

 **nmisa**
National Metrology Institute of South Africa

**STRATEGIC PLAN
2018-2023**

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FOREWORD BY THE MINISTER

Dr Rob Davies, MP
Minister of Trade and Industry

NMISA is mandated in ensuring measurement equivalence with the global International System of measurements, the SI. Metrology plays a fundamental role in numerous aspects of everyday life and NMISA contributes specifically in metals fabrication, automotive and components, plastics, pharmaceuticals and chemicals, bio-fuels, green economies, agro-processing, aerospace, clothing and textile and business sectors to mention but a few. Considering the slow growth outlook in the current economic climate, it is significant for all locally produced goods to compete in world markets and NMISA's collaborative efforts with the dti and other government departments to improve competitiveness in South African industries is notable.

The National Metrology Institute of South Africa underpins all accurate measurements for the country and the region and provides for international acceptance of local measurements. This is important under the current global context that is characterised by a structural shift in the production systems. South Africa will have to adapt and open new sector opportunities in order to respond these structural shifts characterised by the digital (Fourth) industrial revolution; energy and carbon mitigation, waste management etc. The country's competitiveness in this new context demands a very strong well equipped NMISA as a measurement institute that forms a base of the country and the region's quality infrastructure.

The strategic plan for NMISA aims to respond by developing fit for purpose measurement solutions that are required to ensure competitiveness in the key IPAP priority areas that include:

1. Automotives
2. Clothing, Textiles, Leather and Footwear
3. Metals Fabrication, capital and rail transport equipment
4. Agro-processing
5. Business Process Services
6. Marine Manufacturing and Associated Services
7. Aerospace and Defence
8. Electro-technical Industries

These developments are implemented in the context of greater emphasis on the fourth industrial revolution, Industry 4.0, characterised by highly flexibilised industrial production with strong customisation of products. The design principles of industry 4.0 such as the ability to collect and analyse data and provide Real Time capability are highly dependent on accurate measurements and measurement solutions.

I would like to take this opportunity to endorse the NMISA Strategic Plan 2018-23 and Annual Performance Plan 2018-2021 and indicate my confidence that its implementation will result in an enhanced efficiency of the Quality infrastructure to help the South African economy to grow in competitiveness under the new global context with its challenges.



FOREWORD BY THE CHAIRPERSON

Dr Prins Nevhutalu
Chairperson

Metrology impacts every sphere of society and most importantly, measurement assists with the improvement of the competitiveness of the South African industry in support of the national strategic initiatives. Important decisions (economic, social and medical) are based on results of measurements. Measurements are part of our daily lives and wrong or inaccurate measurement can result in losses, disagreement between trading partners and it can also cause harm to people and the environment; our very survival depends on the ability to measure accurately. This is increasingly becoming central in the context of a shift in production systems in the world economy associated with the fourth industrial revolution.

The strategic plan 2018-23 is a continuation of NMISA's response to ensure that South Africa remains globally competitive under new economic context. The strategic plan increases a focus on the new programs to ensure increased provision of relevant fit for purpose measurement solutions to the South African Economy. The Plan present the strategies for growing emphasis and the impact of the NMISA focus areas that have been consolidated under the overall theme of shortening the traceability chain for South Africa and the African continent. Eight thematic thrusts were developed and implemented in alignment to IPAP and other national priorities. The eight strategic thrusts are:

- i. Reference Materials
- ii. Manufacturing Competitiveness
- iii. Quality of Life
- iv. Energy Efficiency
- v. Green Economies
- vi. Redefinition of the SI

- vii. Advanced measurement solutions and
- viii. Commercialisation

The strategic plan recognises the importance of regulations and specifically the effective implementation of regulations that are related to ensuring that South Africa and the region benefits from quality infrastructure which include trade facilitation, consumer safety, public health and safety as well as law enforcement.

The NMISA will continue in the efforts to raise funding for the development of a new NMISA infrastructure that is necessary to respond to the increased demand on the measurement infrastructure in response to technological advancements. The aggressive NMISA Human Capital Development Programme will also be continued capitalising on the strategic alliances that have been built with technical and academic Universities, Science Councils and other NMIs. A diversified skilled human capital is central to the successful implementation of the strategic plan and therefore new strategic alliances will be pursued to enhance the HCD program.

We are looking forward to increased impact of NMISA as a result of the implementation of this strategic plan. The link and contribution of the NMISA programs to National Key Projects and programs and initiatives to help revive and grow the economy will be the NMISA board of directors' area of focus in addition to ensuring good corporate governance and compliance.



Dr P Nevhutalu
Chairperson
NMISA

OFFICIAL SIGN-OFF

It is hereby certified that this Updated Strategic Plan:

- Was developed by the management of NMISA under the guidance of the NMISA Board and the dti;
- Takes into account all the relevant policies, legislation and other mandates for which NMISA is responsible;
- Accurately reflects the strategic outcome orientated goals and objectives which the NMISA will endeavour to achieve over the period 2018 – 2023.



Mr Calvin Sehlapelo
Chief Financial Officer



Mr Ndwakhulu Mukhufhi
Accounting Officer



Dr Prins Nevhutalu
Accounting Authority

Approved by



Dr Rob Davies
Executive Authority



EXECUTIVE SUMMARY

Mr Ndwakhulu Mukhufhi
 Chief Executive Officer

NMISA was established under the Measurement Units and Measurement Standards Act, No. 18 of 2006 (The Measurement Act) as the custodian of the national measurement units and national measurement standards (NMS). In this role, as part of the South African Technical (Quality) Infrastructure, NMISA maintains and ensures the appropriate application of the International System of Units (SI) and other measurement units as defined by NMISA in consultation with the measurement community, for the country.

NMISA also keeps, maintains and disseminates the gazetted NMS. This role is performed through various products and services and is influenced by the external environment.

Technological advances over the past decade are placing stringent demands on metrology and new areas such as industry 4.0 (systems integration, the internet of things, simulation & virtualisation, autonomous robots, additive manufacturing, etc.), nanotechnology, optical techniques, quantum-based technologies, material sciences, etc., developed rapidly and requires new measurement methods and standards. In response, NMIs are investing more funds into development and research activities towards the improvement of existing standards and to facilitate the development of new measurement standards that address emerging national needs.

The redefinition of four of the seven SI base units will fundamentally change the way the international equivalence of measurements is established and will place even more stringent demands on metrology. With an increase in free trade agreements and especially the tri-partite free trade agreement between SADC, COMESA and the EAC, and finally the Continental Free Trade Area (CFTA), it is envisaged that technical barriers to trade may increase in an effort to protect local markets.

At a national level, large infrastructure programmes and the drive towards beneficiation and industrialisation require greater accuracy in measurement.

These are the main influences on the performance environment of NMISA. NMISA programmes are particularly in support of the nine-point plan and the implementation of the IPAP and the delivery and service environment for NMISA has now been tailored to report against the matrix structure in the form of programmes underpinned by regional integration and maintenance of the national measurement standards.

As part of the 2018-2023 planning horizon, NMISA is implementing projects to develop new NMS in anticipation of requirements from industry 4.0 and for manufacturing competitiveness, produce CRM's critical to trade and industry, maintain the international equivalence of the NMS, disseminate traceability to industry sectors and provide reference values for proficiency testing schemes. All the projects will be implemented in support of the goals of the NDP, the IPAP and other government priority projects such as the transport (rail) infrastructure development programme, the drive to a greener, energy efficient economy and regional integration.

In implementing the Strategic Plan 2018-23 NMISA has been structured into a matrix organisational structure with programmes designed and structured to provide fit for purpose measurement solutions to the South African Economy under the overall theme Shortening the traceability Chain for South Africa and the African continent:

- Reference Material Production for Food testing and environmental monitoring
- Green Economies
- Energy Efficiency

“The redefinition of four of the seven SI base units will fundamentally change the way the international equivalence of measurements is established and will place even more stringent demands on metrology”

- Manufacturing Competiveness
- Advanced Measurement Solutions
- Redefinition of the SI
- Quality of Life
- Regional Integration
- Commercialisation

The implementation of the projects under these programmes is focussed on provision of measurement solutions to the NMISA stakeholders and clients with a consideration for the user pay principle. During the strategic planning horizon, the South African fiscus is under tremendous strain with cost containment measures and budget cuts being implemented across all of government and the state-owned entities. The impact of this on NMISA’s sustainability is obvious, necessitating the need for external revenue generation to enhance sustainability both in the short and medium to long term. This is critically important since NMISA did not receive the increase in baseline funding motivated for in the previous financial year necessitated by the need to increase capacity to support national requirement, to realise the new SI and to establish the corresponding NMS.

A condition for the success of the programmes is the drafting and implementation of regulations related to the quality infrastructure. The NMISA executive and project staff will be focussed

on input into the drafting and implementation of regulations in government departments with a regulatory function. Within the dti family, focus will be given to regulations emanating from the Legal metrology act which have impact on Metrology requirements. Implementation of these regulations will unlock the NMISA’s provision of fit for purpose measurement solutions as required by the respective regulators in line with the regulations.

NMISA is committed to building an organisation which reflects the profile of the South African population. The organisation will therefore continue with the implementation of the aggressive HCD programme to ensure a transformed organisation with diverse skills, an enhanced qualification profile and a high-performance culture underpinning customer service to ensure long term sustainability.



Mr Ndwakhulu Mukhufhi
Chief Executive Officer
NMISA



PART A
**STRATEGIC
OVERVIEW**

VISION, MISSION AND VALUES

1. VISION

To be a measurement centre of excellence inspired to consistently deliver outstanding, innovative and internationally comparable measurement solutions that support the country's trade, people's quality of life and enable the protection of the environment.

2. MISSION

To provide the South African Industry and environmental, health and safety sectors with fit-for-purpose measurement standards and measurements. This is achieved by keeping and maintaining the national measurement standards to an acceptable international standard; by disseminating traceability to the South African industry and to ensure the correct application of the International System of Units (SI) in South Africa.

3. VALUES

- Measurement excellence
- Social responsibility
- Economic prosperity
- Good Governance

4. LEGISLATION AND OTHER MANDATES

4.1 LEGISLATIVE MANDATE

NMISA was established under the Measurement Units and Measurement Standards Act, No.18 of 2006 (The Measurement Act);

“To provide for the use of measurement units of the International System of Units and certain other measurement units; to provide for the designation of national measurement units and standards; to provide for the keeping and maintenance of national measurement standards and units and to provide for the establishment and functions of the National Metrology Institute”

NMISA sees to the application of the SI units in South Africa, coordinates the process to approve other measurement units for use, maintains the gazetted NMS, disseminates the NMS and specialised measurement to society, provides reference analysis, offers certified reference materials to industry and others. NMISA continuously improves and expands the NMS to enhance and expand the services it offers to industry and stakeholders.

