How is the CIPM MRA enabling the development of National and Regional Metrology Infrastructures in Africa?

Dr Wynand Louw
Chairperson
AFRIMETS
Outline of Talk

- The history of AFRIMETS in brief
- The AFRIMETS structure
- The members and their metrology needs
- The role of AFRIMETS in Africa
- The status of metrology in the sub regions
- The role of the CIPM MRA in fostering Metrology in Africa
The ancient Egyptians were well known for their Measurement capabilities.

The Royal Cubit of the New Kingdom: 52.4 cm long.

A fragment of a schist cubit-rod.

Length

Mass

The Deben, 12g, 27g, 93.3 g.

Predynastic (5,000 to 7,000 years ago) Stone mass std.
So where does Africa rate today in Measurement capability?

- African countries achievement of independence since the 1950s brought high socio-economic expectations
- The prospects were optimistic because Africans controlled their own political destiny
- The economic boom in the 1960s strengthened this optimism with an increased demand for raw materials*

Unfortunately this optimism gradually evaporated

From the 1970s, most of the African social and economic development initiatives were grounded to a complete halt.

Throughout the continent economies experienced continual crisis characterised by stagnation, rising foreign debts and increased unemployment

To date, the search for industrial, economic and social development paths continue to elude many African Governments

There are areas reversing this trend such as East Africa, Egypt, Southern Africa

Coetzee et al 2001; Eze, 1997; Coetzee (ed)
Science in Africa

- End of the colonial period: **Skills withdrawal**
- **Academic institutions** became “Africa focused” and during civil wars (and the cold war), many **lost touch** with the outside world
- Many Scientists (and metrologists) that **studied overseas** did not return to Africa
- The **best graduates** frequently **leave for more lucrative opportunities** in the developed world
- The **“lost scientific generation”**
- Severe knock-on effect on **“specialist positions”** such as metrologists
- In 2005, **only two nations** in Africa were officially participating in the international metrology system
- 195 countries in the world
- 54 countries in Africa, or 28% of world
- 4% of Members of the BIPM
The Role of AFRIMETS
the history in brief

- In terms of the **CIPM MRA**, Africa was internationally represented by the Southern African Development Community Cooperation in Measurement Traceability, **SADCMET**

- SADCMET **originated in 1980** between South Africa, Lesotho, Madagascar, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe

- It was later **extended to include all 14 members** of SADC

- Kenya, Uganda, Nigeria, Ethiopia and Egypt joined as **Associate members**

- After the signing of the **CIPM MRA in 1999**, SADCMET took on the role as the Regional Metrology Organisation (RMO) for Africa
The idea of a continental African metrology system was born in 2004-2005.

A first workshop was held in SA in March 2006 under the auspices of the New Partnership for Africa’s Development (NEPAD), the PTB and SADCMET.

A second workshop was held in July 2006, attended by a large number of interested parties and other RMOs.
the birth of AFRIMETS, 2006-2007

- Pan African organisations; **AU, NEPAD**
- Regional economic groupings; **COMESA, ECOWAS, SADC, UEMOA, EAC, CEMAC**
- Bureau International des Poids et Mesures (**BIPM**)
- Regional Metrology Organisations; **APMP, SIM, EUROMET, COOMET**
- African sub-regional metrology organisations: **EAMET, MAGMET, SADCMET**
- Individual NMIs; **CSIR NML, BOBS, KEBS, NIS, SON**
- Legal Metrology organisations; **SADCMEL, ONML**
- Other organisations; **SADCA, SADCSTAN, the dti, ARSO, the African Committee of Metrology, the NLA**
- The Network of Users of Scientific Equipment in Eastern & Southern Africa (**NUSESA**)
an umbrella organisation for sub-regional metrology groupings
share experiences and technical infrastructures
transparency;
promote an equal partnerships between organisations and disciplines in metrology;
respect national autonomies;
commit to the development of metrology;
Brotherliness, solidarity and mutual assistance;
Inclusiveness;
common approaches / positions;
excellence;
Increased recognition of African metrology competence.
The Guiding Principles formed the basis for the MoU

The Inaugural General Assembly meeting of AFRIMETS was held at the premises of NEPAD, South Africa 1-2 July 2007

During the two days;
- the MoU was finalised,
- the first Chair, Vice-chairs and Executive committee members were elected

Finally, 5 sub regions and two individual institutes/countries signed the MoU
AFRIMETS was officially accepted as the RMO for Africa by the CIPM in October 2008.

