

 **nmisa**
National Metrology Institute of South Africa

**ANNUAL PERFORMANCE PLAN
2018-2021**



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.

OFFICIAL SIGN-OFF

It is hereby certified that this Annual Performance Plan:

- Was developed by the management of NMISA under the guidance of the Board and the Board Chair, Dr Prins Nevhutalu;
- Was prepared in line with the current Strategic Plan of NMISA; and
- Accurately reflects the performance targets that NMISA will endeavour to achieve given the resources made available in the budget for 2018/19 – 2020/21.

Prepared and compiled by NMISA Directors and Managers.



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ABBREVIATIONS AND ACRONYMS

AFFRMP	Africa Food and Feed Reference Material Programme
AFRA	African Regional Cooperative Agreement for Research, Development and Training Related to Nuclear Science and Technology
AFRIMETS	Intra-Africa Metrology System
APP	Annual Performance Plan
BIPM	International Bureau of Weights and Measures
BRIC	Brazil, Russia, India and China
CAPEX	Capital Expenditure
CC	Consultative committee
CEO	Chief Executive Officer
CFTA	Continental Free Trade Area
CGPM	General Conference on Weights and Measures
ChemMAT	Chemistry and Materials Characterisation
CIPM	International Committee for Weights and Measures
CMC	Calibration and Measurement Capabilities
COTII	Committee of Trade and Industry Institutions
CRM	Certified Reference Material
CSIR	Council for Scientific and Industrial Research
DCLF	Direct Current Low Frequency
DDG	Deputy Director General
Dr	Doctor
DS	Dosimetry
EHS	Environment, Health and Safety
EM	Electricity and Magnetism
EXCO	Executive Committee
HCD	Human Capital Development
HR	Human Resources
ICT	Information and Communication Technology
IPAP	Industrial Policy Action Plan
IR	Ionising Radiation
ISO	International Standards Organisation
KCDB	Key Comparison Database
KPI	Key Performance Indicator
LED	Light Emitting Diode
MAT	Materials Characterisation Group
MEA	Multilateral Environment Agreements
MRA	Mutual Recognition Arrangement
MRL	Minimum Residue Levels
MTEF	Medium Term Expenditure Framework

NEDLAC	National Economic Development and Labour Council
NIST	National Institute of Standards and Technology (NMI of the USA)
NLA	National Laboratory Association South Africa
NMI	National Metrology Institute
NMISA	National Metrology Institute of South Africa
NMS	National Measurement Standard
NRC	National Research Council (Canada)
NRCS	National Regulator for Compulsory Specifications
NTB	Non-Tariff Barriers
OEM	Original Equipment Manufacturer
OH&S	Occupational Health and Safety
OIML	International Organisation of Legal Metrology
OPEX	Operational Expenditure
PFMA	Public Finance Management Act
POP	Persistent Organic Pollutant
PPP	Private Public Partnership
PTS	Proficiency Testing Schemes
RIID	Research International and Infrastructure Development
RMO	Regional Metrology Organisation
RS	Radioactivity Standards
SA	South Africa
SADC	Southern African Development Community
SADCMET	SADC Cooperation in Measurement Traceability
SANAS	South African National Accreditation System
SANS	South African National Standards
SEDA	Small Enterprise Development Agency
SEM	Scanning Electron Microscope
SHEQ	Safety Health Environment and Quality
SI	International System of Units
SKA	Square Kilometre Array
SME	Small, Medium Enterprises
SMME	Small, Medium and Micro Enterprises
TBT	Technical Barrier to Trade
TC	Technical Committee
TCS	Technical Cooperation Section
the dti	Department of Trade & Industry
TI	Technical Infrastructure
VOIP	Voice Over Internet Protocol
XPS	X-ray Photoelectron Spectroscopy