This role is further expanded to be the main advisor and consultant on measurement issues to government departments and public entities. NMISA provides input to lawmakers and regulators to ensure the integrity of measurement issues.

4.2 POLICY MANDATES

4.2.1 The Measurement Act

Act No. 18 of 2006 has been in existence for nearly 10 years and the NMISA will propose amendments to the Act in line with modern developments. Amendments may include a requirement for the use of the calibration services of NMISA and certified reference materials produced by NMISA, by laboratories of public entities and law enforcement agencies. Other amendments need to take the redefinition of the International System of Units (SI) into account and reflect on the Quality System requirements, i.e. accreditation or peer review by other NMIs, in the establishment of traceability to the national measurement standards.

4.2.2 International mandates

South Africa is a signatory to the Metre Convention of 1875. Under the Metre Convention, the International Bureau of Weights and Measures (BIPM) was created to act in matters of world metrology, particularly concerning the demand for measurement standards of ever increasing accuracy, range and diversity, as well as to address the need to demonstrate equivalence between national measurement standards. The International System of Units (SI) was also established under the Metre Convention.

South Africa signed the International Committee for Weights and Measures (CIPM) Mutual Recognition Arrangement (MRA) in 1999. The CIPM MRA was a response to a growing need for an open, transparent and comprehensive scheme to give users reliable quantitative information on the comparability of national metrology services and to provide the technical basis for wider agreements negotiated for international trade, commerce and regulatory affairs. It is the basis for the international acceptance of national measurement standards and for calibration and measurement certificates issued by National Metrology Institutes (NMIs).

The BIPM, CIPM MRA - and associated procedures to establish the equivalence of NMS and the SI - govern the activities of NMISA to ensure a proper measurement system for South Africa.

4.2.3 Industrial Policy Action Plan

The Industrial Policy Action Plan (IPAP) of the Department of Trade and Industry (the dti), which applies to all of the dti's Technical Infrastructure (TI) institutions, including SABS, SANAS, the NRCS and NMISA, states that:

"Multilateral, regional and bilateral trade agreements are all creating long-term downward pressure on tariffs as an instrument of strategic trade policy. The role of Technical Barriers to Trade (TBTs) and Non-Tariff Barriers (NTBs) is increasing the relative importance of technical infrastructure policies and institutions. Developed countries and advanced developing countries are increasingly using TBTs and NTBs to protect their markets. SQAM issues supported by Technical Infrastructure policies and institutions are set to play an increasing role in global trade, in line with TBTs and NTBs".

This re-orientation has two broad strategic thrusts:

- 'Locking out' unsafe and poor quality imports; and
- 'Locking in' access to increasingly demanding export markets"

"Our technical infrastructure institutions will also re-prioritise their activities to support the development, accreditation and enforcement of standards that can create, scale up and resuscitate certain industries while simultaneously contributing to broader social benefits. A sound technical infrastructure plays a significant role in the economy in two ways. First, it assists firms to adopt and meet the quality standards necessary to compete in global markets. Secondly, it assists in ensuring that low-quality imports do not undercut the productive base of our manufacturing sector. The ability to manufacture to specific requirements is critical in many advanced sectors. It is these measurement-based capabilities that are key criteria for potential players to become members of global supply chains."

4.3 RELEVANT COURT RULINGS

NMISA is impacted by court rulings on law enforcement issues such as speed trapping, breath alcohol analysis and any product specification issue in a South African law or regulation. For the period discussed the following rulings and changes to laws will impact the NMISA.

4.3.1 Breathalysers

The Hendrik's judgement in the Western Cape High Court in Sep 2011 led to the newly revised SANS 1793: 2013 (The specification for evidential breath analysers). This did mean that

no evidential breathalysers have been calibrated in South Africa since 2011. Based on this review, tests were conducted on a new generation breathalyser required by the SANS regulations. The type approval application for the Draeger 9510 ZA will be submitted soon to the NRCS. The Western Cape Government is undergoing a pilot project to re-implement the breathalyser at the SAB Shadow Centres. NMISA and Draeger Germany / South Africa are discussing the requirements and design of the new calibration facility for the new breathalysers. As soon as the process is completed, NMISA will be required to calibrate the new breathalysers.

4.4 MEDIUM TERM STRATEGIC FRAMEWORK

The NMS impacts on all aspects of the South African community, whether directly or indirectly: whether it is the mass of a maize consignment traded on international level, the amount of electricity a citizen pays for in a municipality or the radiation therapy a cancer patient receives. Important decisions (economic, social and medical) are based on measurement results.

Government's strategic plan for the 2014-2019 (electoral term), the Medium Term Strategic Framework (MTSF) is the first five-year implementation phase of the National Development Plan (NDP). The MTSF is structured around 12 Priority Outcomes which cover the focus areas identified in the NDP and Government's electoral mandate. These Outcomes constitute the primarily policy imperatives of the Government, according to which all government initiatives must be aligned:

Outcome 1: Improved quality of basic education.

Outcome 2: A long and healthy life for all South Africans.

Outcome 3: All people in South Africa are and feel safe.

Outcome 4: Decent employment through inclusive economic growth.

Outcome 5: A skilled and capable workforce to support an inclusive growth path.

Outcome 6: An efficient, competitive and responsive economic infrastructure network.

Outcome 7: Vibrant, equitable and sustainable rural communities with food security for all.

Outcome 8: Sustainable human settlements and improved quality of household life.

Outcome 9: A responsive, accountable, effective and efficient local government system.

Outcome 10: Environmental assets and natural resources that are well protected and continually enhanced.

Outcome 11: Create a better South Africa and contribute to a better and safer Africa and World.

Outcome 12: An efficient, effective and development oriented public service and an empowered, fair and inclusive citizenship.

NMISA makes a contribution to all government key priorities and the 12 national outcomes. NMISA's activities support and contribute to addressing the following key social, economic and environmental needs through research programmes:

- Industry 4.0
- Shortening the traceability Chain for Africa
- Reference Material Production for Food testing and environmental monitoring
- Green Economies
- Energy Efficiency
- Manufacturing Competitiveness
- Advanced Measurement Solutions
- Quality of Life
- Regional Integration

As part of the 2018-2023 planning horizon, NMISA is implementing projects to develop new NMS in anticipation of requirements from industry 4.0 and for manufacturing competitiveness, produce CRM's critical to trade and industry, maintain the international equivalence of the NMS, disseminate traceability to industry sectors and provide reference values for proficiency testing schemes. All the projects will be implemented in support of the goals of the NDP, the IPAP and other government priority projects such as the transport (rail) infrastructure development programme, the drive to a greener, energy efficient economy and regional Integration.

5. SITUATIONAL ANALYSIS

Technological advances over the past decade are placing stringent demands on metrology and new areas such as industry 4.0 (systems integration, the internet of things, simulation & virtualisation, autonomous robots, additive manufacturing, etc.), nanotechnology, optical techniques, quantum-based technologies, material sciences, etc., developed rapidly and

requires new measurement methods and standards. In response, NMIs are investing more funds into development and research activities towards the improvement of existing standards and to facilitate the development of new measurement standards that address emerging national needs.

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At a national level, large infrastructure programmes and the drive towards beneficiation and industrialisation require greater accuracy in measurement.

These are the main influences on the performance environment of NMISA.

5.1 PERFORMANCE ENVIRONMENT

5.1.1 The International and Regional Environments and their Requirements

NMISA is represented at the highest level of scientific metrology decision making, the CIPM. It is the only representation from the African continent and the CIPM member needs to ensure that the interests of the African NMIs/countries and specifically South Africa, are protected.

The CIPM coordinates metrology world-wide through 9 technical consultative committees (CCs) and a 10th CC for Units. NMISA has membership of 8 of the 9 technical CCs of the CIPM and Observer status on the 9th, and technical experts from NMISA participate in the CC working group activities and represent the region at the plenaries, the policy setting meetings. NMISA also has guest membership of the 10th CC, the CC for Units, through the President of the CCRI that resides in NMISA. Again the interests of SADC and Africa need to be protected at these meetings. The NMIs of Egypt, Kenya and Tunisia are slowly entering the CCs and are joining the NMISA in CC-Mass & related quantities, CC-Length, CC-Acoustics, ultrasound and vibration, CC-Ionising Radiation and CC-QM (chemistry and biology). It is expected that by 2023, there will be substantially more representation from other African NMIs in the CCs.

The degree of equivalence and the comparability of the NMS are maintained through comparisons of the standards

internationally against other national measurement standards through comparisons organised by the CIPM CCs and/or other NMIs under the Regional Metrology Organisations (RMOs) networks. The results of these comparisons and the CMC claims based on the results are published in the BIPM's Key Comparison Database (KCDB), which is accessible for everybody to check and verify a country's capabilities.

At the regional level, NMISA plays a leadership role in the development of accurate measurement and traceability in the sub-region and Africa. NMISA provides the traceability link to the SI and international standards to sub-Saharan Africa and is the main driving force behind the sub-regional metrology programme (SADCMET) and the intra-Africa metrology system (AFRIMETS). NMISA ensures not only the acceptance of the quality system (QS) of the NMISA as fit-for-purpose for the CIPM MRA, but also assists the other African Members of the BIPM and Associates of the CGPM to get their QSs accepted. The respect that the NMISA enjoys at international level is paramount for this process and should not be underestimated as a driver for the acceptance of the African measurement system internationally. This position must be maintained and even be improved.

In the sub-region, six countries in SADC are now Associates of the CGPM and where in the past NMISA had been the lone voice for SADC in international metrology, the NMIs from the 6 countries are at least on a path to represent their countries internationally. It is envisaged that NMISA will remain the primary source of calibration for these countries but they will have CMCs in the international database by 2020. NMISA can harness the resources of these NMIs towards the fulfilment of the metrology requirements for a free-trade zone.

At a practical level, measuring equipment designed for the developed world is not always suitable for the developing world environment. An opportunity exists for the NMISA to design and manufacture measuring equipment to suit African and, in general, developing country conditions. Part of the strategy is to modernise the workshops and to design and manufacture measuring equipment for Africa. Within the Strategy period the electronic and mechanical workshops will be expanded and resourced. Alliances will also be formed with workshops at universities and science councils.

5.1.2 The National Environment



Figure 1. The dti's Technical Infrastructure Institutes

As one of the dti's Technical Infrastructure (TI) institutes, NMISA's activities are critical to the success of the other TIs. Standardisation, metrology, conformity assessment and accreditation are the key issues in the implementation of free trade agreements between countries/economic trade blocks. Together the TIs work towards 'measured once, accepted everywhere' (see Figure 1).