1999-2008 (SADCMET)

2008- (AFRIMETS)
<table>
<thead>
<tr>
<th>Association</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEMACMET</td>
<td>Cameroon, Central African Republic, Chad, Equatorial Guinea, Gabon, Republic of the Congo</td>
</tr>
<tr>
<td>EAMET</td>
<td>Kenya, Uganda, (Tanzania), Rwanda, Burundi</td>
</tr>
<tr>
<td>MAGMET</td>
<td>Algeria, Morocco, Tunisia, Mauritania</td>
</tr>
<tr>
<td>SADCMET-MEL</td>
<td>Angola, Botswana, DRC, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia, Zimbabwe and Seychelles</td>
</tr>
<tr>
<td>SOAMET</td>
<td>Benin, Burkina Faso, Guinea, Guinea-Bissau, Mali, Niger, Senegal, Togo, Côte d’Ivoire</td>
</tr>
<tr>
<td>NEWMET</td>
<td>Egypt, Ethiopia, Ghana, Libya, Nigeria, Sudan</td>
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</tbody>
</table>
### the members (2009)

<table>
<thead>
<tr>
<th>Role</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td>Associate Members</td>
<td>- LNE, France</td>
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<tr>
<td></td>
<td>- PTB, Germany</td>
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<td></td>
<td>- NIRPS (National Institute of Radiation Protection and Research, Nigeria)</td>
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<td></td>
<td>- Madagascar-INSTN, Tanzania-TAEC, Ghana Radiation Protection Institute</td>
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<tr>
<td>Observers</td>
<td>- EURAMET</td>
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<td></td>
<td>- CAFMET (Comité Africain de Métrologie)</td>
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<td></td>
<td>- Arab Federation of Metrology</td>
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<tr>
<td>TC 1A</td>
<td>CI PM, BI PM, J CRB Issues</td>
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<td>-------</td>
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<tr>
<td>TC 1B</td>
<td>OIML Issues</td>
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<tr>
<td>TC 2A</td>
<td>Scientific Metrology Education</td>
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<tr>
<td>TC 2B</td>
<td>Legal Metrology Education</td>
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<tr>
<td>TC 3</td>
<td>Metrology Infrastructure</td>
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<tr>
<td>TC 4A</td>
<td>Legislation Harmonisation; Scientific Metrology</td>
</tr>
<tr>
<td>TC 4B</td>
<td>Legislation Harmonisation; Legal Metrology</td>
</tr>
<tr>
<td>TC 5</td>
<td>Metrology Awareness</td>
</tr>
<tr>
<td>TC 1A: Working Groups</td>
<td>Mass and Related Quantities</td>
</tr>
<tr>
<td>-----------------------</td>
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<tr>
<td></td>
<td>Flow</td>
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<tr>
<td></td>
<td>Pressure</td>
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<tr>
<td></td>
<td>Force, Torque and Hardness</td>
</tr>
<tr>
<td></td>
<td>Dimensional (Length)</td>
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<td></td>
<td>AUV</td>
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<td></td>
<td>Temperature</td>
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<td></td>
<td>Time and Frequency</td>
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<td></td>
<td>Photometry and Radiometry</td>
</tr>
</tbody>
</table>
## TC 1A: Working Groups

<table>
<thead>
<tr>
<th>Ionising Radiation</th>
</tr>
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<tbody>
<tr>
<td>Radioactivity Standards</td>
</tr>
<tr>
<td>DC-LF (Voltage)</td>
</tr>
<tr>
<td>Metrology in Chemistry</td>
</tr>
</tbody>
</table>

- CMC level
- Accredited level
- Developing level

### Quality WG

**Chairperson:** Dr Ahmed El Sayed (NIS)  
**Vice-Chair:** Monica Peart (NMISA)

- Representatives of Sub regions

### TC 1B: Working Groups

**Weigths and Measures**
Current Situation

- AFRIMETS structures are in place
- Work Programme for 2009 includes:
  - 5 AFRIMETS comparisons
  - 2 regional Proficiency Testing schemes
  - Legal Metrology work and action plan
  - Fund raising activities
  - Sub regional metrology workshops
- WG meetings (Mass, Length, IR, Temp, P&R, MIC, LM) held in SA in July 2009
- 3rd General Assembly meeting held in SA in July 2009
Current Situation
The CIPM Consultative Committees: AFRIMETS member participation

<table>
<thead>
<tr>
<th>Consultative committees (10)</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultative Committee for Acoustics, Ultrasound and Vibration (CCAUV)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Electricity and Magnetism (CCEM)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Length (CCL)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Mass and Related Quantities (CCM)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Photometry and Radiometry (CCPR) (Chairmanship)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Amount of Substance (CCQM)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Ionising Radiation (CCRI)</td>
<td>Observer</td>
</tr>
<tr>
<td>Section I</td>
<td>Full Member</td>
</tr>
<tr>
<td>Section II (Chairmanship)</td>
<td>None</td>
</tr>
<tr>
<td>Consultative Committee for Thermometry (CCT)</td>
<td>Full member</td>
</tr>
<tr>
<td>Consultative Committee for Time and Frequency (CCTF)</td>
<td>Full member</td>
</tr>
</tbody>
</table>
The Greater Role of AFRIMETS in Africa