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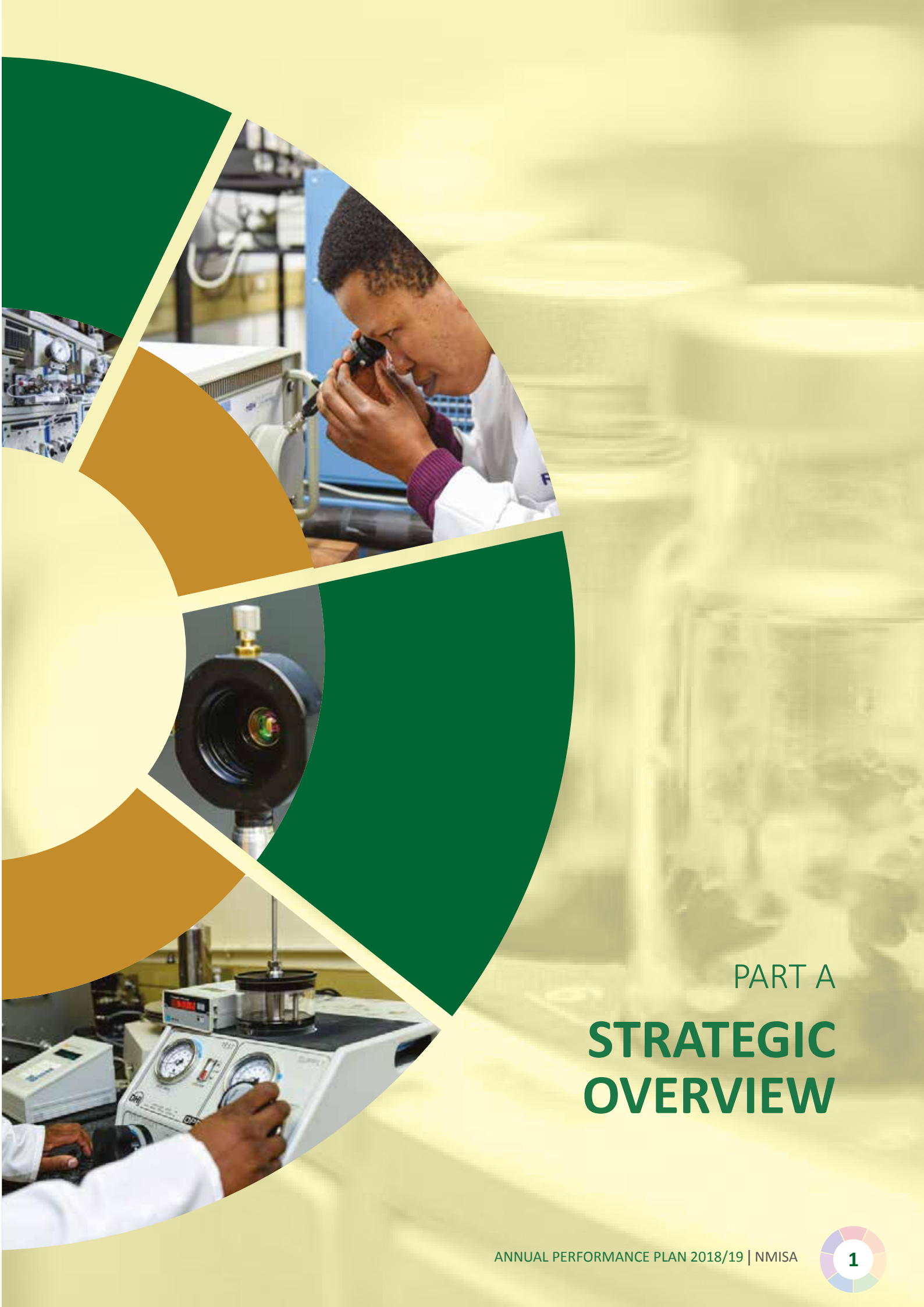
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PART A

STRATEGIC OVERVIEW

1. UPDATED SITUATIONAL ANALYSIS

1.1 ORGANISATIONAL STRUCTURE

The role of NMISA is to ensure that measurements performed nationally (and regionally) are accurate and internationally acceptable. This enables trade, component manufacturing, the legal acceptance of measurement results for law enforcement, accurate measurement in environment and safety and is crucial for health care.

