Cs fountains and optical frequency standards (neutral atoms: Sr, Ca, Ag, …, ion traps : Yb+, other…, nuclear transition). There is also development on optical local oscillators, test of fundamental constant and Rydberg constant.

In the time field, studies are more related to high precision time comparisons by different methods like TWSTFT (two way satellite time and frequency transfer) and GPS carrier phase. Also, there is some realisation of time scale in the frame of the Galileo programme and time algorithms.
The resources dedicated to this field represent about **6,5 % of the total R&D activity** in Europe.

ELECTRICITY and MAGNETISM
Three categories were listed : DC and quantum metrology, low frequency, radiofrequency and microwave.
It is clear that a consequent number of countries performed active researches and developments in electricity and magnetism.
Quantum physics seems a priority for a great number of countries for the implementation of new calibration instrumentations (high level standards) as for long term researches. It can be mentioned : development of programmable Josephson effect (Josephson Arrays Voltage standards), AC - quantum Hall effect (QHE), capacitance in terms of QHE, single charge and single flux quantum, etc. In summary, research area concerns quantum physics for the ohm law, and instrumentations developed for those specific topics as cryogenic current comparator (CCC).
In low frequency, it appears that there is more specificity on NMI competence. For example, Slovenia develops research on high resistance, Spain, Finland and Turkey activities on high voltage, Slovenia

and Austria on shunts. There is also developments for AC/DC transfer for some new range (below 1μV) or power measurement under non sinusoidal conditions.
In radiofrequency and microwave, a consequent number of countries performed R&D for EMC references. Studies are also performed in S-parameters, antennas or impedances.

It can be noted that studies on topics like electrical and magnetic field with highest time and spatial resolution, flux and flux density, electrical pulse measurement and more generally studies, dielectric measurement for health and safety, or optic communication instrumentation, are performed at the present time, but in a limited number of NMIs.
The resources dedicated to this field represent about **16 % of the total R&D activity** in Europe.

c)- Optic and thermometry

OPTICAL RADIATION
Three categories were listed : photometry, radiometry, colorimetry.
A majority of NMIs performed R&D in this field, and developed an activity in colorimetry. A second important topic is the implementation of references in the UV range for radiometry.
New studies seems to appear in a few NMIs, like quantum optics for quantum information and few photon metrology, optical property of materials, fibre optics, flash photometry, perception and appearance, specific studies with applications for medical and health.
The resources dedicated to this field represent about **8,8 % of the total R&D activity** in Europe.

THERMOMETRY
Three categories were listed : thermometry, humidity and thermal properties of materials.
Practically all NMIs declared performing R&D in this field. Apparently, humidity is a major topic in the new developments (including studies on extreme trace of humidity and humidity generator) as new fixed points for temperature.
Developments are also focused on references for extreme temperatures, cryogenic on one hand (below 1 K) and very high temperature (above 1 000 °C up to 3000 °C) on the other hand.
Following the recommendation of the CIPM, some countries (mainly United Kingdom, Germany and France) are working on quantum programme to link thermal metrology to fundamental constant, projects on the Boltzman constant.

A few countries seem to develop references for thermal properties of materials like conductivity, heat capacity or diffusivity.
It can be noted also studies on noise thermometry (mainly the Netherlands), quantum thermal measurement at nano-scale (United Kingdom), dielectric constant and constant volume gas thermometry (Germany).
The resources dedicated to this field represent about **7,5 % of the total R&D activity** in Europe.

d)- Chemistry and ionising radiation

METROLOGY in CHEMISTRY
Four categories were listed : gas analysis, organic, inorganic, electrochemistry.
Considering the answers from NMIs, it appears that a large number of R&D subjects are in development in the whole different categories, with application for a wide number of sectors like environmental, food industry, bio-analysis, healthcare, medicine, etc.
In the gas domain, trace gas analysis and single molecule detection, ozone, humidity for gas and calorific value of natural gas are the main topics developed.
Researches and studies are also performed on bio-enzyme sensors and bio-molecules, PCB, trace metal and trace of other elements, purity analysis and pure substance, electrolytic conductivity, pH-metry, particles detection, etc.
The resources dedicated to this field represent about **10 % of the total R&D activity** in Europe.

IONISING RADIATION

Three categories were listed : photon dosimetry, radio-activity, neutron measurement.

Nuclear medicine is one the major R&D activity in this field, improvement of capabilities being quite crucial. Nuclear medicine concerns a great number of different experiments on absorbed dose, air kerma and photon dosimetry for a wide range of energy and dose rates. Some studies are also performed for low energy X-ray.

In radioactivity, research is concentrated on studies on different rays (alpha, beta and gamma) with elaboration and implementation on various methods.

Other focused points of R&D are Monte Carlo simulation, bolometry, calorimetry and radon references.

A few laboratories are working in the field of neutron, mainly on neutron spectrometry and neutron radiation high power for nuclear fusion (Germany and United Kingdom).

The resources dedicated to this field represent about **13,5 % of the total R&D activity** in Europe.

e)- Others

This questionnaire raises a certain number of R&D areas, generally new and/or recent, but not even, areas that were not really included in the "classical metrology fields", until now, as in CIPM Consultative Committees and/or Euromet Technical committees, with may be exception of nanometrology in the dimensional metrology field. Some of those areas are sometimes transverse activities and common to many different metrology domains. Studies started in a specific field and were extended sometimes to other domains.

Globally, resources dedicated to all those activities represent about **14,5 % of the total R&D activity** in Europe.

NANOREFERENCES

A majority of laboratories are working at a nano-scale level in different manners. Nanometrology, in the sense of nanometry, was presented in the § 3.2.4 - a) with researches on surface topography, AFM and nano-positioning.

Some important developments are also performed in nanotechnology for quantum electronics, nano-force references (force measurements at nano-scale) or nano-balance for micro-thrusters.

HEALTHCARE, METROLOGY for MEDICINE

The metrological approach in medicine, and for healthcare sector in general, is quite a new approach that both metrologists and health professionals are to deal with. A certain number of activities have been listed, and that some NMIs started to work on :

- drug discovery and diagnostic, endo-vasculator device critical measurement, biomarker, bio-system;
- nano bio-patterning for electronics and sensing application;
- quantification for DNA, gene expression, protein;
- nuclear magnetic resonance (NMR) for tomography, quantification of vivo-parameter, spin polarised rare gases for lung diagnosis, electroencephalography, bio electric and magnetic methods, optical imaging generating method, …..
- etc….

This non-exhaustive list shows us how the huge work and researches to performed will be in the next few years.

SOFTWARE

With the development of information techniques and tools, with an infinite number of possible applications even not yet known, NMIs needed to get competences in these sectors.

They developed activities for software in metrology, in particular for uncertainty analysis, software safety (including secured data transfer), but also modelling techniques and tools for simulation and visualisation.

MATERIALS
New techniques have to be developed for a better knowledge on materials as physical modelling for magnetic materials, and characterisation of materials for porosity, electrochemistry, wear and degradation for example.

3.2.5 - Euromet R&D dissemination

NMIs are greatly involved in technical committees and working groups of many different organisations and institutions, to propose their expertises in particular to accreditation bodies, standardisation bodies at national and/or international level (International bodies like OIML, WELMEC, CC of CIPM, CEN, CENELEC, ISO, IEC, ITU-R, IMEKO, CIE). The complete list is given ***in appendix 4***.
Performing training and providing technical assistance is a way largely used for dissemination of metrology knowledge ; this will be described in details in the task 1.4 on knowledge transfer.

More than one presentation per year per person is given to conference / congress, representing more than 1700 scientific presentations a year (at international and/or national level) About 800 articles are proposed and published to a scientific revue (e.g. with editorial reviewers).