- In addition to measurement equivalence and harmonisation of Legal Metrology activities
  - Liaison with the AU/NEPAD
  - Liaison with other RMOs and especially a GULF Metrology programme
  - Establishment of Metrology Infrastructure
  - Coordination between SRMOs
  - Coordination of donor funding
  - Awareness creation
  - Training
  - Regional Measurement Institutes?
the metrology needs of Africa

- Africa’s economy relies on **agriculture, minerals/metals and oil**
- Cocoa products, coffee, sesame, cassava, nuts, honey, cotton, fruits and vegetables, spices, flowers and plants, wood, essential oils, seafood and gastropods
- minerals/metals - gold, platinum, diamonds, copper, coal and most other metals
- Oil and natural gas

*www.export-forum.com/Africa*
EAMET

- Is based on the EAC
- Vast potential in mineral, water, energy, forestry and wildlife resources
- Total combined population – 88 million
- Total combined GDP - $100 billion
- Main export products
  - Coffee
  - Bananas (Burundi 10th largest exporter in the World)
  - Cotton
  - Coffee/Tea
  - Sugarcane
  - Dairy and meat products

The status of metrology in EAMET

Kenya
- Kenya has a well established Standards and Metrology body (KEBS), Legal Metrology (WMD)
- KEBS associate member of the CGPM (Full member of BIPM in Jan 2010)
- Most laboratories accredited to ISO 17025
- Sets standards, keeps NMS, performs testing, customs inspection. Meets most needs of TI in Kenya
- Challenges remain: MIC started

Uganda
- Well established Scientific and Industrial and Legal Metrology, Uganda National Bureau of Standards (NBS)
- Standards development, verification, inspection, measurement standards, testing
- Can not meet testing needs due to lack in capacity. Fish ban, 1999

the status of metrology in EAMET

**Rwanda**
- Rwanda Bureau of Standards (RBS)
- Standardisation, Quality assurance, metrology, testing
- Dimensional, Electricity, Instrumentations, Mass, Temperature, Volume, Pressure

**Burundi**
- Bureau Burundais de Normalisation et Contrôle de la Qualité (BBN)
- Standardisation and Metrology division
- Certification, accreditation and inspection
- **Main Products Certified by BBN:**
  - Organic products (fruits and vegetables)
  - Honey, palm and cotton oil
  - Passion fruit juice, mineral water
  - Milk, Tea

NEWMET

- GDP: $810 billion
- Population: 325 million
- Natural resources: Potash, salt, bauxite, manganese, gold, copper, platinum, oil, natural gas, diamonds
- Agriculture (47% of GDP): Products--coffee, cereals, pulses, oilseeds, khat, meat, cocoa, hides and skins
- Industry (12% of GDP): Types--textiles, processed foods, construction, cement, and hydroelectric power
- Tourism (Egypt)

www.state.gov/r/pa/ei/bgn/2859.htm www.selamta.net
Egypt
- has a well established Scientific and Industrial Metrology body (NIS)
- some laboratories accredited to ISO 17025
- Quality system approved by EURAMET
- With national laboratories, can perform most testing for Egypt

Nigeria
- Well established Standards, Scientific and Industrial and Legal Metrology body, SON
- Standardisation, conformity assessment
- Permission to establish a metrology section
Ghana
- Ghana Standards Bureau (GSB)
- MSTQ
- Metrology, Standards, Testing and Quality Assurance
- Testing, Inspection, Certification, Calibration
- Dimensional, Mass, Electrical, Instrumentations, Mass, Temperature, Volume, Density, Pressure, Force, Frequency

Ethiopia
- Quality and Standards Authority of Ethiopia
- Standardisation, Metrology, Legal Metrology
- Mass, Dimensional and linear, Volume and Flow, Pressure and Force, Temperature, Electrical Quantities and T&F Measurements
the status of metrology in NEWMET

**Libya**
- Libya National Centre for Standardisation and Metrology (LNCSM)
- Standards, Metrology and Accreditation

**Sudan**
- Sudanese Standards and Metrology Organisation (SSMO)
- Standardisation, Calibration, Weights and Measures
- Specialist laboratories
  - Food and feeds
  - cereals
  - engineering (civil, mechanical, electrical, electronic, chemical)
  - pharmaceuticals
  - environmental
  - Gold
  - chemicals, microbiology and mycotoxins