Measurements performed for regulatory/legal purposes require traceability through a national reference, as provided by NMISA. Regulations also apply to the use of measurement instruments in areas of trade, health care, environmental protection, traffic surveillance and safety at work and the calibration of these instruments have traceability to the NMS. NMISA therefore has a further role to play in providing technical support for many other acts and regulations, such as the Atomic Energy Act, Act No. 90 of 1967 and the Occupational Health and Safety Act, Act No. 85 of 1993.

NMISA is a relatively small NMI in terms of size and budget. It is not possible to conduct all research necessary to fulfil the national accurate measurement needs. The solution is research alliances and networks. The strategy is that for each research thrust, identify research excellence in South Africa and abroad and set up the alliances and network for each. Special emphasis will be placed to include universities outside the main research stream, as well as technical universities, in the networks.

The physics department of UCT has started a development programme towards quantum measurement standards. This is an opportunity for NMISA to fast-track the development of quantum standards in electricity and magnetism.

NMISA has designated iThemba Laboratory for Accelerator-Based Sciences to represent the NMISA/South Africa in medium and high energy neutron measurements. This will lift the profile of metrology in Africa and create an opportunity to increase the sphere of influence internationally. Other such designations may be explored.

5.2 ORGANISATIONAL ENVIRONMENT

NMISA is a Type 3A public entity. It is managed by a Chief Executive Officer (CEO), supported by an executive management team and governed by the NMISA Board.

NMISA manages its technical activities through four technical divisions, namely Physical Metrology, Electricity and Magnetism, Ionising Radiation as well as Chemistry and Materials Characterisation, these are assisted by a cross-cutting Research, International and Infrastructure Development division, and supported by the suite of support functions e.g. Compliance, Planning, Legal, Finances, Supply Chain Management, Human Resources, IT, InfoComms and Internal Audit.

The technical activities of NMISA are mapped onto the international metrology structures. Cross-cutting research initiatives allows for the use of expertise from different technical divisions to contribute to national priorities such as Green Industries, Manufacturing Competitiveness and reference materials requirements for Food and Feed.

NMISA adheres to a total quality management system and has identified the regulatory requirements applicable to its services operations and products in order to ensure compliance. NMISA received certification of its OH&S and EMS management system to ISO 14001 and OHSAS 18001, which specifies requirements for Environmental management systems and an occupational health and safety (OH&S) management system. NMISA adheres to a total quality management system and all relevant and applicable laboratories are accredited to ISO/IEC 17025 whilst the chemistry laboratories are also accredited to ISO Guide 34 and ISO/IEC 17043 (production of reference materials and for conducting proficiency testing schemes). The Safety, Health, Environment and Quality (SHEQ) Department handles all matters relating to health and safety of staff, from ensuring a safe working environment and environmental sustainable practises.

The Information and Communications Division (InfoComms) aims to develop a consistent NMISA way of representing the institute across the board, where all stakeholders that interact with the institute experience the same level of service excellence. Over and above this, the division is responsible for the visibility of the institute both internally and externally (in the public).

InfoComms works to support NMISA in achieving its organisational goals and strategic objectives and it serves the organisation's needs for Marketing and Communication. This will be achieved by the creation of value proposition and fostering strong client relationships, in order to gain financial return and long-term brand and stakeholder value. This division, alongside other divisions like Human Resources, supports NMISA toward achieving its mission, vision and mandate through an engaged workforce and corporate culture that promotes the institute as a trusted partner that strives to provide industry with fit-for-purpose measurement standards.

5.2.1 Organogram

The corporate structure is mapped out in Figure 2. Technical is organised into four technical divisions, namely Physical Metrology, Electricity and Magnetism, Ionising Radiation and Chemistry. The support functions are grouped into three enabling divisions namely Finance (with SCM), Corporate Services and the Office of the CEO.

The redefinition of the SI Units directly impacts on the organisational structure. It is imperative that NMISA realigns its current organisational structure to obtain maximum organisational performance. Figure 3 outlines the realignment or organisational structure to SI Units. It will facilitate effective collaboration within and facilitate cross-cutting research programmes and initiatives that require input from all employees to achieve success. The matrix approach facilitates the most effective manner to manage its maintenance technical activities through.

This approach disintegrates the concept of silo's or islands and reinforces the need to work together towards one integrated vision to achieve success. The realignment also accommodates the mandatory legislation that differentiates financial responsibilities from corporate responsibilities. This risk is mitigated by provisioning a Corporate Services Director position that will embrace all corporate responsibilities within the organisation. This includes resource management of all personnel, infrastructure and communications.

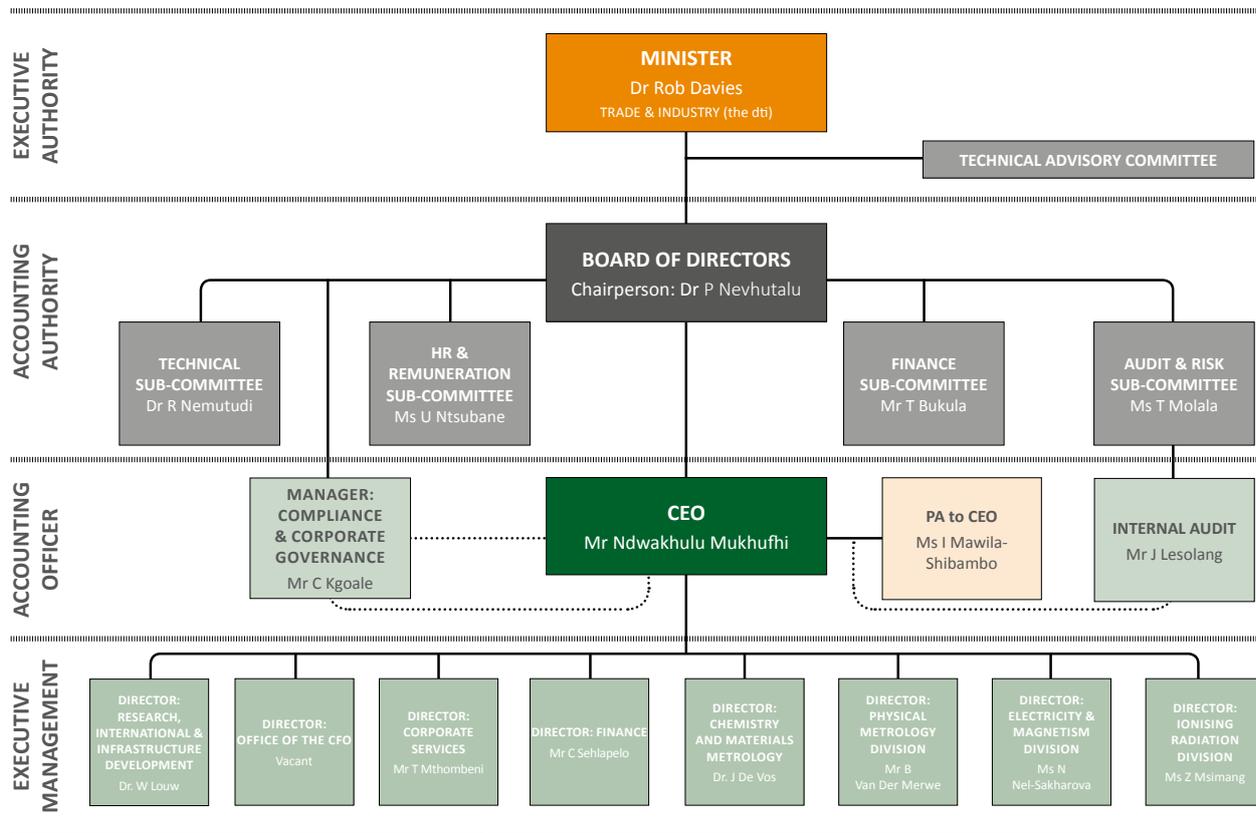


Figure 2. Organisational Structure

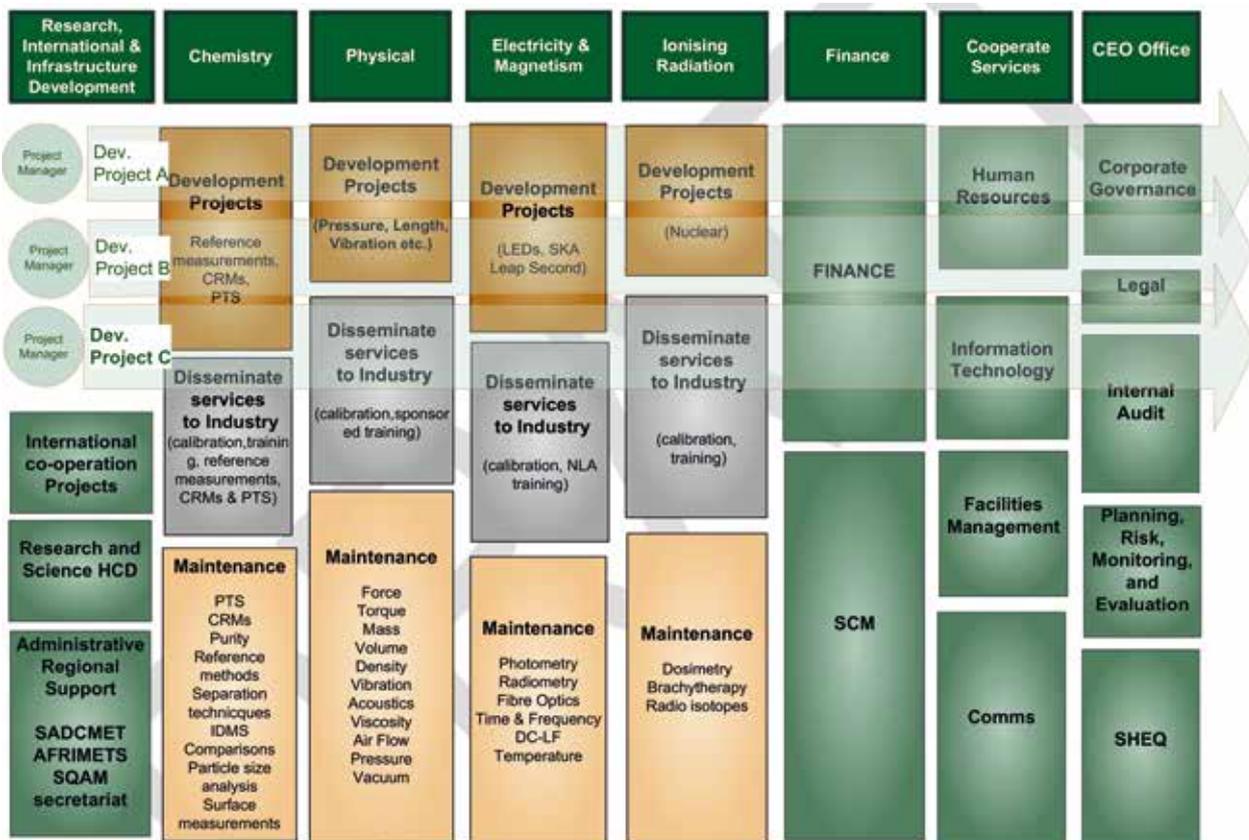


Figure 3. Technical Organisational Structure

5.2.2 Internal Business Review

NMISA's ability to develop new NMS and to maintain and/ or improve the existing NMS to levels required by industry is under threat from an ageing infrastructure. This includes the NMS as well as the building infrastructure.