The figures 7a shows the distribution of the publication to scientific revues and participation to conference for countries other than UK, DE, IT and FR.
The figure 7b shows the distribution of publication to scientific revues for UK, DE, IT and FR.

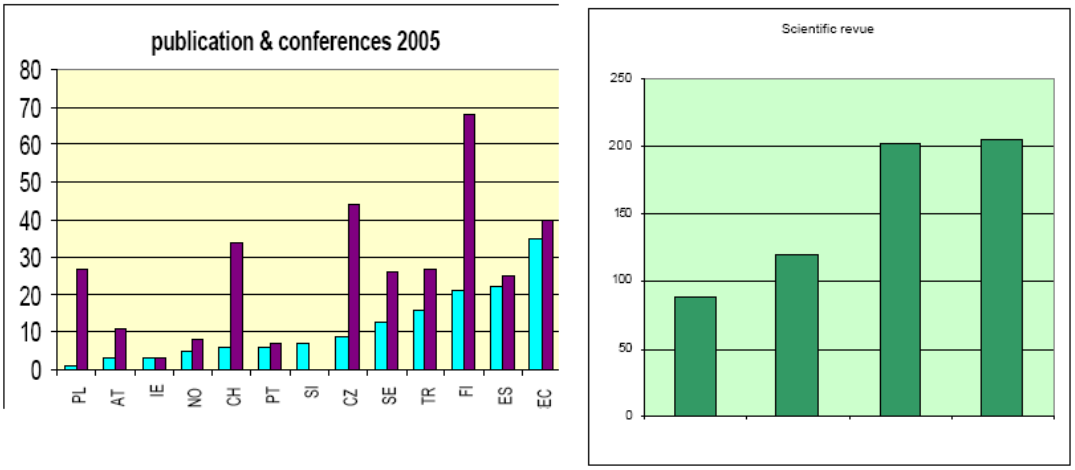


Fig.7. a&b - *Overview of the number of publication a*

The present participation to conferences/ congresses for those countries is quite important, mainly for Germany with about 900 communications a year. For United Kingdom, Italy and France the number of presentations is between 220 to 140 respectively).

4 - CONCLUSION

Analysis of received answers from the inquiry permitted to give an evaluation of the financial effort dedicated to research and development in metrology within Europe, including some of the accession states.

The global financial R&D contribution has been estimated to **190 M€,** which represents about **1 500 full time equivalents** (FTEs).

European countries showed also their willingness to have strong cooperation in research projects, and it should be noted that Euromet is the essential point for the organisation of this collaboration with more than 250 active projects at the present time, and with a very high number of participants in those Euromet projects. 85 % of the countries declared have collaboration in research within Euromet.

On the main develop topics, it appears that 30 % of the financial R&D effort is dedicated to Electricity-magnetism and Ionising radiation (with apparently a large contribution to quantum physics and nuclear medicine, respectively) and 10 % to metrology in chemistry. New areas (like software, bio-references, healthcare, "nano-field", etc.) and long term research (studies for new definition of SI units, for example) represent also about 10 % of the global R&D metrology budget.

This analysis will be a milestone for the other tasks of iMERA project (for the elaboration of the EMRP and knowledge transfer, for example) and gives a snapshot of R&D axis within Europe in metrology at the present time.

5 - RECOMMENDATIONS

The landscaping questionnaire gave the opportunity to share a large amount of information on the metrology R&D activities performed by European NMIs (including Designated Institutes): the manpower available in each metrology field, new areas in development, an idea of available financial support per field, etc.

The analysis of this landscape should give some ideas and inputs for identifying the R&D programme priorities in individual countries. It will provide background for the programme owners and programme managers forum, Task 2.2. Combined with personnel mobility opportunities (output from Task 1.7), and the recommendations of Task 2.3 (Identifying opportunities and quantifying the benefits of collaborative R&D and shared facilities to aid national funding decisions), this sharing of information will provide a sound basis for future choices on collaborative metrology R&D in Europe.

The landscape:

- gives a snapshot of R&D activities in each country, in each field;
- gives a global view of R&D in Europe per domain;
- gives a better idea of manpower in each metrology sector and globally;
- points out new areas of development;
- provides a view on mobility opportunities;
- is a vital step to enabling a trans-national research programme.

The report will also be useful to EUROMET TC chairs and technical experts to get a better idea of R&D performed in their fields across countries, in particular the chapter § 3.2.4 on "the analysis of R&D developed subjects in metrology" and the detailed annexes.

To summarise and for the continued efficiency of the project :

- the roadmaps elaborated in Task 4.1 and this Task 1.1 report will be pillars to support the work of Task 5.1 - Preparation of the European Metrology Research Programme;
- the detailed annexes and other parts of the report give information of R&D activities per field and per country useful to Euromet TC chairs

- we encourage each EUROMET TC to make use of this information by collating a summary of the existing R&D programmes/activities in relevant technical areas, to complement this report and the roadmaps, to support the elaboration of the EMRP;
- EUROMET should consider mechanisms for maintaining the information in this report – an up to date resource of this nature will be vital for making informed choices throughout the lifetime of the EMRP and beyond.

6 - ACKNOWLEDGEMENTS

Authors would like to acknowledge all the participants for the time they spent to fulfil the questionnaire, their availability for answering to added questions and remarks, in particular countries which are not iMERA partners at the present time.

We would like to thank warmly Attilio Sacconi from INRIM (ex-IMGC) for fruitful remarks, discussions and comments for elaboration of the questionnaire, but also for his point of view on what could be considered really as metrology R&D.

Finally, a great and warm thank to Andy Henson from NPL, manager of this project, for his recommendations, advices, availability and continuous support.

7 - ANNEXES

- Appendix 1 : « ***Questionnaire on metrology R&D landscaping in Europe*** »
Questionnaire sent to all Euromet countries by July 2005.

- Appendix 2 : « ***R & D budget dedicated to metrology - final figures*** »
Summarised table of all figures received on budget.

- Appendix 3 : « ***Euromet R&D budget per field and per activity (detailed figures)*** »
All the detailed data for budget and FTEs, e.g. per field, per activity and globally.

- Appendix 4 : « ***List given by countries of national / international standardisation bodies NMI's participation*** »
Collection of NMI's participation to standardisation and accreditation bodies, mainly.

- Appendix 5 : « ***R&D fields of research in metrology / answers from all countries*** »
Attached template received on the metrology R&D topics developed in each country (*separate files*).

APPENDIX 1

Questionnaire on metrology R&D landscaping in Europe

iMERA – Implementing Metrology in the European Research Area

Task 1.1: National programme landscaping

Please send your responses to the Task Leader (address below) by: 15th August 2005

COUNTRY:

Name of the person, responsible of the answer:
Laboratory:
Address:
Tel.:
E-mail:

Questionnaire

Preamble

This questionnaire only applies to research (R&D) directly linked to the "measurement" mission of a National metrology institute (NMI)/Designated Laboratory (DL). It does not include current maintenance activities, legal metrology, accreditation when it applies, academic training, comparisons which do not support CMCs. It includes international cooperation activities as participation to Consultative Committees of the CIPM, EUROMET TC/WG,…

This questionnaire should cover the "metrology research" performed in NMI and DL(s) of the concerned country. Where the "metrology research" is spread between more than one single Institute, please collate this to produce the overall landscape in one single questionnaire.

The foresight and prioritisation mechanisms will be covered separately by other questionnaires (tasks 1.2 and 1.3).