*www.sol-sd.com, www.iso.org*
SADCMET/MEL

- Is based on SADC
- Has extensive mineral resources, including estimated 70% of the world’s platinum, 60% of gold and 40% of diamonds
- Main exports include agro-foods, manufactured goods, minerals, oil
- Total population of 255 million
- Total GDP $800 billion
Technical Infrastructure (Standards, Metrology, Accreditation) well established in SADC region
- Supports all sectors of the economy
- NMISA can provide traceability to the region, supported by secondary standards in most countries
- Legal metrology system well established in 12 of the 14 SADC countries
- Challenges in providing traceability for GMO analysis, environmental analysis (dioxins, furans), POPs
- Is based on the MAGHREB countries (excluding Libya)
- Mauritania joined in May 2009
- Main exports currently are agro-food products, fish products and cotton
- Total population of 85 million
- Total GDP $450 billion
- Very little *intra trade*

Morocco

- Scientific and Industrial and Legal Metrology well established at the National Metrology Laboratory (LNM) at the Laboratoire public d'essais et d'etudes (LPEE)
  - Accredited by internal accreditation body
  - Mass and Force
  - Temperature and humidity
  - Dimensional
  - Pressure
  - Electrical
  - Industrial hydraulics
- Participates in MAGMET and AFRIMETS comparisons
- Next step is Associate membership of the CGPM
the status of metrology in MAGMET

**Tunisia**

- Scientific and Industrial metrology conducted by the Central Laboratory for Analysis and Testing (LCAE), the National Defense Laboratory (DEFNAT) and the Precision Measurement Equipment Laboratory (PMEL)
- In 2008, the **National Agency of Metrology (ANM)** was established to be responsible for Legal and Scientific and Industrial metrology and the roles of LCAE, DEFNAT and PMEL was formalised
- **Associate member** of the CGPM
- Participates in MAGMET and AFRIMETS comparisons
- The National Accreditation Council (**TUNAC**) is a **signatory** to the International Laboratories Accreditation Co-operation (**ILAC**)
the status of metrology in MAGMET

Algeria
- Legal Metrology well established National Office for Legal Metrology (ONML)
- Scientific and Industrial Metrology conducted in the ONML
- Member of OIML

Mauritania
- Signed the MAGMET MoU in 2009
- Corresponding member of OIML
- No information available at present on capabilities
SOAMET

- Is based on UEMOA (the West African Economic and Monetary Union)
- Niger holds the world's biggest Uranium reserves
- Significant Gold reserves in Mali
- Senegal, Côte d’Ivoire, Burkina Faso, Benin and Guinea-Bissau holds large mineral reserves
- The region boasts significant petroleum reserves
- Main exports currently are agro-food products (cacao) fish products and cotton.
- By 2006, Côte d’Ivoire supplied 46% of the world cacao production
- Total population of 125 million
- Total GDP $160 billion
- Accounts for 0.1% of global trade

The secretariat for metrology (SOAMET) was formed by the council of Ministers of UEMOA.

Interesting approach of designating existing laboratories as “regional NMIs” (some accredited to ISO 17025) to be responsible for primary traceability for selected parameters.

This way, resources are optimised.
CEMACMET

- Metrology cooperation of CEMAC (the Economic and Monetary Community of Central Africa)
- Equatorial Guinea, one of the smallest countries in Africa is the 3rd largest exporter of oil in Sub-Saharan Africa
- Gabon’s per capita income is 4x the average of Sub-Saharan pci
- Main exports are agro-food products, cassava, cotton, coffee, cocoa, diamonds, petroleum
- Total population of 39 million
- Total GDP $108 billion
- Very little scientific metrology activity

Summary of Metrology status in Africa

- High Level (participating in the CIPM MRA) Metrology facilities:
  - *South Africa, Egypt, Kenya*

- Legal Metrology and Industrial and Scientific Metrology facilities
  - *Tunisia, Ghana, Morocco, Tanzania, Ethiopia, Ghana, Botswana, Zimbabwe, Uganda, Cote d’Ivoire*

- Legal Metrology and establishing Scientific metrology facilities:
  - Algeria, Libya, Sudan, Nigeria, Malawi, Angola, Swaziland, Mozambique, Rep. of Congo, CAR, Benin, Burkina Faso, Guinea Bissau, Namibia, Seychelles, Gabon, Madagascar, Mauritania, Rwanda, Burundi

- Only Legal or no Metrology facilities:
  - Lesotho, Somalia, Eritrea, Gambia, Mali, Liberia, Comores, Cape Verde, Cameroon, Niger, Senegal, Togo
Conclusion

- AFRIMETS was designed to be the RMO for Africa in support of the CIPM MRA and intra-Africa and global trade
- Many challenges remain, such as the establishment of basic scientific metrology facilities in more than 20 countries, or regional metrology facilities to support traceability for issues such as environmental and POPS monitoring
- The CIPM MRA created awareness of metrology in Africa
- The CIPM MRA contributes to the desire of African nations to establish scientific metrology facilities
Thank You!