The NMS and other standards are continually reviewed to ensure that they still meet the needs of the South African industry through engagement with industry and other stakeholders through technical advisory forums and participation in national interest forums. With a doubling of accuracy requirement about every ten years, modern metrology laboratories need to be custom built with advanced environmental control; clean power supplies; surgical grade clean rooms; protection against electromagnetic interference and provision for very low vibration flooring.

To successfully fulfil its mandate, NMISA has to ensure that the equipment and facility infrastructure that supports the NMS are maintained and upheld to stay abreast with technology developments and to ensure the requirements of the South African community are met. This implies continued investment in the required infrastructure.

The measurement infrastructure in the country unfortunately did not keep up with modern developments and the export industry is increasingly faced with the inability of the local measurement system to provide the analysis and traceability needed for exports

In response, almost R600 million has been allocated towards the re-capitalisation of NMISA and a feasibility study for new accommodation. At the end of 2018, most movable measurement systems and NMS would have been upgraded with immovable systems (such as the NMS for Force and Underwater Acoustics) waiting for the completion of the new accommodation.

In the chemistry division the life-cycle of instruments is short due to the rate at which technology changes internationally, and the rate at which allowable residue values of contaminants in foodstuffs and other products are being decreased. The measurement needs and tolerances of the fast-advancing ICT industry also increase exponentially. The result is that even though the instruments are currently renewed, within five years they will again be obsolete. A renewal strategy will be included in the plans for the new accommodation.

New accommodation

NMISA is located on the CSIR's Scientia Campus in Pretoria and still occupies the facility where the first laboratories were built in the early 1960's, with no major building infrastructure investment. The building infrastructure has reached the technical limit of modifications that can be accommodated for the continued housing of the NMS and delivering its services.

The institute has reached an infrastructure crossroad- it is at a critical point where small additional investments will not enable it to continue with services it is mandated to provide. Better environmental conditions, a modern layout and state-of-the-art equipment is needed to maintain and keep NMS and to ensure industry remains globally competitive. Current building infrastructure challenges include:

- Air-conditioning: Climate control is not ideal for the operations of NMISA. Scattered over five buildings at the current site, some areas have a centralised air-conditioning system, while other laboratories have individual systems. The centralised systems are not able to cope with the control demands, or the different requirements from laboratories served by the same system.
- Clean air and clean rooms: Dust produced by the old centralised systems and inadequate window design carry dust by air through doors and other entrances, negatively affecting the optical and chemistry laboratories. Clean rooms are needed to facilitate technology advances in optics and lasers.
- Electricity supply: Most of NMISA's equipment is sensitive to fluctuations in electricity supply. Sudden/unexpected fluctuations in the electricity supply have resulted in damage to critical metrology equipment. Intermediate measures have been put in place, but are far from ideal, as the basic electricity infrastructure is not meeting the NMISA's demands.
- Vibration: High-accuracy scientific equipment is sensitive to vibration and electrical fields, and these should be minimised to ensure the minimum contribution to the measurement uncertainties of the equipment.
- Maintenance of the accreditation scope and measurement and calibration capabilities: NMISA participates in comparisons to establish its measurement capability, and is accredited to provide calibration services to specific accuracies and uncertainties. These capabilities are published locally and internationally, and are what attract

customers (regional and international) to use NMISA as a service provider of choice. Accuracies and uncertainties are directly linked to the laboratory’s environmental condition, and increasingly infrastructure problems are hampering NMISA in delivering to its full capability.

To address the aged infrastructure issue, NMISA management motivated strongly for a re-capitalisation project to modernise the institute and a project was registered at National Treasury for a feasibility study towards re-capitalisation. In addition a special grant was allocated for renewal of instrumentation and the costs associated with the feasibility study, and an additional funding of R50 million was allocated for 2013/14, R100 million for 2014/15, R154 million for 2015/16, R163 million for 2016/17 and R146 million for 2017/18.

During 2017/18 National Treasury informed NMSIA that any funding towards new premises will have to come from current allocations or the dti. Subsequently the dti informed NMISA that funding will be guaranteed towards new premises and a capital allocation of R123 million was made for 2018/19, with a note that in addition, savings may be redirected towards new premises from the department’s budget.

5.2.3 International Benchmarking

NMISA is a small NMI in global terms that is punching far above its weight. It is the only NMI from a developing country with membership of all the technical consultative committees of the CIPM, for the last 16 years it had a member on the CIPM, it represents Africa on many international forums and is overall well respected.

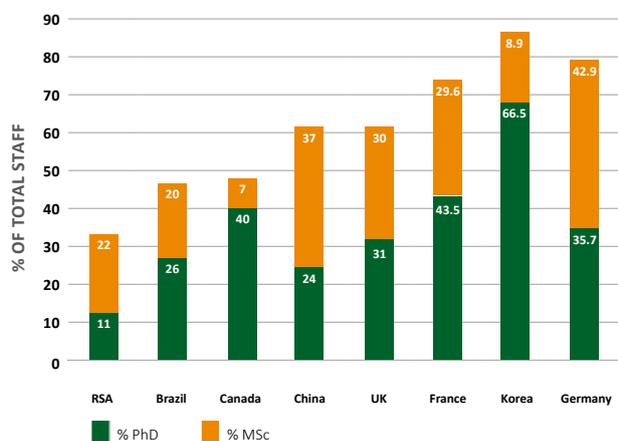


Figure 4. Staff qualification profile (% of total staff with MSc and PhD degrees).

This respect was established over many years but needs to be backed-up with well-educated and trained staff. During 2010/11 a benchmarking study with other NMIs showed that NMISA was falling behind in academic qualifications. Although it had seasoned metrologists that had a high standing internationally, it sounded alarm bells for the future and the skills that will be needed when the SI has been re-defined. The comparison of NMISA with a few major NMIs is shown in Figure 4.

It was also falling behind in scientific outputs, but in comparison was doing well with calibration and measurement capabilities accepted in the international database, as shown in figure 5.

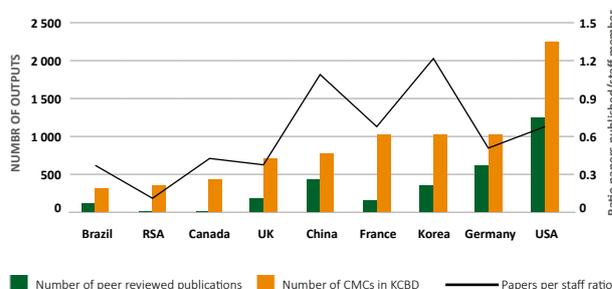


Figure 5: Comparison of technical outputs: CMCs in the KCDB and peer reviewed publications per year

Since then, NMISA has embarked on a drive to improve the qualification profile and the improvement is shown in figure 6. The publication ratio per staff member has improved by 20% and is planned to be at least on par with Brazil and Canada by 2023.

5.3 DESCRIPTION OF THE STRATEGIC PLANNING PROCESS

NMISA looks both internally and externally, as part of its strategic planning process, consulting shareholders, the dti, and monitoring national priorities and programmes, to determine possible and probable emerging needs. NMISA’s Board also plays a critical role in strategic guidance of the organisation, especially through the Technical Committees and Consultative Advisory Forum, where high-level inputs and advice are gleaned from selected industry experts.

Further to this, strategic input into NMISA activities occurs at three distinct levels:

- National, with input from stakeholders and associates in South Africa
- Regional and Continental, with input from stakeholders across the African continent
- International, where, due to the mandate of NMISA, work

inherently requires liaison with other NMIs and the BIPM/ CIPM.

This strategic review specifically included

- Internal business review of all technical and support divisions;
- Presentations to the NMISA Board;
- Industry inputs through the consultative advisory forum (Board level) and technical advisory forums (NMISA divisional level);
- Alignment of activities to the 12 key government outcomes, IPAP and actions by the other TI institutes;
- International trends and directives, as per feedback from meetings of the CIPM and other specialist forums; and
- International benchmarking against other NMIs.

NMISA's activities support and contribute to the following key social, economic and environmental needs:

- quality of life
- manufacturing and industrial development
- commerce and trade
- safety and security
- energy savings and green energies
- environmental protection
- food safety
- information and communication technologies (ICT)
- regional development

NMISA aligns activities to support the dti's strategic objectives, namely:

- Promoting the co-ordinated and accelerated implementation of the government's economic vision and priorities;
- Promoting direct investment and growth in the industrial and services economy, with particular focus on employment creation;
- Raising the level of exports and promoting equitable global trade;
- Promoting broader participation, equity and redress in the economy; and
- Contributing to Africa's development and regional integration within the New Partnership for Africa's Development (NEPAD) and AFRIMETS.

Furthermore, all NMISA's activities are, directly or indirectly, in support of the twelve key government outcomes.

6. STRATEGIC OUTCOME ORIENTED GOALS

The National Metrology Institute of South Africa (NMISA) is guided overall by seven goals, namely:

Goal 1: Keep, maintain and develop the national measurement standards

To provide for the use of measurement units of the International System of Units and certain other measurement units; to provide for the designation of national measurement units and standards; to provide for the keeping and maintenance of national measurement standards and units; to provide for the establishment and functions of the National Metrology Institute; to provide for the repeal of certain laws; and to provide for matters connected therewith.

Goal 2: To ensure that the South African measurement system is internationally comparable

To ensure that the South African measurement system is internationally comparable, by participating in the activities of the International Committee for Weights and Measures as per the Mutual Recognition Arrangement (CIPM MRA).

Goal 3: To modernise NMISA's infrastructure and equipment through recapitalisation.

Recapitalise and modernise NMISA to ensure that the national measurement standards support international trade, health, environmental and safety requirements and remain internationally relevant.

Goal 4: Provide measurement knowledge and expertise

Provide measurement knowledge and expertise as a key component of the Technical Infrastructure with regard to public policy objectives and measurement compliance issues in terms of health, safety and the environment.

Goal 5: Provide an integrated human capital development programme for metrology.

To maintain and ensure continued expertise and establish the necessary skills according to internationally acceptable standards.