Send your responses to:

iMERA WP 1.1, c/o Maguelonne CHAMBON, LNE, 1 rue Gaston Boissier 75 724 Paris Cedex 15, FRANCE
E-mail : maguelonne.chambon@lne.fr , Tel.: + 33 (0)1 40 43 40 53 by **15th August 2005**

1- National resources for research only

1-1 Overall budget

Overall budget	2003	2004	2005
Man power M€			
Investments (capital investment), M€			
Other costs*			
Personnel, FTE (number of full time equivalent)**			

* For "Other costs" include any costs not falling into other categories (e.g. consumables, minor equipment, travel and subsistence etc), or if they are a very small proportion of the total this category can be ignored throughout the questionnaire. If you have major costs not fitting the above add an appropriate category to the table(s).
** FTE = Full time equivalent (so that a person working half time = 0.5 FTE)

1-2 Detailed resources by "EUROMET" R&D for 2005

Technical activity	Man power (M€)	Investments (M€)	Other (M€)	Total Personnel (FTE)
Acoustics Ultrasound & vibration				
Electricity and Magnetism				
Flow				
Interdisciplinary Metrology (including nano and bio)*				
Ionizing radiation				
Length				
Mass and related quantities				
Metrology in chemistry				
Photometry and radiometry				
Thermometry				
Time and frequency				
Other**				
Total				

* to be described
** to be described

1-3 Detailed resources by category for 2005

Category	Man power (M€)	Investments (M€)	Other (M€)	Total Personnel (FTE)
Development of existing capabilities (improvement)				
Long term underpinning research				
New research areas				
Support of calibration activities (including high level traceability and support to CMCs)				
Total				

1-4 Personnel for 2005

Number of FTE (2005)	Male	Female	Total*	
			Staff	Others
Scientist (PHD, Engineer)				
Technicians				
Administration				

* "Staff" = FTE of permanent employees
* "Others"= students/stagiaire, guest workers, short fixed term contracts which are not routinely renewed

2- Cooperation and collaboration in research (active in 2004)

2-1 European level

Technical activity	Number of EUROMET projects in which you have participated as a partner	Number of EUROMET projects in which you have participated as a coordinator	Number of participation in other projects (EU, ..)
Acoustics Ultrasound & vibration			
Electricity and Magnetism			
Flow			
Interdisciplinary metrology			
Ionizing radiation			
Length			
Mass and related quantities			
Metrology in chemistry			
Photometry and radiometry			
Thermometry			
Time and frequency			
Total			

2-2 National and European level

Involvement of other Institutions (other than NMI and DL) in your R&D, please tick the appropriate box:

Never: ☐ Sometimes: ☐ Often: ☐

Relation with other Institutions for research (eg: strategic relationship, other *ad hoc* collaboration, etc): describe the way you collaborate

3- Dissemination

Publication (number)	2002	2003	2004
Scientific review			
Other			
Number of presentations in conferences			

4 - Participation in standardization activities:
Technical committee and Working group of ISO, CEN, CENELEC, National standardization body, etc (please describe shortly)

5 - List of Major facilities (Definition in EUROMET directory) and special laboratory facilities

6- Status and description of the research in metrology:

See Attached template.**

Send your responses to:

iMERA WP 1.1, c/o Maguelonne CHAMBON, LNE, 1 rue Gaston Boissier 75 724 Paris Cedex 15, FRANCE
E-mail : maguelonne.chambon@lne.fr , Tel.: + 33 (0)1 40 43 40 53 by **15th August 2005**

***** All the country templates given in appendix 5***

APPENDIX 2

R& D budget dedicated to metrology - final figures

Summary table of the metrology R&D budget elaboration

EUROMET NMIs		Budget metrology k€				
		Total metrology euromet	R&D only per activity in % FTE	R&D only per activity detailed	Total per activity detailed	Total per field
NML	IE	225	202,5	210	230	230
MIRS	SI	361,95	289,56	259,45	361,95	361,85
BEV	AT	640	344,64	0	0	0
JV	NO	1300	693,29	480	900	900
GUM	PL	1623,8	726,33	884,3	1474,4	337,2
UME	TR	2750	1104,4	1100	2750	2050
IPQ-INETI-DPRSN	PT	1843	1357,37	0	0	0
SP	SE	3040	1660,45	1570	3040	3030
CMI	CZ	2270	1702,05	1470,7	2270	2266,7
DFM	DK	3100	3100	3090	3090	2470
CEM	ES	4550	3107,2	5090	6890	4100
MIKES	FI	4600	4065,02	0	0	0
NMi-VSL	NL	5777	4773,54	4970	5778	5778
METAS	CH	6312	5848,93	4500	4800	4800
INRIM & ENEA	IT	20670	15703	16020	20670	20680
LNE	FR	28385	21195,08	22857	30016	28410
NPL	UK	50870	46810,57	47270	51260	50890
PTB	DE	84200	79779,5	80200	84200	84930
Total		***222518***	***192463***	***189971,45***	***217730***	***211234***

figures not available

APPENDIX 3

Euromet R&D budget per field and per activity (detailed figures)

Description of the total metrology budget per categories (in yellow, figure not available or not exploitable)

EUROMET NMIs		Metrology budget in k€								Total R&D budget (A+B+C) k€
		New area (A)		Improv. CMC (B)		Long term R&D (C)		Support to CMC (D)		
		Manpower & other	Invest.	Manpower & other	Invest.	Manpower & other	Invest.	Manpower & other	Invest.	
BEV	AT									
SMD	BE									
SAMTS	BG									
CEC	CEC									
METAS	CH	150	100	1200	1600	750	700	300		4500
CMI	CZ	134,3	92,7	604,3	185,4	268,6	185,4	335,8	463,5	1470,7
PTB	DE	6400	1700	2900	700	55100	13 400	3300	700	80200
DFM	DK	2370	210	470	40					3090
CEM	ES	860	540	1300	1190	620	580	1030	770	5090
MIKES	FI									
LNE	FR	2592	1130	8539	1570	8186	840	6554	605	22857
EIM	GR									
OMH	HU									
NML	IE			195	15			20		210
LS	IS									
INRIM & ENEA	IT	2000	850	7420	1040	4090	620	3830	820	16020
CU	LU									
LNMC	LV									
NMi-VSL	NL	912	306	1307	569	1307	569	768	40	4970
JV	NO	120		360				420		480
GUM	PL	24,2	457,5	177,6	189,9	35,1		303,8	286,3	884,3
IPQ-INETI-DPRSN	PT									
SP	SE	170		1160	40	200		1270	200	1570
MIRS	SI	84,5	42,2	48,3	24,1	60,35	30,1	48,3	24,1	259,45
SMU	SK									
UME	TR			690	140	230	40	1380	270	1100
NPL	UK	11980	1190	15270	1540	15810	1480	3640	350	47270
ZMDM	YU									
Total		***27797***	***6618,4***	***41641,2***	***8843,4***	***86657,05***	***18444,5***	***23199,9***	***4528,9***	***189971,45***

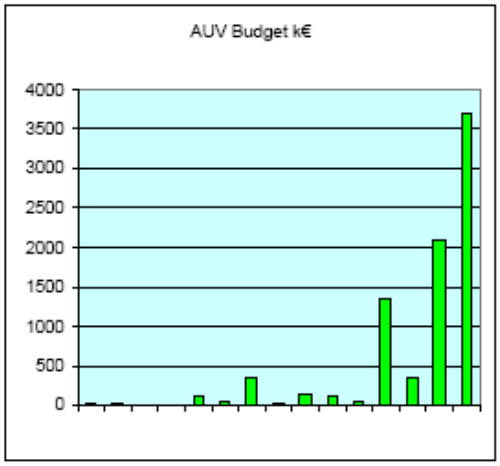
Total metrology budget per fields (in yellow, figure not available or not exploitable)