NMISA is a Type 3A public entity, managed by a chief executive officer (CEO), supported by an executive management team and governed by the NMISA Board:

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 (SI) and to designate other measurement units for use; to provide for the designation of the national measurement standards (NMS) and to provide for the keeping and maintenance of the NMS.

As the custodian of the national measurement units and NMS, NMISA maintains and ensures the appropriate application

of the 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.

The trade of goods and services around the world is the lifeblood of the global economy, and is increasingly important to domestic economic growth, productivity and investment opportunities. For customers to consider trade to be fair and benefit from it, for component manufacturing to be effective and efficient and for effective health care and the protection of the environment, measurements taken in different parts of the world need to be accurate, equivalent to each other, and accepted by each other. Important decisions (economic, environmental, social and medical) are based on measurement results. NMISA makes a contribution to all government key priorities and the 14 national outcomes and has aligned its key programmes to the IPAP priority sectors.

The goal of the National Industrial Policy Framework is to “*prevent industrial decline and support the growth and diversification*

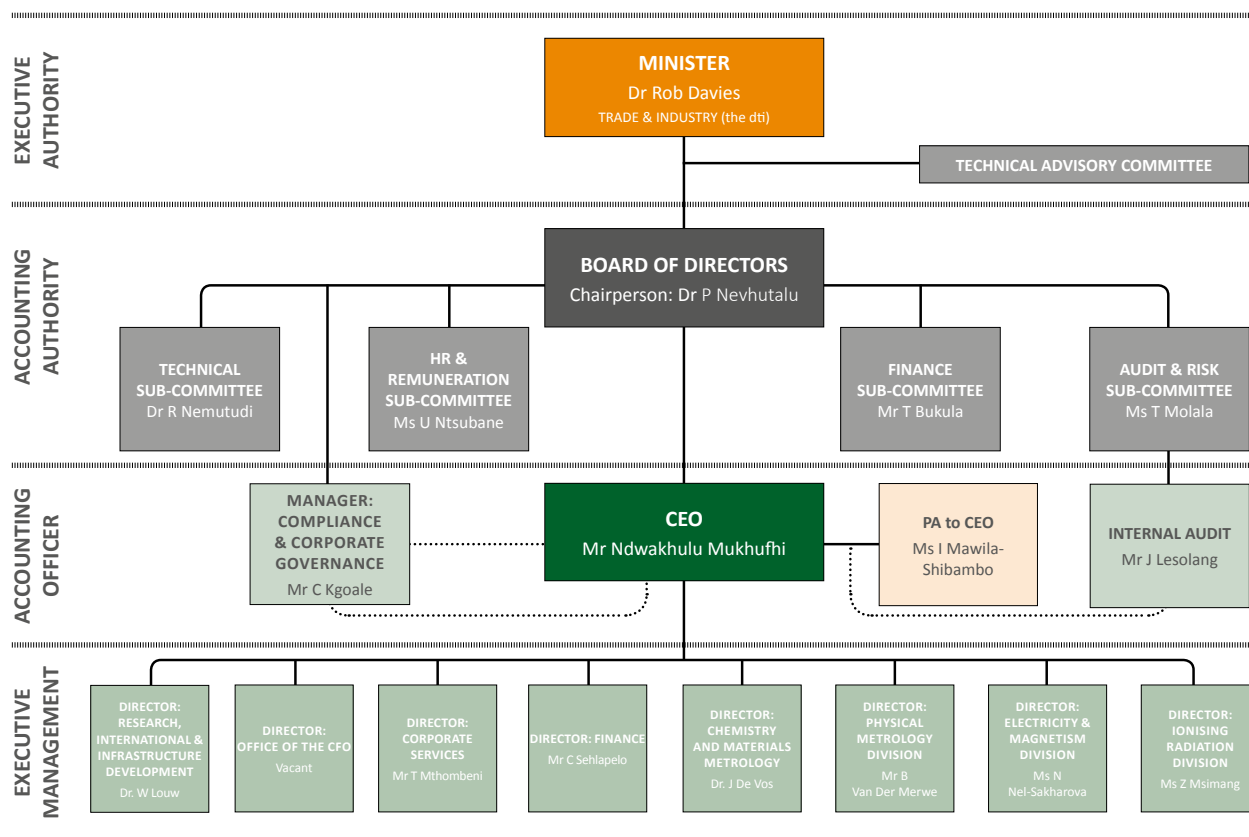


Figure 1. Organisational Structure

of South Africa's manufacturing sector. Manufacturing drives growth and employment and can generate significant job creation directly as well as indirectly in a range of primary and service sector activities".