Goal 6: Provide essential support to South African public and private enterprises through dissemination of the national measurement standards, units and expertise.

Provide essential support to South African public and private enterprises through dissemination of the national measurement standards, units and expertise.

Goal 7: Adhere to the regulatory requirements of a 3A public entity and sound corporate governance.

Comply with government directives, the PFMA, treasury regulations and regulatory issues in terms of Government regulations.

6.1 PRODUCTS

National Measurement Standards (NMS)

NMISA maintains the gazetted national measurement standards. These standards underpin the South African measurement system and facilitate national traceability of measurements to the SI, or to other international agreed references.

Reference Measurements

NMISA maintains a number of reference measurements in a number of parameters through which the NMS is disseminated. These methods are verified and validated, and underpinned by Calibration and Measurement Capabilities (CMCs).

Certified reference materials

Certified Reference Materials (CRMs) are ‘controls’ or standards used during the analysis and/or quality assurance process of products. Since most analytical instrumentation is comparative, it requires a sample of known composition (reference material) for accurate calibration. The highest order CRMs are usually produced and certified by primary method and under stringent manufacturing procedures, under the jurisdiction of a national metrology body. Accredited laboratories are required to use CRMs to ensure traceability of their results.

6.2 SERVICES

Calibrations

Delivering direct traceability to the NMS, NMISA serves the high-end calibration laboratories by performing calibrations to the highest accuracy (smallest uncertainty). NMISA also holds accreditation to ISO/IEC 17025 for most of the parameters and ranges that it offers calibration services for.

Reference measurements and chemical analysis

NMISA provides reference measurements and analysis according to its calibration range and services.

Measurements, testing and analysis

NMISA offers measurement services to industry. This includes method development for customers, assisting them in problem solving or analysis in support of research projects.

Training

The expertise residing in NMISA staff is an important contribution to the development of a skilled and capable workforce through training in measurement science. Where and when required, NMISA assists especially SANAS and the NLA with training courses. NMISA staff are also involved as invited lecturers in graduate and post-graduate academic courses.

Certification

NMISA has built capability to value assign chemical samples and gas mixtures for customers, including purity.



PART B

STRATEGIC OBJECTIVES

STRATEGIC OBJECTIVES

7. PROGRAMMES TO NATIONAL INITIATIVES

The NMS impacts on all aspects of the South African community, whether directly or indirectly: whether it is the mass of a maize consignment traded on international level, the amount of electricity a citizen pays for in the city or the radiation therapy a cancer patient receives. Important decisions (economic, social and medical) are based on measurement results. The work of NMISA contributes to among others:

- Industry 4.0
- IPAP goals with a special focus on manufacturing competitiveness, advanced manufacturing, agro processing and beneficiation
- Quality of Life
- Environmental monitoring
- Energy efficiency
- Law enforcement
- Regional integration

7.1 STRATEGIC OBJECTIVES

NMISA is guided overall by twelve strategic objectives; namely:

1	Provide for the national measurement units by maintaining the SI units, units outside the SI and equivalents of units
2	Maintain the Schedule of National Measurement Standards
3	Keep, maintain and develop measurement systems for bringing national measurement standards and reference methods into being
4	To ensure internationally recognised and comparable national measurement standards and units by participating in the Metre Convention, CIPM MRA and AFRIMETS activities
5	Establish confidence in the accuracy of the national measurement standards by suitable and documented quality and management system
6	To maintain the Calibration and Measurement Capability (CMC) claims in the KCDB as internationally peer reviewed evidence of South Africa’s measurement capability
7	Recapitalise and modernise the NMISA to ensure that the national measurement standards support international trade, health, environmental and safety requirements
8	As the foundation of the South African measurement system provide technical measurement expertise and support for public policy objectives, accreditation, standardisation and regulatory affairs
9	To maintain and ensure continued expertise and establish the necessary skills according to internationally acceptable standards
10	Disseminate traceability, measurement expertise and services to South African public and private enterprises by means of calibration, measurement or analysis, and certified reference materials
11	Provide appropriate technology and skills transfer to the South African industry, especially to SMEs
12	Comply with government directives, the PFMA, treasury regulations and regulatory issues in terms of health, safety and the environment and apply good governance.

The trade of goods and services around the world is the lifeblood of the global economy, and is increasingly important for domestic economic growth, productivity and investment opportunities. For customers to consider trade to be fair and benefit from it, measurements taken in different parts of the world needs to be equivalent to each other, and accepted by each other. NMISA makes a contribution to all government key priorities and the 12 national outcomes and has aligned its key programmes to the IPAP priority sectors and the NSI.

Without a measurement infrastructure it is difficult to manufacture to international specifications and tolerances to ensure the integrity of export commodities. Measurement assists with the improvement of the competitiveness of the South African industry in support of the national strategic initiatives. Measurements are part of our daily lives and wrong or inaccurate measurement can result in losses, disagreement between trading partners and can also cause harm to people and the environment; our *very survival* depends on the ability to measure accurately. The list of potentially hazardous chemicals that we are exposed to (both naturally occurring and anthropogenic) is ever increasing and the lack of analytical services to monitor these environmental toxins is impacting on South Africa's ability to provide comparable data that informs Government needing to address compliance issues that are becoming critical in trade negotiations and overcoming technical barriers to trade (TBTs). Countries and trade regions impose regulations and directives to trade goods, protect the health of their people and the environment. Stricter legislation and the initiation of environmental programs are being applied globally that directly impact on the South African people and South African trade.

Participation in the Consultative Committees provides clear direction for future stakeholder needs and remaining abreast of technological developments. The research scope is very diverse and complex and should provide for evolving and expanding measurement service needs. The aim of international benchmarking is to carry out Key Comparisons, and where necessary pilot studies, to critically evaluate and benchmark NMI/ designated Institute (DI) claimed capabilities and competences for the execution of 'higher order' measurement procedures for well-defined gaseous compounds and organic molecular entities for which the SI traceable amount of substance is to be determined (organic compounds, organometallic compounds, and large bio-molecules) and to consider, on a selective basis, similar activities for high-priority method-dependent analyses/ measures. Realising the SI units remains the cornerstone to providing accurate measurement to underpin all research activities and cross-cutter projects embarked upon.

Research thrust areas are identified from national government needs and priorities, national science focus areas, international metrology trends and stakeholder requests that inform the development of the South African NMIS. The collaborative platforms for each thrust are established with the appropriate representation from NMISA technical divisions, academia, research institutions and the relevant NMI(s). TID ensures the maintenance of the platform. An essential part of the strategy is to tap into national research funding, national bilateral scientific agreements and donor funding to augment the NMISA parliamentary grant funding – mostly used for the maintenance and dissemination of the NMS. From the QI angle, TID links to development projects in the region sponsored by the European Union (EU), the United Nations Industrial Development Organisation (UNIDO) and the Physikalisch Technische Bundesanstalt (PTB), the main partner to NMISA for metrology development in SADC and Africa.

These programmes will provide NMISA with the unique opportunity to contribute to the achievement of several South African National Development Goals for 2030 including: empowering young scientists through training in scarce analytical skills; supporting increased intra-regional trade in Southern Africa through reliable measurements in the agricultural export sector; supporting the drive to reduce non-communicable diseases, such as malnutrition and diabetes, through accurate reporting of nutritional content on food labels.

The primary aim of sustainable research and development is to establish and provide the appropriate infrastructure framework for NMISA that incorporates various essential research elements to achieve our mandate, and to maintain the framework and international linkages. This framework must provide the enabling environment for innovation that can foster and nurture novel ideas from inception to execution; from a new or improved national standard to new commercial products, and to incubate measurement capability at all levels of society to render products.

The strategy to achieve these aims is not to imitate academic or research institutions, but to establish collaborative forums with academia and research institutions and most importantly, to harness the expertise of other National Metrology Institutes in favour of NMISA and South Africa. NMISA needs to ensure that the strategic alliances are formed and must maintain the relationships with all levels of the scientific metrology community, as well as the other components of the Quality Infrastructure (voluntary and regulatory standards, accreditation, legal metrology and conformity assessment). A critical component of the strategy was to get NMISA declared

as a research institution, a status that was removed after being established as a technical infrastructure institution.

Why the importance of proving equivalence and having calibration and measurement capabilities? It filters down to Quality of Life. **Environmental and human health** are affected by air quality (mortality and morbidity), inhalation of particulates and toxic gases, water pollution, maintenance of infrastructure (clean water and sanitation), solar radiation (antioxidants, ozone formation and depletion), metals exposure (illicit mining, lead poisoning) and climate change (dust storms, flooding). Human health cannot be uncoupled from the environment. Urbanisation, industry, poor economic growth, poverty, inequality and apartheid have also adversely affected human health and if there are no humans, then what is the point? The importance of traceable measurements then becomes even more paramount, second only to education, provision of an enabling environment and community awareness. There is a need to motivate demand driven community involvement and improve organisational behaviour.

Both food quality and safety are important aspects of life. *‘Food safety implies the absence or safe levels of contaminants, bacteria, naturally occurring toxins or any other substance that may make food injurious to health.* Regulations in the food industry exist to protect the health of consumers and to ensure fair practices in the food and feed trade. Safe animal feed is important for the health of animals, the environment and for the safety of foods of animal origin. Apart from the financial implications resulting from the loss of livestock, there are several examples linking the safety of animal feed to the safety of foods that humans consume, including BSE (a.k.a. Mad Cow disease). In 1999, farmers in Belgium were alerted to a feed contamination problem when increased deaths of new-born chickens were observed. The problem could be traced back to poultry consuming animal feed contaminated with transformer oil, which was indirectly contaminated with polychlorinated biphenyls and dioxins; toxic organic compounds.

The presence of contaminants and residues in food and feed is an international concern, as reflected in numerous regulations within South Africa and its major export markets, including the European Union, United States, China, Japan, Brazil and other parts of Africa. Regulations may potentially be used as technical barriers to trade, locking-out “unsafe” exports originating from African countries lacking the measurement capability to quantify at the regulated minimum contaminant levels. The same lack of measurement capability can also be exploited by foreign states to dump unsafe products into the South African

market. In the global setting, analytical laboratories are required to test for contaminants in food and feed at levels that meet internationally regulated limits. Food and feed safety regulations increase as new/ emerging contaminants are identified, while existing limits are lowered, resulting in analytically challenging measurements. This requires laboratories to continuously develop new measurement capabilities or improve existing ones. Hand-in-hand with meeting food safety regulatory limits is the trade metrology requirement that all measurements be internationally comparable.