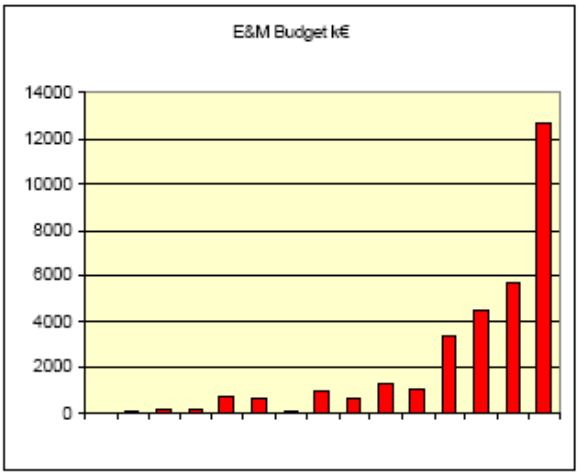
EUROMET NMIs		AUV Budget k€	E&M Budget k€	Flow Budget k€	IR Budget k€	L&MD Budget k€	M&RQ Budget k€	Chemistry Budget k€	OR Budget k€	T&TP Budget k€	TF Budget k€	IM&nano Budget k€	Other Budget	Total Budget
BEV	AT													
SMD	BE													
SAMTS	BG													
CEC	CEC													
MIKES	FI													
EIM	GR													
OMH	HU													
LS	IS													
CU	LU													
LNMC	LV													
IPQ-INETI-DPRSN	PT													
SMU	SK													
ZMDM	YU													
NML	IE	16	34			75	54			28		23		**230**
GUM	PL	20,5	36,3	24,2		190,5	6,6	1,1	17,4	10,3	28,1	2,2		**337,2**
MIRS	SI		129,5		19,2		69,75	39,2		76,7	27,5			**361,85**
JV	NO		240	120	60	60	60		180	60	60	60		**900**
UME	TR	100	730	130		300	290	120	120	180	80			**2050**
CMI	CZ	43,1	688,7	89,6	316,3	623,3	236,8	100,3	75,7	38,2	5	49,7		**2266,7**
DFM	DK	350	100	430		560		70	580	300			80	**2470**
SP	SE	30	980	260		160	530	30	220	190	630			**3030**
CEM	ES	150	670	30	1070	320	560	380	470	200	180	70		**4100**
METAS	CH	110	1310	50	480	550	670	660	380	120	320		150	**4800**
NMi-VSL	NL	40	1065	502	470	1109	274	842	673	519	104	80	100	**5778**
INRIM & ENEA	IT	1350	3420	630	2410	1630	2170	1280	1620	1320	1270	320	3260	**20680**
LNE	FR	343	4500	305	8040	711	2192	1174	1499	2989	5994	663		**28410**
NPL	UK	2090	5720	2290	2510	4710	3250	6270	4330	3870	2490	5680	7680	**50890**
PTB	DE	3700	12600	1800	13300	11800	3700	7100	8400	6200	2000	530	13800	**84930**
Total		***8342,6***	***32223,5***	***6660,8***	***28675,5***	***22798,8***	***14063,15***	***18066,6***	***18565,1***	***16101,2***	***13188,6***	***7477,9***	***25070***	***211233,75***

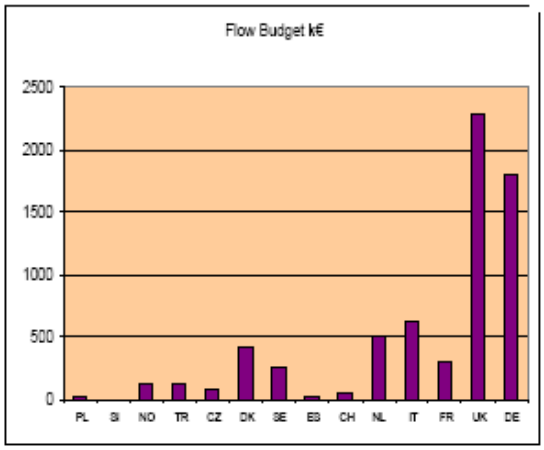
FTE corresponding R&D metrology budget (in yellow, figure not available or not exploitable)

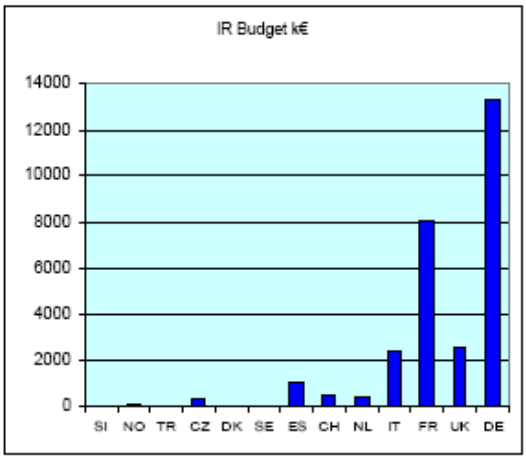
EUROMET NMIs		FTE for R&D				Total FTE	Total FTE / R&D	% FTE R&D metrology on FTE R&D	Total	Corresponding
		new area (a)	Improv.CMC (b)	Long term R&D (c)	Support to CMC (d)	metrology (a+b+c+d)	Metrology (a+b+c)		Metrology Budget (k€)	R&D metrology Budget (k€)*
BEV	AT	0,5	2,5	0,5	3	6,5	3,5	53,85	640	344,64
SMD	BE					0	0		0	0
SAMTS	BG					0	0		0	0
CEC	CEC	10	20	10	10	50	40	80	0	0
METAS	CH	1	13	8	4	26	22	84,62	6912	5848,93
CMI	CZ	2,25	10,12	4,5	5,63	22,5	16,87	74,98	2270	1702,05
PTB	DE	66,8	29,6	551,2	35,9	683,5	647,6	94,75	84200	79779,5
DFM	DK	17,36	3,41			20,77	20,77	100	3100	3100
CEM	ES	10,04	23,9	10,46	20,62	65,02	44,4	68,29	4550	3107,2
MIKES	FI	10	13	15	5	43	38	88,37	4600	4065,02
LNE	FR	20,96	69,05	66,26	53	209,27	156,27	74,67	28385	21195,08
EIM	GR					0	0		0	0
DZM	HR								412	
OMH	HU					0	0		0	0
NML	IE	0	2,61	0	0,29	2,9	2,61	90	225	202,5
LS	IS					0	0		0	0
INRIM & ENEA	IT	26,37	82,9	52,78	51,25	213,3	162,05	75,97	20670	15703
CU	LU					0	0		0	0
LNMC	LV					0	0		0	0
NMi-VSL	NL	5,5	7	7	4,1	23,6	19,5	82,63	5777	4773,54
JV	NO	2	6	0	7	15	8	53,33	1300	693,29
GUM	PL	2	14,24	2,9	23,65	42,79	19,14	44,73	1623,8	726,33
IPQ-INETI-DPRSN	PT	0,3	5,15		1,95	7,4	5,45	73,65	1843	1357,37
SP	SE	1,6	10,7	1,9	11,8	26	14,2	54,62	3040	1660,45
MIRS	SI	1,59	0,91	1,14	0,91	4,55	3,64	80	361,95	289,56
SMU	SK					0	0		0	0
UME	TR	0	38	13	76	127	51	40,16	2750	1104,4
NPL	UK	61	77	81	19	238	219	92,02	50870	46810,57
ZMDM	YU					0	0		0	0
Total		***239,27***	***429,09***	***825,64***	***333,1***	***1827,1***	***1494***		***223529,75***	***192463,43***