NMISA has a very specific role in this context. Without a measurement infrastructure it is difficult to manufacture to international specifications and tolerances to ensure the integrity of commodities, locally and for the export market. Competitive manufacturing relies on accurate, internationally comparable measurement that is achieved through the establishment of the "traceability" of the measurement result to the SI or internationally agreed references. In line with its mandate, NMISA ensures the comparability of measurements made locally with those of our main trading partners.

Measurement thus assists with 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 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 the South African people and South African trade.

Measurement underpins everything and, when considered in the broadest sense, contributes to the overall quality of life. NMISA's flagship projects are principally in support of the nine point plan of the IPAP:

- Revitalisation of Agriculture and Agro Processing Value Chain:
 - o Reference material production facility for POPS in fruit and vegetables, mycotoxins in maize and other matrices particular to Sub-Saharan Africa
 - o Ensuring accurate measurement of amino acids in food and biopharmaceuticals
- o Determining contaminants in food and beverages in support of food safety
- Advancing Beneficiation:
 - o Establishing a state-of-the-art Materials Characterisation facility for accurate surface and bulk measurements of composition, morphology and structural properties of metals and nanomaterials, with a special emphasis on nanoscience/manufacturing
 - o Developing dimensional accuracy evaluation and diagnostic methods for additive manufacturing
- Unlocking the potential of SMEs and Co-operatives:
 - o Developing Virtual Reality based training modules in accurate measurement
 - o Training SMEs in accurate measurement and the Quality Infrastructure
 - o Providing direct measurement assistance to SMEs with the potential to export
- Implementation of Higher Impact IPAP:
 - o Improve the National Measurement Standards to be on par with the developed world, i.e. at primary standard level, in general support of industrialisation
- Growing the Oceans Economy:
 - o Establishment of an underwater acoustics calibration capability. This will enable equipment used to measure distance under water, to be accurately calibrated in support of Oceanography, Maritime research, Marine Biology, aquaculture etc.
 - o Reference materials for fish toxins
- Resolving the Energy Challenge:
 - o In support of air monitoring, provide reference measurements to determine sizes of fine to coarse dust particles
 - o Establish a primary standard for Resistance measurements (Quantum Hall) in support of the distribution network and diagnostic measurements
 - o Produce a prototype solar cell based on silicon nanowire technology for manufacturing in South Africa
 - o Assist alternative energies through the provision of measurement standards for nuclear technologies
- Crosscutter Broadband Rollout:
 - o Support the ICT industry through measurement standards for Fibre Optics

- o Improve the National Timekeeping to a level required by the SKA and in support of Broadband
- Crosscutter Science and Technology:
 - o Develop Quantum standards in collaboration with universities and top NMIs
 - o Develop a Kibble (Watt) balance as primary mass standard for Africa
 - o Implement an Avogadro project for a primary standard for Amount of Substance (chemistry)

And in support of Health, Environmental Monitoring, Law enforcement and Customer protection:

- Monitoring dioxins, halogenated flame retardants, pesticides and other contaminants in sediment, soil and water
- Monitoring greenhouse gasses towards clean air
- Assessing the purity of raw chemical substances to prevent harmful substances entering products
- Classification of biodegradable plastics to ensure correct labelling, recycling, etc.
- Ensuring correct dosage when ionising radiation (x-rays, etc.) are used for diagnostics (x-ray imaging) or treatment (irradiation of cancerous tumours)
- Ensuring accurate dosimetry measurement (dosage monitoring) of workers exposed to radiation (miners, hospital x-ray and radiation centres, nuclear power plants, research facilities, etc.)
- Assist with accurate blood alcohol measurements; accurate speed measurements, reference materials for forensic analysis, etc.