There is a shortage of reference materials and measurements that would allow testing laboratories to 1) better assess the accuracy of measurement results; 2) continuously monitor performance of analytical procedures and 3) demonstrate laboratory competence through participation in relevant PT schemes, utilising the appropriate matrix reference materials. These shortages can be addressed through establishment of the Reference Material Programme including the African Food and Feed **Reference Materials programme** (AFFRMP). This programme will facilitate food trade; in support of agro-processing, food and feed safety, advanced materials & manufacturing, environmental monitoring and in support of growth strategies and trade agreements: Africa Growth and Opportunity Act (AGOA), SA-EU Development and Cooperation Agreement (TDCA), Trade, Investment and Development Cooperation Agreement (TIDCA) and the Industrial Policy Action Plan (IPAP).

NMISA is embarking on a **modernised approach to research** aligned with the impact following the redefinition of the SI units for mass and amount of substance. It is evident that there is a clear need to shorten the traceability chain from the SI for Africa. This involves the Isotope manufacturing route (mass and density) and the realisation of Planck constant. Two approaches have been adopted to obtain this value, one is to use an electronic device called a Kibble Watt balance, the other is to derive the constant from Avogadro’s number, obtained by counting the number of silicon atoms in a 1 kg silicon sphere. NMISA plans to collaborate in the development of a table top Kibble Watt balance that will be robust enough for the rugged environment we work in in Africa. Such a Kibble Watt balance would have to be a world class one, taking the uncertainty into consideration as it is a key issue. NMISA could coin the market for the small masses with an uncertainty comparable to the Kibble Watt balance; and then NMISA on behalf of South Africa, can sell traceability for the 100 g. This capability will directly benefit metals beneficiation, advanced manufacturing and underpin accuracy of measurement in chemistry.

NMISA will investigate the niche opportunity and compete with the developed NMIs where appropriate. Consideration must also be given to the impact on the other parameters that are directly affected (density, electricity, etc.). This will be an opportunity for South Africa to provide traceability for the continent or for Sub-Saharan Africa (developing and least developed); this could potentially include South America.

Opportunities to further collaborate with NPL(UK), NIST, PTB and NIM (China) will be explored. These NMIs are at the head of the research field for the Kibble Watt Balance and Avogadro projects (silicon sphere) as well as reference materials and have indicated their willingness to assist NMISA and are geared to handle visiting researchers. To embark on such a project will require adequate resources and training. NMISA will send experienced metrologists and masters/PhD students for training to NPL(UK), NIST, PTB and NIM and host international scientists at NMISA, where more students can benefit from the training. By joining a big international research team, our scientists get the input and learning from the experienced contributors.

As South Africa, we have a vested interest to collaborate with an African partner in such an endeavour and strengthen ties with the African Union. NMISA can approach Ethiopia for the Kibble Watt Balance and Tunisia for the Avogadro project as part of bridging the gap and forging ties with our African NMI counterparts; it is the only way to also bridge the gap between physics and chemistry and harness these scientific tenets to bring Africa forward into the new world.

“Science, Technology and Innovation (STI) are recognised as key drivers of long-term economic growth. Information and telecommunication can provide for state-of-the-art time and frequency standards to support the **SKA SA/MeerKAT** project. The knowledge and expertise in Time and Frequency measurement science vested in the NMISA, combined with the legal authority to realise South Africa’s time scale, place NMISA in a unique and strategic position to supply time and frequency reference signals to the SKA. NMISA can also assist the SKA African partner countries in developing and enhancing their time and frequency capabilities using the strong networks the NMISA has established within the African continent through technical infrastructure development projects in those countries. NMISA will improve its Time and Frequency capability and research time transfer techniques during the next five years through cooperation between not only internal areas in NMISA (Time & Frequency, Fibre Optics and Photonics Laboratories), but also external partners, e.g. square kilometre array (SKA), Nelson Mandela Metropolitan University (NMMU) and the Italian National Metrology Institute (INRiM).

In response to the Nuclear Build programme, South Africa will need to re-establish its nuclear fuel cycle industry, which would include developing uranium enrichment plants and nuclear fuel production. NMISA is developing measurement capabilities in support of nuclear power generation.

A rapidly growing area that may require metrological support by dc low frequency standards is transmission and distribution of electrical energy. **Smart Grids** and new ultra-high voltage transmission, both dc and ac, are some of the factors contributing to the growth for metrology research. The corresponding quantities for which measurement facilities may be necessary to be developed are harmonic power, voltage and current phasors (synchrophasor measurements), current ratios up to 20 kA, voltage ratios up to 1000 kV (dc and ac), and characteristics of switching and lightning impulses. NMISA will be undertaking a needs analysis for metrology needs related to Smart Grids (intelligent electric grid), transformer and other power equipment efficiency.

Technological advances over the past decade are placing stringent demands on metrology and new areas such as nanotechnology, optical techniques, quantum-based technologies, material sciences, etc. developed rapidly and requires new measurement methods and standards. In response, NMIs are investing more funds into development and research activities towards the improvement of existing standards and to facilitate the development of new measurement standards that address emerging national needs.

To ensure proper coordination and monitoring of priority projects of national interest and evaluation of deliverables in research and development projects, the technical divisions are structured in a matrix organisational structure. The matrix type organisation is a type of hybrid- a mix of both the functional and project organisational structures. It provides the project and customer focus of the project structure while it retains the functional expertise of a functional structure, an important element in a field such a metrology where it takes long years of post-graduate learning to develop competent metrologists.

The projects will be organised as multi-disciplinary projects across technical divisions that will deliver outcomes such as new/ improved NMS. The matrix organisational structure also provides opportunities for people in the functional divisions and sections to pursue career development through assignment to various types of projects. This also allows for easier coordination of student development projects such as the NMISA post-graduate bursary programme. Project managers are metrologists appointed from the leading technical divisions.

In the light of advanced measurement made at the frontiers of science, such as sensitive and accurate methods developed to measure the long term integrity of carbon capture and storage facilities; monitoring carbon dioxide at ambient levels with ppb accuracy, the Quantum SI; direct traceability for Earth observation systems at uncertainties of 0,01% for incoming and 0,3% for reflected radiation to enable detection of decadal climate change. Smart and interconnected measurement: networks of self-calibrating sensors monitoring chemical species in the atmosphere. Such networks will make use of new mathematical strategies that exploit the 'internet of things' to provide real time data verification and quality assurance. Embedded and ubiquitous measurement: Traceable environmental data publicly accessible in real time from sensors embedded in vehicles and mobile devices. Providing data for citizens to minimise their personal exposure – there is an urgent need to invest in a core group of highly qualified and experienced scientists necessary to provide this service and to realise the potential of these research endeavours. This not only includes scientists at the cutting edge of scientific measurement and discovery, but establishing mechatronic workshops fully equipped to machine parts and meet the exacting measurement demands for projects as needed on site. Procurement will triple to capacitate and resource these projects, which again will impact on resourcing finances, and supply chain management. These resource considerations will be discussed in section 7.3.

Detailed information on the maintenance, international, national and cross-cutter projects can be found in the Annexures.

7.2 RESOURCE CONSIDERATIONS

NMISA's ability to effectively and sustainably deliver on its mandate is dependent on the maintenance and dissemination of the national measurement standards. This requires NMISA to invest in the national measurement standards and the equipment comprising the NMS and other standards, and

to develop its scientists and support to the highest level. Concurrent to this, NMISA is very aware of the fact that the age gap is vast between the experienced scientists and the younger scientists with far less knowledge, experience and know-how. Bridging this gap is paramount.

With scientific inflation estimated at more than 10%, NMISA's baseline funding has effectively declined over the last few years. This was evident in the decline of the capital investment allocation provided with the baseline funding and the need to offset this against appointing capable staff to do the scientific work. While NMISA was still a small organisation (~80 to 100 staff), the organisation could operate within the budget, but this is no longer the case. Parallel to the decline in capital investment, the staff compensation bill increased as a percentage of total budget.

National Treasury has approved a project to recapitalise NMISA and the additional funding received for the project has alleviated a very tenuous situation; where the organisation urgently needed to replace obsolete instrumentation and national measurement standards and appoint the next generation of scientists that are required for contingency and succession planning.

NMISA's investment into research and development did decline in the early years' after becoming a technical infrastructure institute, but with the tide turning towards novel measurements supporting science and technology and linked with the opportunities afforded NMISA through the recapitalisation project, the research aspect of NMISA will require additional capital investment. Since research is critical for the further development and improvement of the current national measurement standards to continuously meet the national needs and to be able to pro-actively place NMISA at the forefront of traceability for a fast-paced growing economy, the baseline funding for NMISA needs to be increased or other funding sources will have to be found. The cost of the additional programmes is estimated at over R200 million for the 5 year period.

	2018/19 R'000	2019/20 R'000	2020/21 R'000	2021/22 R'000	2022/23 R'000
	5.7% (existing)	5.6% (existing)	5.5% (existing)	5.5% (existing)	5.5% (existing)
Revenue	273 156	288 453	304 318	321 053	338 711
Transfers received	232 784	245 820	259 340	273 604	288 652
Rendering of service	31 561	33 328	35 161	37 094	39 134
Investment income	8 811	9 304	9 816	10 355	10 925
Expenditure	273 156	288 453	304 318	321 054	338 711
Administrative and operating expenditure	68 558	72 397	76 379	80 580	85 011
Employee cost	122 653	129 522	136 645	144 160	152 088
Repairs and maintenance	9 312	8 777	9 260	9 768	10 307
Recapitalisation project	72 753	76 827	81 053	85 511	90 214
Audit fees	880	929	980	1 034	1 091

7.2.1 Financial Plan

The spending focus over the five year period will be on providing metrology and advanced measurement assistance to specific industry sectors as identified in IPAP, the research and development (R&D) programmes and building capacity in the institution to better fulfil its mandate.

The NMISA budget is expected to decrease to R273 million in 2018/19 due to a reduction in both the NMS and the Recapitalisation grants. It is then expected to grow again due to an annual increase in the Recapitalisation grant and an increase in external revenue.

7.2.2 Capital expenditure projects

NMISA is currently embarking on an ongoing process of recapitalisation and modernising the NMI infrastructure through the replacement of the aged and obsolete equipment and funding towards a feasibility study for a PPP project towards new laboratories and equipment. Below is a table detailing funds spent so far and the projected spending in the period under discussion. Worth noting is the reducing projected spend as informed by the shrinking fiscal purse that NMISA is experiencing from the shareholder's MTEF allocation. This is as reflected from 2016/17 in the table.

NMISA has seen an increase in the fixed asset book from R128 million since the inception of the recapitalisation drive to R382 million in the current year. The table below represents spending on the recapitalisation towards capex and the feasibility study since 2014 and the projected spend in the 5 year forecast.