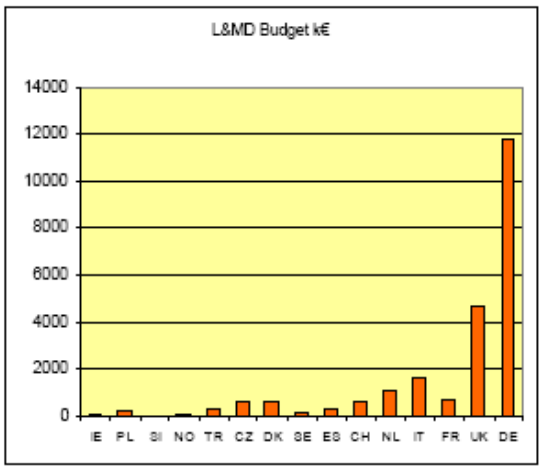
R&D budget for Metrology per field and per country

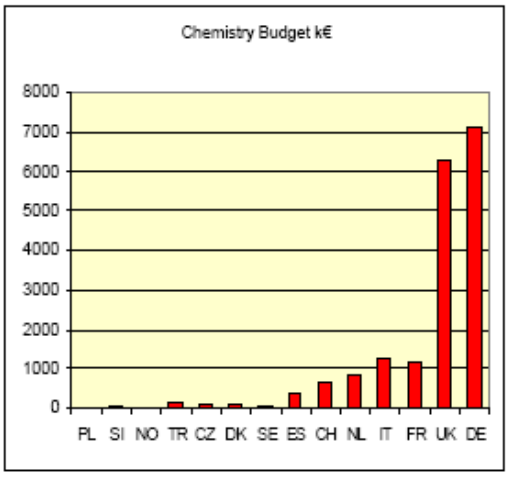


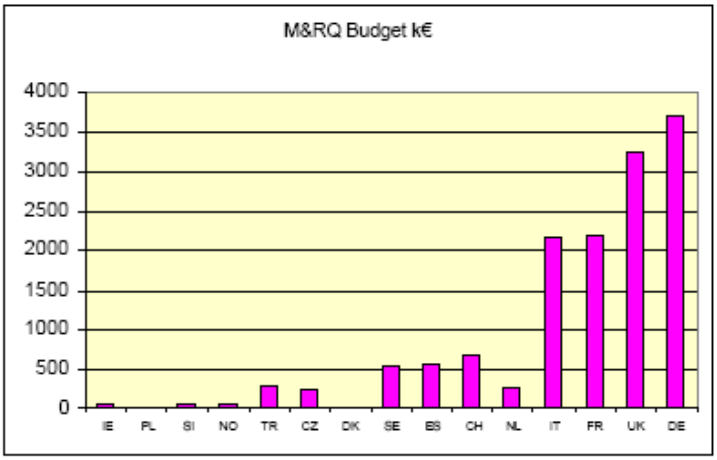








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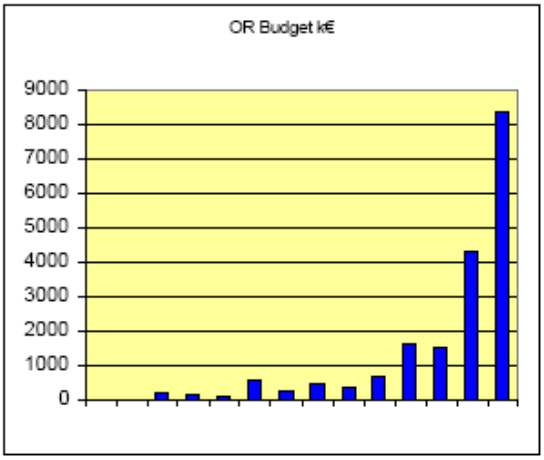
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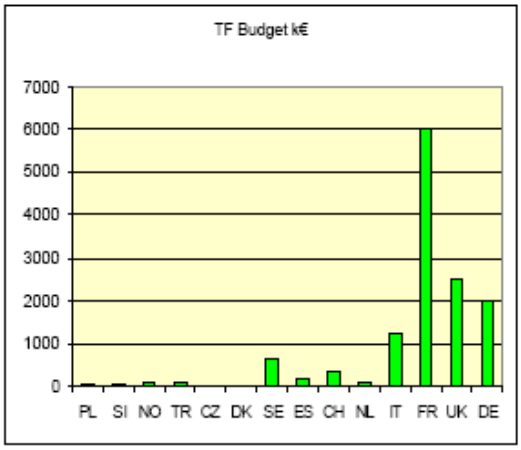
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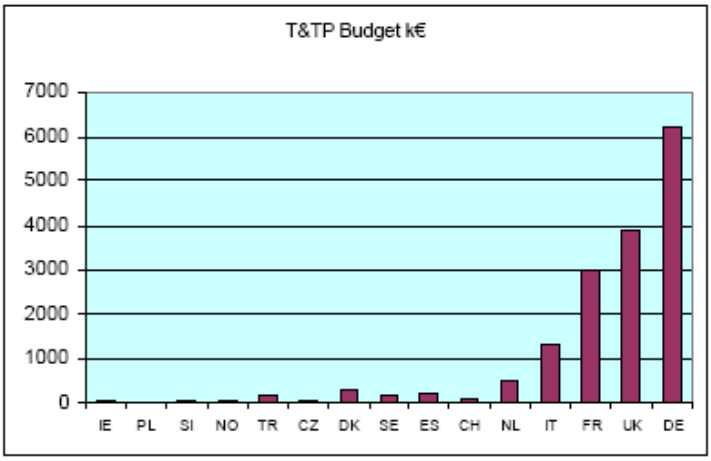
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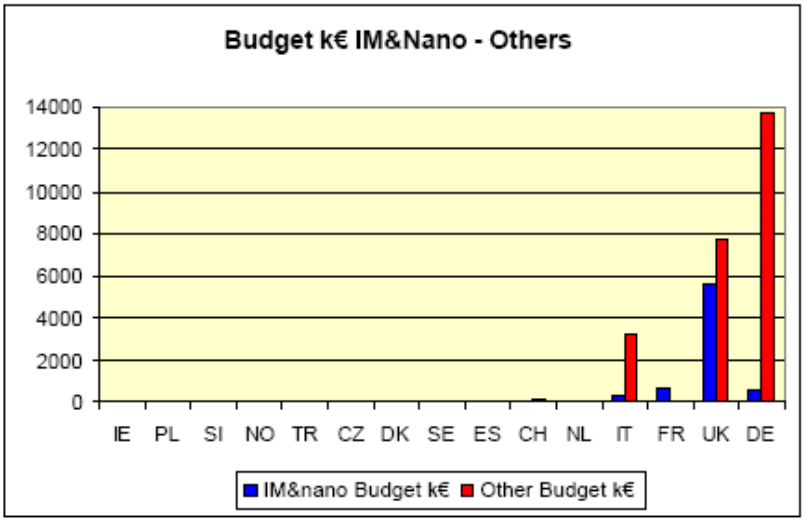


* IM : *Interdisciplinary Metrology*
Nano : *nanometrology*

APPENDIX 4

List given by countries of national / international standardisation bodies NMI's participation

AT - Austria

International

ISO:	TC 28/SC3/WG 1	Calibration of storage and transport containers
	TC164/SC1	Material test - tension
	TC164/SC3	Material test – hardness test
IEC:	TC29 WG4	Sound level meter
	TC29 WG5	Calibration of microphones
	TC29 WG17	Sound calibrators
CEN:	TC176	Heat meters
	TC294/WG1	Remote reading
	JWG (with CENELEC)	NAWIs
CENELEC:	BTTF63-4	Electronic taximeters