Contribution to IPAP, Quality of Life, Manufacturing and Industrial Development, Trade and Commerce, Safety and Security, Energy Saving and Green Energies, Environmental Protection, Food Safety, Information and Telecommunications and regional development are proactively supported by the technical divisions and are guided overall by seven strategic outcome orientated goals that support its mandate, mission and vision, and which in a broader sense contributes to the objectives of the dti and the government's twelve national outcomes.

1.2 PERFORMANCE DELIVERY ENVIRONMENT (EXTERNAL)

South Africa is a signatory to the Metre Convention, a treaty dating back to 1875. Under this 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 SI was also established under the Metre Convention and is overseen by the International Committee for Weights and Measures (CIPM). The whole system is governed by the General Conference on Weights and Measures (CGPM), whose members are the states that signed the Metre Convention. South Africa adhered to the treaty in 1964.

In 1999, the BIPM and the National Metrology Institutes (NMIs), with the consent of their governments and thus the CGPM, created the CIPM Mutual Recognition Arrangement (MRA). The CIPM MRA gives 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 capabilities (CMCs) and calibration and analysis certificates issued by NMIs.

As the custodian of the South African NMS, NMISA develops and maintains primary and secondary standards (chemical and physical quantities) for South Africa and compares those standards with other national standards (and the international standard for mass, the International Prototype of the Kilogram or IPK) to determine their equivalence and ensure global comparability. These standards are disseminated to the South African industry through a range of services and products and in the case of a measurement dispute, reference analyses are provided to ensure conformity.

Technological advances over the past decade are placing stringent demands on metrology. New areas in metrology, such as nanotechnology, optical techniques, quantum-based technologies, material sciences, etc. are developing rapidly and require new measurement methods and measurement standards. In response, NMISA is investing more funds into research activities and are actively pursuing opportunities for collaboration with their peers in order to pool resources. NMISA thus engages in research towards the improvement of existing standards and to facilitate the development of new measurement standards to address emerging national needs.

1.2.1 INTERNATIONAL AND REGIONAL PARTICIPATION

The CIPM has established ten Consultative Committees (CCs) to oversee and arrange for the comparison of national measurement standards. The CCs bring together the world's experts in their specified fields as advisers on scientific and technical matters and are pivotal in the arrangement of key comparisons that compare the measurement capabilities and determine the measurement equivalence of national measurement standards. NMISA has full membership to nine of the ten CCs, guest membership of the 10th (Consultative Committee for Units) and membership of the CIPM.

Membership of a CC is open to institutions of Member States of the BIPM that are recognised internationally as experts in that field. This normally requires that:

- They be national laboratories charged with establishing national measurement standards in the field;
- They realise, keep and maintain primary standards;
- They be active in research and have a record of recent publications in research journals of international repute; and
- They have demonstrated competence by a record of participation in international comparisons organised either by the CIPM through its CCs, the BIPM or a regional metrology organisation (RMO).

Membership of the CCs allows an NMI to participate in the comparison of NMS and measurement capability at the highest level, i.e. a direct comparison to the NMS of developed countries and upcoming developing countries, that includes all the major trading partners of South (and Southern) Africa. In the absence of membership to a CC and its working groups, NMISA will have to wait for a second round of comparisons in a regional metrology organisation such as AFRIMETS, where the "second tier" NMIs compare their standards. As the only NMI in Africa with membership of all the CCs, NMISA provides the link to the international measurement system to Africa and thus plays a leading role in the development of metrology infrastructure in Africa, especially in support of South Africa's immediate neighbours in the SADC. This is crucial for the successful implementation of regional free trade agreements. This role is emphasised in the dti's strategic goals and the South African contribution towards mutual acceptance of testing results in the region (Regional Integration).