RECAPITALISATION PROJECT

Capital Expenditure	2014/15	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	2021/22
	84 468	152 352	129 977	119 677	72 753	76 827	81 053	85 511

7.2.3 HCD

NMISA's ability to effectively and sustainably deliver on its mandate is dependent on the maintenance and dissemination of the national measurement standards. This requires NMISA to invest in the national measurement standards and the equipment comprising the NMS and other standards, and to develop its scientists and support to the highest level. Concurrent to this, NMISA is very aware of the fact that the age gap is vast between the experienced scientists and the younger scientists with far less knowledge, experience and know-how. Bridging this gap is paramount.

With scientific inflation estimated at more than 10%, NMISA's baseline funding has effectively declined over the last few years. This was evident in the decline of the capital investment allocation provided with the baseline funding and the need to offset this against appointing capable staff to do the scientific work. When NMISA was still a smaller organisation (<100 staff), the organisation could operate within the budget, but this is no longer the case. Parallel to the decline in capital investment, the staff compensation bill increased as a percentage of total budget.

National Treasury has approved a project to recapitalise NMISA and the additional funding received for the project has alleviated a very tenuous situation; where the organisation urgently needed to replace obsolete instrumentation and national measurement standards and appoint the next generation of scientists that are required for contingency and succession planning.

NMISA's investment into research and development did decline in the early years', after becoming a technical infrastructure institute and losing access to research funding from CSIR, but with the tide turning towards novel measurements supporting science and technology and linked with the opportunities afforded NMISA through the recapitalisation project, the research aspect of NMISA will require additional capital investment. Since research is critical for the further development and improvement of the current national measurement standards to continuously meet the national needs and to be able to proactively place NMISA at the forefront of traceability for a fast-paced growing economy, the baseline funding for NMISA must be increased.

7.2.4 Integrated Human Resource strategy

7.2.4.1 Strategic priorities

The main goal is to provide a skilled, competent and transformed workforce to assist the organisation to carry out its mandate.

The goal will be achieved through the following objectives:

- Recruitment and selection
- Reward and Recognition
- Enhance the HCD programme to help improve core skills
- Staff retention and succession planning
- Enhance the organisational qualification profile
- Addressing diversity and Employment Equity
- Ensure efficient performance management system
- Increase capacity in support functions including Human Resources
- Review our processes and develop enabling policies to improve the organisational effectiveness

7.2.4.2 Recruitment and Selection

Focus strategies will be developed to recruit suitable skills including Mathematicians, Statisticians and Software Developers as identified in the executive summary to enable the organisation to deliver on its strategic goals and objectives. The recruitment policies will be reviewed to ensure that skilled and qualified candidates are sourced at the right time. The use of social media will be enhanced to reach a bigger pool of talent to tap into.

7.2.4.3 Reward and Recognition

NMISA strives to create a performance-oriented remuneration philosophy which fairly rewards management and staff for their contributions to the organisation in achieving its strategic, financial and operational objectives. The remuneration packages and incentives will be regularly evaluated through market-related surveys. Packages are structured on a cost-to-company basis and include contributions to disability, life insurance and retirement benefits. The salary structure and incentives will be reviewed to realign our offerings to the dynamic employee (look at generational differences and drivers)

7.2.4.4 Enhance HCD

An undergraduate bursary and post-graduate studentship programme was launched in 2011/12 to start the internal development of a pipeline of especially young black researchers who will be assigned to specific projects with senior NMISA researchers and retired researchers (appointed on contract) to mentor, guide and disseminate their extensive knowledge to the students through their study programmes.

A pipeline comprising interns, graduates and post-graduate bursars has been developed. The institute hosts internally

supported internships, as well as those supported from other programmes of the dti, the DST, the NRF and Innovation Hub.

The focus for the HCD programme will be on:

- Increasing the intake of bursars, postgraduate students, interns/In-Service trainees
- Recruitment of post-doctoral fellows
- Mentoring and coaching
- Actively sourcing external funding for HCD initiatives
- Approaching relevant SETAs, NSF and other donors including other NMIs
- Contracting retired researchers to mentor and coach young students

7.2.4.5 Plan to address the identified critical skills issues and challenges

The shortage of skills will be addressed through the improvement of current and the implementation of new HCD programmes. There is also a need to manage these programmes more strategically, collectively and ensure a consistent approach in implementing these programmes across NMISA. Furthermore, stronger performance monitoring and reporting frameworks will be implemented to ensure that greater value is extracted from resources invested in the HCD initiatives.

Bursary programme

The Bursary Programme is designed to financially support full-time students (under-graduate) and part-time students (post-graduate) in obtaining a qualification in areas deemed a priority by NMISA for capacity building. Bursars participate in vacation work during the period of study in order to gain practical experience that is in line with their field of study, or in the case of post-graduate students, spend most of their time in the NMISA laboratories. Upon completion of the Bursary Programme, the bursar is contractually obliged to enter into permanent employment with NMISA for at least the duration of the bursary.

The number of bursaries allocated will be increased every year as follows:

- **Undergraduate bursary programme**
Approximately thirty (30) undergraduate bursaries will have been awarded in total by 2018/19 with a target of five (5) bursaries granted every year, with a period of 3-4 years depending on the course.

- **Postgraduate Bursary/Studentship programme**

Selected honours and masters graduates who are registered (or applying for registration) at a South African university may obtain their next qualification based on research performed at the NMISA. The studies are then funded by the NMISA.

Approximately twenty five post graduate bursaries will have been awarded by 2018/19, with a target of five (5) bursaries granted every year, with a period of three years for a Doctoral degree and two years for a Masters.

Internship Programme

The Internship Programme is a learning programme of experiential nature designed for graduates to gain work experience by being provided the opportunity to work with seasoned metrologists in areas of advanced measurement. The Internship Programme has a defined period of up to one year, in which the Intern is appointed full-time by NMISA on a fixed-term contract. Approximately five (5) interns will be hosted per year. The programme has been extended to also provide training for support roles. Interns have been trained in functions including Information Technology, Internal Audit, SHEQ and Human Resources.

Staff exchange programme

Building on the NMISA's partnership with other NMIs, metrologists will be sent to other NMIs for training and exposure. Experts from other NMIs will also be hosted in various metrology areas in the NMISA to either provide training to NMISA staff, or to be trained (for example metrologists from the region). This benefits NMISA by way of exchange of information; ideas and knowledge; and builds relationships which promote the development of scientific co-operation and contacts between South Africa and other countries. The programme is aimed at promoting world-class research at NMISA whilst developing new research links between South Africa and other countries.

NMISA employees will also be afforded opportunities to pursue post-graduate studies at other NMIs that have special programmes for this purpose, for example KRISS of South Korea and the PTB of Germany.

Contract researcher/ metrologist programme

Post-graduate or post-doc students are appointed on one to three year research contracts on specific metrology development projects. They acquire basic metrology and advanced measurement and research skills. In partnership with the DST and the NRF, researchers are also sent overseas to participate in metrology projects at other NMIs.

The last intake into this programme was before NMISA left the CSIR, and new opportunities will be explored. This will include identifying experienced retired researchers that can be appointed on contract for 6 months to one year to coach and mentor young bursars full time, thus taking over this burden from full time staff.

Professionals Development programme

The Programme entails a collection of structured, intervention type learning and development platforms aimed at advancement of metrologists and leadership development. The programme seeks to correct NMISA’s human capital profile in order to achieve the organisational strategic goals. This is done by growing metrology skills and leadership capability in a structured manner.

Management and leadership development programme

The focus will be on executive leadership development while monitoring implementation of the skills acquired by middle management after completion of their training during 2015/16 financial year.

Metrologist Development programme

The Metrologist Development programme aims to advance staff as part of the metrology Career Ladders by attending to the upgrade of staff qualifications and by facilitating access to development programmes and opportunities, with a specific focus on addressing transformation.

This programme is supported by the following initiatives:

- Opportunities for further studies
- Courses/conferences/workshops
- Mentorship /Coaching

7.2.4.6 Retention and Succession

Retention of highly skilled people is crucial to our sustainable growth strategy; the highly skilled personnel will play a vital role in training and developing young professionals. Sustainable retention strategies are being put in place to ensure continued support and development of the new recruits. Agreements on transfer of skills will ensure smooth succession planning.

Activities to improve retention include:

- Continuously review salary structures to ensure that NMISA pays competitive and market-related salaries.
- Improve and implement retention incentive schemes

The goal of the NMISA, in terms of its retention strategy, is to maintain a 90% retention rate or, a 10% turnover rate, of competent and well performing technical and support employees.

The activities with regards to the retention strategy, are structured around the four retention factors as listed below:

Table . Staff retention strategy

Retention Factors	Criteria
Compensation	Remuneration that is: <ul style="list-style-type: none"> • Fair • Competitive • Flexible • Transparent
	A reward and recognition programme that incorporates: <ul style="list-style-type: none"> • Bonuses • Performance increases • Incentives • Long service awards • Achiever awards
	Offering competitive benefits such as: <ul style="list-style-type: none"> • Employee wellness programme • Retirement Benefits • Support for further studies • Paid maternity leave policy • Opportunity to attend local and international conferences
Environment and Relationship	Provide employees with an environment or corporate culture that values and enables: <ul style="list-style-type: none"> • Open and honest communication • Productive interpersonal relationships • Trust • Constructive conflict management • Adequate leadership • Realistic expectations and perceptions • Team development
Growth	Provide employees with opportunities for <ul style="list-style-type: none"> • Career development • Training • Mentoring/coaching • Adequate performance management • Succession opportunities
Support	Provide employees with a supportive environment such as one that provides for: <ul style="list-style-type: none"> • Employee Wellness Programmes • Training and Development • Conditions of service tailored to family responsibility of employee

7.2.4.7 Enhancing NMISA qualification profile

A recent international benchmarking study indicated that NMISA is lagging behind leading NMIs with its percentage of graduate and post-graduate technical staff. Although it has been explained that the skills requirements of NMISA are different to that of developed country NMIs, the drive towards a modern NMI with a strong research and development component that could support industrial development necessitates that the qualification profile has to be improved. The NMISA aims to substantially increase the number of staff with PhD and MSc qualifications over the five year period (depending on additional funding to the institute).

The recruitment and selection process will be improved to ensure that a high calibre of candidates with the right qualification level are sourced to help enhance the organisational qualification profile. The Figure 6 below indicates the targets set for the period 2014 to 2019.