National

ON (National standardization body):

FNA025	Technical calculation
FNA031	Testing of geometric product specifications
FNA047	Optics and illuminating engineering
FNA068	Packing
FNA070	Measurement and automatic control in process technology
FNA087	Timber
AHG087	Timber measurement
FNA088	Radiation protection
AG 088…	Measurement uncertainties in dosimetry
G 088.11	Low-level measurements
AG 088.14	Radon
AG 088.18	Dose determination in X-ray diagnostics
AG088.MG2	Dosimetry and radiotherapy
FNUA122	Water meters
FNA129	Quality management and applied statistics
AHG132.05	Storage tanks and petrol stations
FNA218	Heat measurement
AG218.04	Remote reading
AG 218…	Heat cost allocators
AG 218 …	Heat cost accounting

OVE (National standardization body):

FA MR..	Measurement and automatic control and testing technology
FA MR13	Instruments for electric energy measurement and load control
FA MR38	Transducers
FA MR42	High voltage testing instruments

CEC

Participation in ISO-REMCO for reference materials and to specific WGs of CEN

CH - Switzerland

International

CIE Commission Internationale d'Eclairage
Div2, photometry / radiometry
Div4; Reporter on „Tolerances and Uncertainties in Lighting Design and Measurement"

IEC Internat. Electrotechnical Commission
TC 29, WG4, sound level meters
WG17, sound calibrators
CISPRA, radio interference measurements

ITU-R International Telecommunication Unit
WP7A, time signals and frequency standard emissions

CEN/CENELEC Comité Européen de Normalisation/Electrotechnique
TC169/WG5, street lightning
TC216/WG3, flue gas analyzers

National

Swiss association for electro, energy and information technology
WG members in the fields of: electricity meters and instrument transformers, acoustics, nuclear instrumentation, laser safety, emc, lenght

Swiss association for illumination technology

Association Suisse de normalisation
TC members in the fields: acoustics, motor testing, street vehicles. flow

CZ - Czech Republic

International

ISO : CASCO WG 25
TC 108 / SC 3

IEC: TC 13 and TC 68
OIML: TC 1 to 18

National

Czech Standards Institute
Czech Accreditation Institute

DE - Germany

In total PTB counts 1046 memberships in bodies and committees, both standardization and non-standardization; both national and international.

International

PTB cooperated in 2004 in 286 international standardization projects, of which

ISO	66
CEN	60
IEC	49
OIML	52
CENELEC	14

WELMEC	26
others	19

National
PTB cooperated in 2004 in 402 national standardization projects, of which

DIN	180
DKE	77
others	145

BAM cooperated in numerous bodies and committees; nationally most important DIN, internationally most important ISO, CEN

ES - Spain

- **Acoustics Ultrasound & vibration**

- AENOR CTN 209 – ISO TC 29. Electro acoustics: Participation in National Standardization Body's activities, particularly about sound level meters, sound calibrators, sound exposure meters and filters.
- AENOR/CTN 81 – SC 6: Vibration and shock. Standards about accelerometers calibration (and vibration measurement chains), and measuring instrumentation for human response to vibration.
- IECTC/29: ELECTROACOUSTICS: WG: 4, 5, and 17
- IECTC/87: ULTRASONICS: WG: 8, 9, 12,
- AEN/CTN206/SC29 ELECTROACOUSTICS: Chairmanship
- AEN/CTN209/SC87: ULTRASOUND: Chairmanship

- **Electricity and Magnetism**

- Participation on Working Group of AENOR, CTN 82-SC4 and CTN207-GT13 (Electrical energy) with a representative on IEC Electrical Energy Working Group.
- GT42: "High Voltage Testing and Measurements" of the Spanish standardization body AENOR that it is coordinated with IEC and CENELEC standardization bodies.
- CIGRE D1.33 "High Voltage Testing and Measurements" that support the CENELEC standards in this field and where the most relevant high voltage intercomparison have been developed.

- **Length**

- Participation in AENOR Sub-Committees No. 1 (General Metrology) and No. 2 (Dimensional Metrology), both belonging to the national standardization Technical Committee CTN-82 devoted to Metrology. In these Sub-Committees most of the work is dedicated to discuss drafts for/of international standards for ISO Committees and Working Groups (TC-213, TC-69, etc.), as participants and/or observers, depending on the existing status for the different groups.

- **Mass and related quantities**

- Participation in AENOR Sub-Committees No. 1 (General Metrology) and
No. 5 (Mechanical and Thermal Quantities), both belonging to the national standardization
Technical Committee CTN-82 devoted to Metrology.

- **Metrology in chemistry**

- Participation in AENOR Sub-Committees No. 1 (General Metrology) in the ISO TC 158 and ISO REMCO

- **Photometry and radiometry**

- Participation in AENOR Sub-Committees No. 1 (General Metrology)

- **Thermometry**

- Participation in the Sub-Committees No. 5 (Mechanical and Thermal

Quantities), belonging to the national standardization Technical Committee CTN-82 devoted to Metrology

- **Time and frequency**

- The head of the Time Section acts as president of the 59 Military Standardization Office, related to time and frequency matters.

In all technical activities there is participation in the technical committees of the National Accreditation Body, ENAC, and in the corresponding European Accreditation WG´s as required.
Most of the members of the staff cooperate with ENAC acting as technical auditors in all technical activities audits.

FI - Finland

National
Statements about draft standards for Finnish Standards Association SFS

FR - France

International
CIE : Commission Internationale de l'Eclairage : vice - president
ISO : ISOTAG4 and different TC, SC
CEN : different TCs, and technical bureau
EA : Participation to elaboration of EA guides
WELMEC

National
- AFNOR (standardisation body) : participation to standardisation commissions of AFNOR and to Strategic Committee
- COFRAC (accreditation body) : participation to technical accreditation commissions and audits in the frame of accreditation by COFRAC (about 25 experts).

HR - Croatia

The experts from the field of metrology are being directly involved in different working groups and TC's of the national and international standardisation institutions.

National
National accreditation body: TO 45; TO 100; TO 43; TO 402; TO 108;TC 176..
National standardization body : TC 176
Croatian Standardization Office (National standardization body):
FER: E-TC 100, TC 43, E-TC 402, E-TC 108
BI: ETC 402, TC 43, TC 108, TC 4002

IT - Italy

International

ISO

- TC164 Mechanical testing of metals (WG1 Terminology and symbolsSC1: Uniaxial testing; SC3: Hardness testing; SC4 Toughness testing.
- TC213 Dimensional and Geometrical Product Specifications (WG10: Coordinate Measuring Machines, WG4: Uncertainty and decision rules)
- TC 85/SC2 Radiation protection

IEC

- SC65B Devices (WG5:Temperature sensors)
- TC29 Electro-acoustics (WG 5, WG 17)
- TC 68 Magnetic alloys and steels (WG2)
- CISPR/A Radio-interference measurements and statistical techniques
- SC45B Radiation protection instrumentation

CIE (*Commission Internationale de l'Eclairage*)

- Division 2 Measurement of light and detectors (TCs: 2.16, 2.23, 2.37, 2.46, 2.48, 2.49, 2.52, 2.53)
- Division 3 Interior environment and lighting design (TC 3.33)
- Division 4 Lighting and signalling for transport (TCs: 4.10, 4.15, 4.16, 4.19, 4.24, 4.26, 4.33, 4.38, 4.40)

CEN

- TC169 Lighting application (WGs: 1, 5, 7, 169/226)

CENELEC

- TC106X Electromagnetic field in human environment (WG3)

National

UNI (Italian standardisation body corresponding to ISO) and UNI federated bodies

- Technical Central Commission
- Various TCs and related WGs:
    - Cultural Heritage
    - Dimensional and GPS
    - Flow pressure and temperature
    - Tribology
    - Quality management
    - General metrology (UNI/CEI)
    - Laser instrumentation (UNI/CEI)
    - Mechanical testings
    - Non destructive testings
    - Measurement and instrumentation (Italian thermo-technical committee)
    - Industrial processes: meas. & controls (Italian thermo-technical committee)
    - Acoustics
    - Light and illumination
    - Optical properties of glass
    - Nuclear Energy

CEI (Italian standardisation body corresponding to IEC)

- Various TCs and WGs:
  - Conformity assessment
  - Environment
  - Insulation in low voltage equipment
  - Electro-acoustics
  - Measuring equipment for electro-magnetic quantities
  - EMC (various WGs)
  - Human exposure to e-m fields
  - Instrumentation for radiation protection

NO - Norway

JV takes part in a number of OIML working groups, and in one Norwegian subcommittee reporting to IEC.