1.2.2 THE TECHNICAL MEASUREMENT ENVIRONMENT

Participation in international activities at CC and Technical Committee (TC) levels is imperative. These interactions serve to benchmark South Africa's capability to compete in measurement equivalence that directly impacts on our ability to disseminate traceability to the country. In order to do this, metrologists have to be extremely proficient at measurement science and techniques. This requires time and effort as it takes three to five years (building on a post-graduate degree) to master the art of metrology to the level where international participation is meaningful. It also requires sophisticated techniques, time and money and very good planning to align with the international call for participation and the availability of scientists and resources in the laboratory. This has to be balanced with national collaborative projects and research projects that are on-going as part of the performance requirements in each laboratory.

Training and development of young scientists remains critical as the metrology skills are not readily available in the market. The pool of young professionals, especially the young black professionals is not yet adequate. An integrated training and development plan has been developed to assist each metrologist, whether experienced or new in the field, in improving skills and ensuring a pipeline of young metrologists through the bursary program, training in metrology and internships. These young professionals are provided with skills suited to industry and where possible appointed as metrologists. It is in the ambit of those young professionals to grasp the learning opportunities afforded them.

1.2.3 THE NATIONAL ROLE

The NMS maintained and disseminated by NMISA underpins and/or supports directly and indirectly the daily activities of South Africa on almost all levels. As one of the dti's Technical Infrastructure (TI) entities, the activities of NMISA are critical to the success of the other TI's. Standardisation, metrology, conformity assessment and accreditation are the key issues in the implementation of free trade agreements between countries/economic trade blocks. NMISA plays a role in providing technical support for many other acts and regulations, ranging from the Occupational Health and Safety Act (Act 85 of 1993) to the Atomic Energy Act (Act 90 of 1967). It serves the more than 1300 accredited laboratories in South Africa and provides measurement and measurement assistance to over 400 industrial companies.

The role of NMISA is to ensure that measurements performed nationally (and regionally) are accurate and internationally acceptable. This enables trade, component manufacturing, the legal acceptance of measurement results for law enforcement, accurate measurement in environment and safety and is crucial for health care.

NMISA is a Type 3A public entity, managed by a chief executive officer (CEO), supported by an executive management team and governed by the NMISA Board:

The national significance of NMISA is illustrated as not only the link between the international measurement system and the South African measurement system, but in the vertical integration that allows South Africa to have a credible domestic measurement system to facilitate and ensure trade, commerce, manufacturing, services and consumer and environmental protection.

1.3 ORGANISATIONAL DELIVERY ENVIRONMENT (INTERNAL)

1.3.1 THE ORGANISATION

NMISA manages its technical activities through four technical divisions, namely Physical Metrology, Electricity and Magnetism (EM), Ionising Radiation (IR) and Chemistry and Materials Metrology (ChemMAT), with a cross-cutter Division that coordinates Research, International and Infrastructure Development (RIID), including Regional Integration activities, the liaison activities with the TI, the regional metrology organisations (RMOs) and other NMIs. The divisions are supported by Finance and Corporate Services Divisions.

Resources from the Divisions are mapped onto the international metrology structures, especially the ten CCs of the CIPM. Thematic research programmes comprising of Reference Materials, the Green Economy, Energy Efficiency, Manufacturing Competitiveness, Quality of Life, the Redefinition of the SI, Advanced Measurement Solutions, Commercial Services and Regional Integration allows for the use of expertise from different technical divisions to contribute to national and regional priorities such as the gas economy and environmental monitoring in support of climate change programmes, food safety and export protection, additive manufacturing, advanced materials & nanotechnology and to support the regional and continental free trade areas.

NMISA adheres to a total quality management system managed by the SHEQ office and handles all matters relating to

accreditation of technical competencies and health & safety of staff. This is achieved by ensuring a safe working environment; the identification of laboratory and workplace hazards/aspects and ensuring environmental sustainability, through training of staff in safety awareness; inspections; and compliance with the relevant legislation. The laboratories which can be accredited by SANAS are officially accredited to ISO/IEC 17025 and in the case of chemistry, ISO/IEC 17034 (for production of certified reference materials). Accreditation to ISO/IEC 17043 (for conducting proficiency testing schemes) is being attained for the laboratories officially providing PTs. Three laboratories can't be accredited yet due to a lack of national expertise. They will declare their competency according to the CIPM MRA rules.