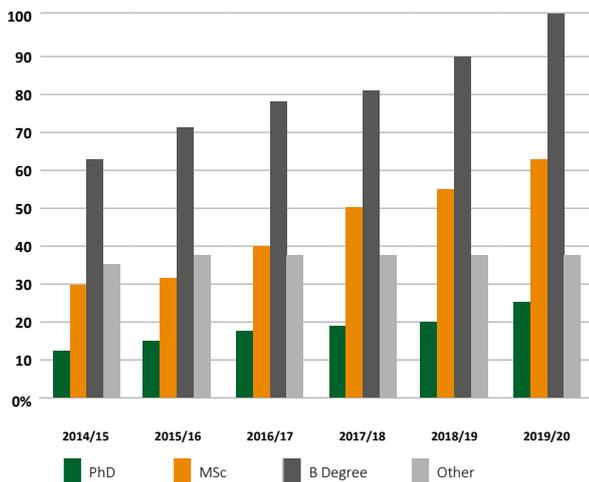


Figure 6. Projection of staff qualification profile

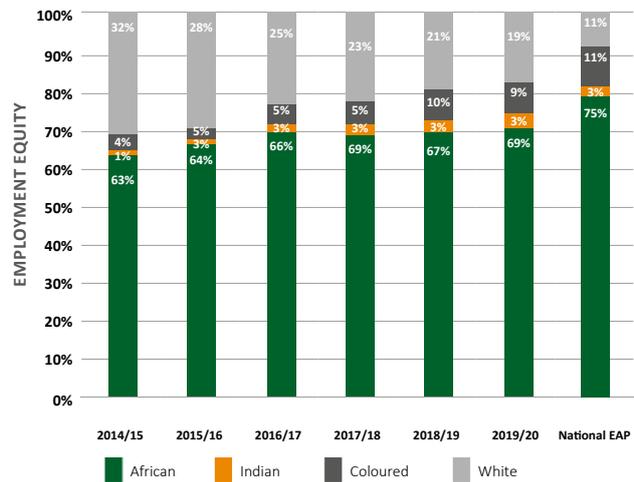


Figure 7. Employment Equity/ Staff Demographics

7.2.4.8 Addressing diversity and Employment Equity

Transformation of the NMISA workforce in terms of employment equity remains a challenge due to the shortage of metrology skills in the market. Initiatives to facilitate the integration of diversity into all human resource processes including recruitment and selection, performance management, training and development, career management, succession planning, reward and recognition will be put in place.

NMISA will continue to focus on recruiting black professionals as the institute's employment equity profile lags behind the targets. This is due to a limited pool of suitably trained black professionals, as well as an outflow of newly trained metrologists to the calibration laboratories and industry. Various programmes have been implemented to address employment equity and to boost the recruitment and retention of black professionals. The projected employment equity profile, based on the national demographic profile, is illustrated in Figure 7. Evaluating past trends in staff turnover percentages, the demographics of the resignations, upcoming retirements and ability to appoint skilled black professionals and HCD students and interns, a growth rate of 9-10% per year is projected, leading to a 69% total transformed workplace at the end of the Strategic Plan period. The targets for the period 2014 to 2019 are shown in figure 7.

7.2.4.9 Ensure efficient performance management system

Gaps have been identified in the performance management system. The procedure currently in use is not supported by a policy, therefore it poses risks for the organisation. A policy will be developed and an electronic performance management system will be implemented.

7.2.4.10 Increase capacity in support functions

Conduct workforce planning for the whole organisation with a focus on increasing capacity in support functions to ensure effective support to enable the core functions to focus on the core activities.

More effort will be put into areas where gaps have been identified due to implementation of the recapitalisation and modernisation project.

7.3 Risk Management

NMISA adheres to a disciplined and integrated approach towards risk management that supports the alignment of strategy, process, people, and technology, and allows the organisation to identify, prioritise, and effectively manage its critical risks. By understanding all its risks in an integrated framework, NMISA properly executes strategies to successfully achieve its goals, objectives and to meet its set performance targets. At least once a year NMISA will undertake a thorough re-assessment of its risks.



PART C

LINKS TO OTHER PLANS

8. LONG-TERM INFRASTRUCTURE AND OTHER CAPITAL PLANS

Table . Recapitalisation project

Name of PPP	Purpose	Outputs	Current value of agreement (R thousand)	Date when agreement expires
NMISA recapitalisation project	Office accommodation, modernisation and recapitalisation of NMS	Feasibility study report filed with the National Treasury for TA1 approval (Fit for purpose office accommodation)	R20m	Ongoing (Approval of TA1 outstanding)

9. ANNEXURES

9.1 ACRONYMS AND ABBREVIATIONS

AFFRMP	African Food and Feed Reference Material Programme
AFRIMETS	Intra-Africa Metrology System
AIS	Automotive Investment Scheme
AMI	Advanced Metals Initiative
APMP	Asian Pacific Metrology Programme
ARMC	African Resources Management Constellation
APMP	Asian Pacific Metrology Programme
AU	African Union
BIPM	International Bureau of Weights and Measures
BRICS	Brazil, Russia, India, China and South Africa agreement
CC	Consultative committee
CCQM	Consultative Committee for Amount of Substance: Chemistry and Biology
CEMACMET	Economic and Monetary Community of Central Africa Metrology Cooperation
CGPM	General Conference on Weights and Measures
CIPM	International Committee for Weights and Measures
CMC	Calibration and Measurement Capability
CMM	Co-ordinate Measuring Machine
COTII	Committee of Trade and Industry Institutions
CRM	Certified Reference Material
COMESA	Common Market for East and Southern Africa
DST	Department of Science and Technology
EAMET	East African Community Metrology Programme
ECOWAS	Economic Community of Western African States
the dti	Department of Trade & Industry
EE	Employment Equity
EHS	Environment, Health and Safety
EU	European Union
GDP	Gross Domestic Product
HCD	Human Capital Development
HEI	Higher Education Institutions
IAEA	International Atomic Energy Agency
ICT	Information and Communications Technology

IEC	International Electro-technical Committee
INMETRO	National Institute of Metrology, Quality and Technology, Brazil
IPAP	Industrial Policy Action Plan
ISO	International Standards Organisation
IVM	Institute for Environmental Studies, Amsterdam
JCRB	Joint Committee of Regional Metrology Organisations and the BIPM
KCDB	Key Comparison Database
KEBS	Kenya Bureau of Standards
KPI	Key Performance Indicator
KRISS	Korean Research Institute for Standards and Science
KPI	Key Performance Indicator
MOE	Ontario Ministry of the Environment, Canada
MRA	Mutual Recognition Arrangement
MGI	Measurement in support of Green Industries
MMC	Measurement for Manufacturing Competitiveness
MTEF	Medium Term Expenditure Framework
MSc	Master of Science
NEDLAC	National Economic Development and Labour Council
MAT	Materials Characterisation
MoU	Memorandum of Understanding
NEPAD	New Partnership for Africa's Development
NEWMET	North-Eastern and Western Africa sub-regional Metrology organisation
NIS	National Institute for Standards, Egypt
NMI	National Metrology Institute
NPL	National Physics Laboratory, UK
NMISA	National Metrology Institute of South Africa
NMS	National Measurement Standard
NPLI	National Metrology Institute of India (CSIR-National Physics Laboratory)
NRCS	National Regulator for Compulsory Specifications
NRF	National Research Foundation
NRL	National Reference Laboratory

NWU	North West University, Potchefstroom
OEM	Original Equipment Manufacturer
OIML	International Organisation of Legal Metrology
PFMA	Public Finance Management Act
PhD	Doctor of Philosophy
POPs	Persistent Organic Pollutants
PPP	Public Private Partnership
PPPFA	Preferential Procurement Policy Framework Act
PRGM	Primary Reference Gas Mixtures
PRM	Primary Reference Mixtures
PT	Proficiency Test
RIID	Research, International and Infrastructure Development
RMO	Regional Metrology Organisation
SAAQIS	South African Air Quality Information System
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SADCMEL	SADC Cooperation in Legal Metrology
SADCMET	SADC Cooperation in Measurement Traceability
SANAS	South African National Accreditation System
SANS	South African National Standards
SARIR	South African Research Infrastructure Roadmap
SCM	Supply Chain Management
SHEQ	Safety, Health, Environment and Quality

SI	International System of Units
SKA	Square Kilometre Array
SME	Small and Medium Enterprise
SOAMET	“Secrétariat Ouest-Africain de Métrologie” or the Secretariat of Metrology of UEMOA
SQAM	Standards, Quality Assurance, Accreditation and Metrology
SKA	Square Kilometre Array
SRI	Strategic Research Infrastructure
TBT	Technical Barrier to Trade
TC	Technical Committee
TCQM	Technical Committee for Amount of Substance
TID	Technical Infrastructure Development
TQMS	Total Quality Management System
UJ	University of Johannesburg
ULg	University of Liège, Belgium
UNIDO	United Nations Industrial Development Organisation
UST	University of Standards and Technology
UP	University of Pretoria
UV	Vrije Univesiteit, Amsterdam
VAMAS	Versailles Project on Advanced Materials and Standards
WG	Working Group
WTO	World Trade Organisation

9.2 THEMATIC PROGRAMMES

The table below shows the requested funding for the programmes. Only activities listed below will be implemented 2018/19 and the others will be shifted to start in 2019/20.

Description	2018/19 R'000 (Available Funding)	2019/ 20 R'000	2020/21 R'000
Reference Materials <ul style="list-style-type: none"> AFFRMP Forensics Environmental Mineral beneficiation Nano Particles 	33 438	44 960	48 480
Green Economies <ul style="list-style-type: none"> Air Pollution Monitoring Terrestrial & Aquatic Monitoring Alternative Technologies (PVs) Materials Characterisation (Surface and structure analysis) 	24 692	26 770	28 140
Energy Efficiency <ul style="list-style-type: none"> Solid-state lighting Power & Energy Smart grids Traceability for AC-DC transfer Difference Measurements 	23 856	23 970	15 720
Manufacturing Competitiveness <ul style="list-style-type: none"> Dimensional standards Machine tool evaluation, including additive manufacturing Thin films Torque and hardness laboratory 	12 150	40 700	39 380
Advanced Measurement Solutions <ul style="list-style-type: none"> SKA Time reference signals Structured Light Metrology 	9 890	23 965	18 190
Redefinition of the SI <ul style="list-style-type: none"> Avogadro Project Watt Balance 	21 154	43 980	14 650
Quality of Life <ul style="list-style-type: none"> Health Pharmacology Radiation measurements Ultraviolet measurements 	23 860	36 945	36 360
Commercial Services <ul style="list-style-type: none"> Breath Alcohol Blood Alcohol PRGMS Reference Measurements 	23 150	19 500	27 750
Regional and International Integration <ul style="list-style-type: none"> AFRIMETS SADCMET APMP CC & CIPM TI Interaction Collaborative Projects (Universities & RIs) 	14 885	15 852	16 724
CEO office, Corporate services and Finance <ul style="list-style-type: none"> Communication and Marketing IT HCD (operational component & HR) Facilities Rental, Operational and Finance HR Compensation Support Finance CEO office 	59 264	62 583	66 025

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