PL - Poland

National

• Co-operation with the Polish Committee for Standardisation (PKN) –
participation in the work of PKN's Technical Committees e.g.:
- No 8 - Terminology, documentation and letter symbols, quantities and units to be used in electrical technology,
- No 48 - Bases of machine engine construction,
- No 81 - Instrument transformers and power transformers,
- No 123 - Mechanical testing of products,
- No 105 - Electro-acoustics, audio- and video-information storage systems,
- No 157 - Physical hazards in working environment,
- No 207 - Bases of decline forming and characteristics of surface layer,
- in the area of force instruments and machines.

International

• Co-operation with the following ISO committees:
- Technical Committee ISO/TC 164, Mechanical testing of metals (BM),
- ISO/REMCO.

• Co-operation with the IEC TC 29 Electro- acoustics.

PT - Portugal

International
ISO (gas)

National
TC/IPQ (gas, uncertainties), TC/IPAC (accreditation criteria

SE - Sweden

International
ISO/TC 28 via STG-TK 411 (Measurement methods for petroleum products)
CEN TC 221 SC2 (petrol stations)
CEN/TC176/WG2 heat meters
ECE/GTB Photometric working group
IEC/TC 86 Fibre OpticsWG 4
CEN/TC85 Eye-protective equipment
ISO/TC94 Eye and face protectors
ISO TC69 – WELMEC WG4 + SIS TC 304 Application of statistical methods
CEN WG166 + SIS Pre-normative R&D in nanotechnology
WELMEC WG2 Directive implementation
WG7 Software
WG 10 Measuring Equipment for liquids other than water

SI - Slovenia

The distributed system participates in many relevant WG of ISO, CEN and CENELEC. Thay are also active in national standardisation bodies.

SK - Slovakia

International

CEN	CENELEC	IEC	ISO
TC 92/WG1	TC 62	TC 25	TC 12
TC 170	TC 76	TC 29	TC 30
TC 176/WG4	TC 86A	SC 45B	TC 112
TC 290	TC 86D	TC 62	TC 172
		SC 62C	TC 213/WG1
		TC 76	ISO-REMCO
		TC 86	ISO-CASCO
		SC 86A	
		SC 86 B	
		SC 86C	
		TC 87	

UK - United Kingdom

NPL presently has 759 committee representatives, involving 141 members of staff, on 675 committees or bodies. Approximately 49% of these are related to documentary standards, including 45 chair positions.
For example this includes membership of the following standards committees:

International
ISO : 92 (9) [number of members (number of chairs or convenors)]
CEN : 35 (5)
IEC : 30 (4)

National
BSI (UK national standards body) : 114 (15)

YU - Serbia and Montenegro

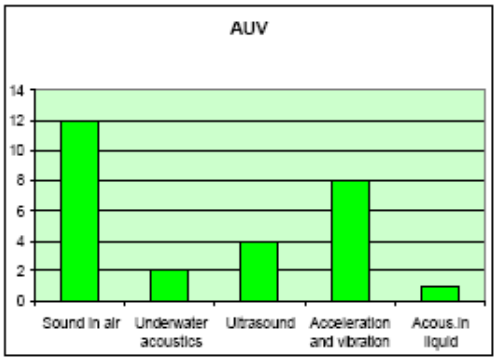
National standardization body (Institute of Standardization) of Serbia and Montenegro has its Technical Committees, in which the experts from ZMDM are the active members. There are members form ZMDM in almost all Technical Committees dealing with metrology issues and matters of conformity and general interest.

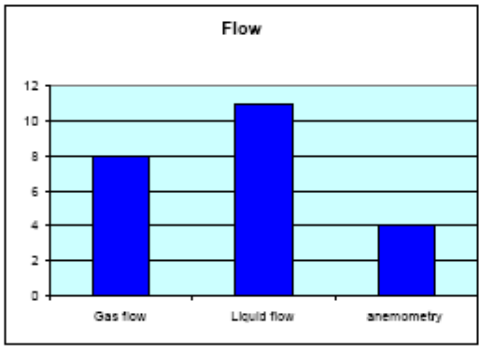
APPENDIX 5

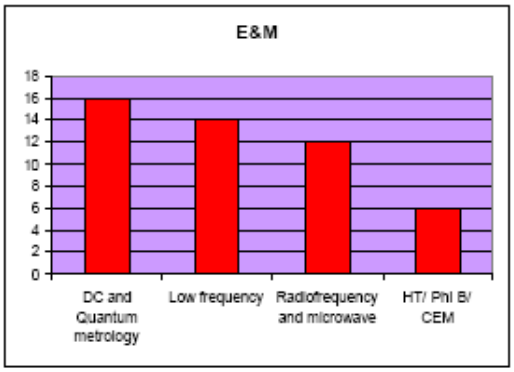
R&D fields of research in metrology
answers of all countries

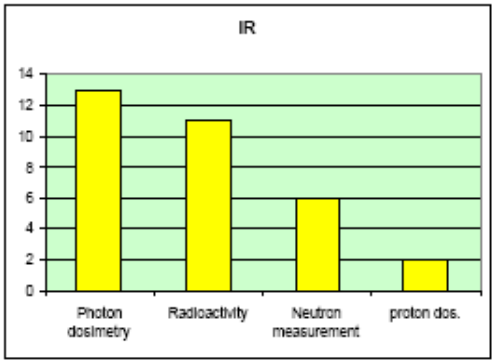
"See attached templates"

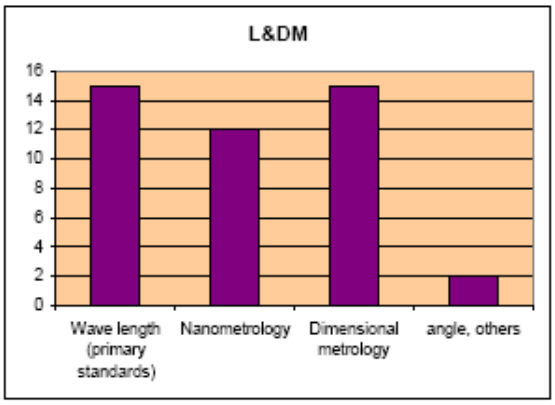
Landscaping - number of countries working in the field
« result summary »

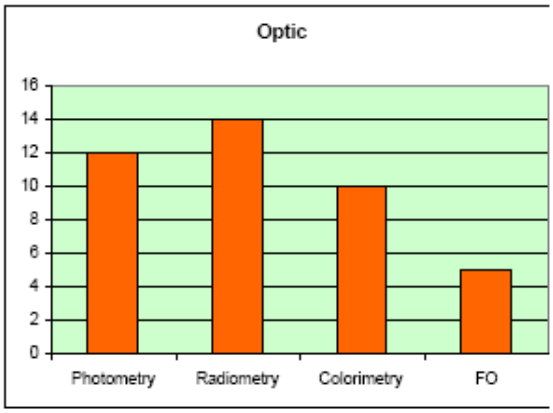


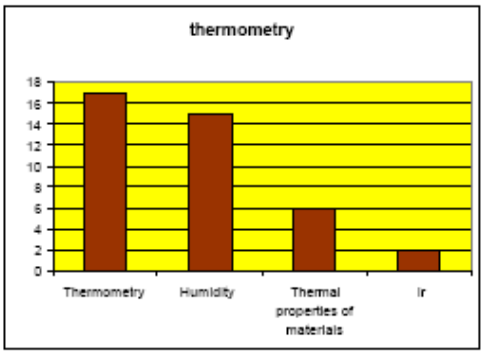








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Thermometry
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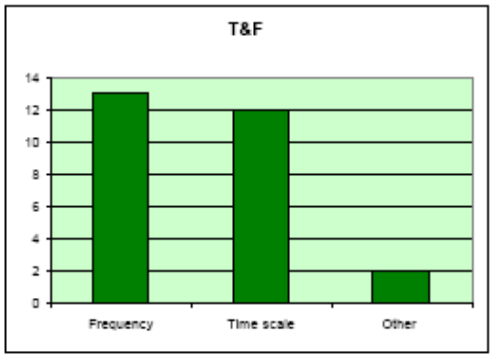
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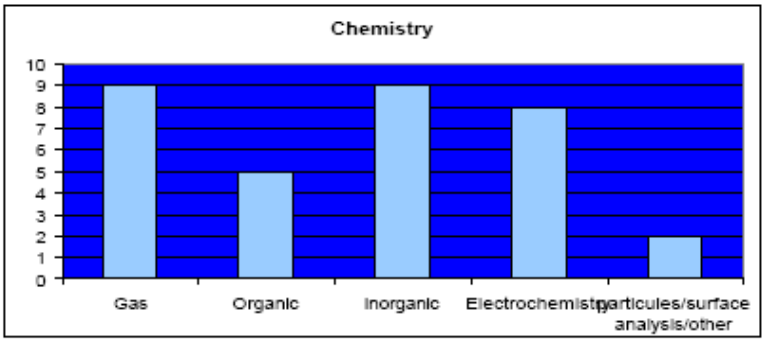
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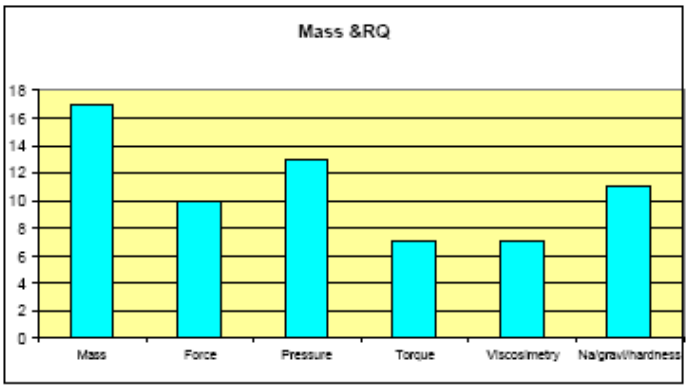
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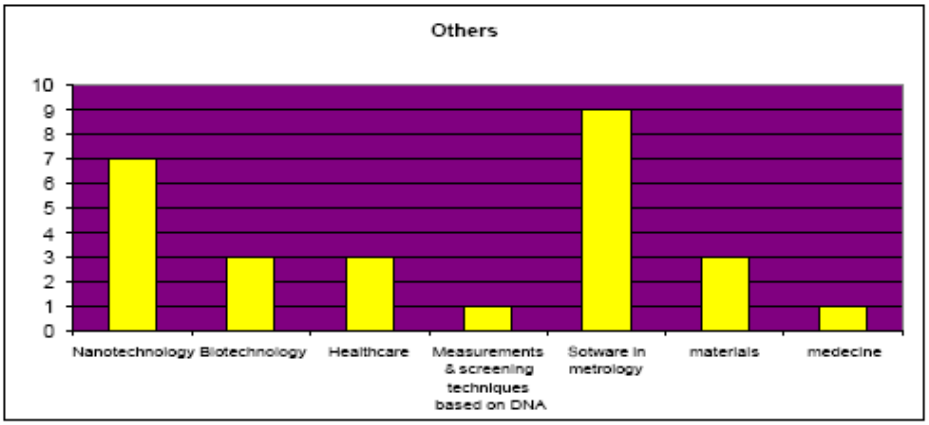
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Nanotechnology
Biotechnology
Healthcare
Measurements & screening techniques based on DNA
Sotware in metrology
materials
medecine

Annex 4:

The European Metrology Research Programme – the EMRP (Version 2007)

"http://www.euramet.org/index.php?id=993"

Annex 5:

iMERA Plus Research Council Opinion

Formal opinion of the EMRP Research Council with regard to the iMERA-Plus (ERA-NET Plus) 2007 Call and Selection process and list of selected Joint Research Projects

EMRP and iMERA-Plus have given a full and open description of the iMERA-Plus call for the proposals and selection process that they have undertaken in the past 7 months. They have explained the critical constraints they had to work within and the overall aims of this ERA+NET phase of the EMRP ambition.

The issues raised by the Research Council concerned the challenge of comparison of projects from the 4 different Targeted Programmes. IMERA-Plus explained their approach to this issue and satisfied the Research Council that they had done their utmost to ensure independent evaluation and fair allocation across the 4 TPs. In fact only 4 of the total of 39 projects were directly affected by this "between TP" competition. IMERA-Plus explained how they elicited non-NMI stakeholder input for the Health TP, which is a non-traditional challenge for the NMIs across Europe.

The Research Council would like to congratulate the EMRP and iMERA-Plus on the very good process they have implemented under the ERA-NET Plus phase of the EMRP. The Research Council was particularly impressed by the fact that the different National Governments have recognised the need to make a genuine cross European basis for Metrology by matching the EU contribution by a factor of 2:1 and allowing national resources to be subject to an independent joint European process of selection.

The Research Council therefore gives a positive opinion of the process and the outcome of the iMERA-Plus call and project selection process, including the final ranked list of Joint Research Projects. The Council look forward to successful outcome of these challenging metrology research projects over the next few years. This current initiative is an important contribution to the further development of the European Research Area.

Furthermore, recognising the success of this pilot phase, the Research Council strongly recommends that the metrology community and the European Commission move rapidly towards a proposal to Council and Parliament for a joint programme under Article 169 of the European Treaty. Metrology underpins virtually all areas of research in the Framework Programme, facilitates innovation and supports many aspects that impact on the quality of life of the European citizens. Open to all interested and competent European institutes able to deliver sustainable input into the European metrology system and working with wider stakeholders, such a programme will have significant impact at European level. The Research Council see the joint EMRP under Article 169 as a crucial component of the European Research Area

EMRP Research Council, Paris, 28th November 2007

Institutional members:

Hendrik Emons	European Commission
Daniel Esteve	European Research Council
Ulrich Panne	EUROLAB
Knut Lindlov	WELMEC

Personal members:

Mikko Paalanen	Finland
Christophe Salomon	France
Klaus von Klitzing	Germany
Matthew Reed	Great Britain
Rene Dändliker	Switzerland
Elly Plooij-van Gorsel	Netherlands