NMISA has identified the regulatory requirements applicable to its services, operations and products in order to maintain regulatory compliance. NMISA has achieved certification of its occupational health and safety (OH&S) and EHS management system guided by ISO 14001 and OHSAS 18001 which specifies requirements for Environmental management systems (EMS) and an OH&S management system, to enable NMISA to control its OH&S risks/ environmental aspects and improve its OH&S and EMS performance.

NMISA delivers its services through:

Calibrations: Delivering direct traceability to the national measurement standards (NMS), NMISA serves the accredited calibration and testing laboratories by performing calibrations to the highest accuracy (smallest uncertainty). Calibration is also provided directly to industry in cases where there are no accredited calibration laboratories, or the desired accuracy can only be provided by NMISA.

Reference Measurements and certification of reference materials: NMISA provides reference measurements and analysis according to its calibration range and services. In addition NMISA has built capability to value assign chemical samples and gas mixtures for customers, including purity. This capability allows NMISA to produce pure standard CRMs or calibration solutions and Primary Reference Gas Mixtures (PRGMs) that are internationally recognised and accepted.

Measurements, testing and analysis: NMISA offers advanced measurement services to industry. This includes method development for customers to assist with problem solving, and performing analysis in support of research projects.

Training: The expertise residing in the staff of NMISA is an important contribution to the development of a skilled and capable workforce through training in measurement science. NMISA assists SADC and Africa in capacity building by providing

consultation services and training to their metrologist. Where and when required, NMISA assists the National Laboratory Association of South Africa (NLA-SA) with training courses. Special development projects to assist SMEs have been created and are being rolled out. NMISA staff is also involved as invited lecturers in graduate and post-graduate academic courses.

1.3.2 TECHNICAL ACTIVITIES

To ensure proper coordination of priority projects of national interest and monitoring and evaluation of deliverables in research and development projects, the capabilities are structured in a matrix organisational structure. The matrix type organisation is a 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 building blocks of the matrix structure are the capabilities that contribute to the thematic research programmes:

Physical Metrology

Physical metrology (PM) plays a fundamental part in the innovation process. To develop new products and processes, companies need to measure quantity, quality and performance. To manufacturing companies, the need for accurate measurements is critical. For example, the manufacturing of precision engineering components to tight specifications in the automotive, aviation etc. industries. Physical Metrology plays a vital role in our everyday lives, from ensuring accurate quantities when procuring food and household products to quality of life and law enforcement. Physical metrology forms the foundation of all measurements in mass, volume, density, air flow, force, torque, hardness, pressure, vacuum, viscosity, acoustics, ultrasound, vibration and dimensional measurements. These form the foundation of the research projects in the Redefinition of the SI (Shortening the Traceability chain for Africa) and Manufacturing Competitiveness. It also provides the essential base units (kilogram, metre, etc.) for the other research programmes.

Ionising Radiation

Ionising Radiation (IR) provides traceability and specialised measurement techniques for users of Ionising Radiation products

and techniques in the country and the region. IR is further establishing itself as a regional measurement and traceability hub to enable accurate ionising radiation measurements to support trade, energy efficiency, environmental, health and safety requirements. This is achieved by establishing NMS that are fit for purpose for the African region, that are traceable to international measurement standards, whilst staying abreast with the developments of standards internationally, and by training end users from the region.

IR comprises of Dosimetry that is re-establishing radiation protection capabilities and is developing primary standards for beta dosimetry (absorbed dose to tissue) and particle emission rate, and Radioactivity standards that support the radioactive isotope production facilities in South Africa and provide an essential environmental monitoring service to the National Nuclear Regulator (NNR).

IR capabilities provide the basis for the Quality of Life research programme and contributes to the Green economy.

Electricity and Magnetism

Electricity and Magnetism (EM) involves electromagnetic parameters. It is the custodian of the national time, establishes the national temperature scale and provides traceability for radio frequency, photometry & radiometry and direct-current low frequency (DCLF). EM further contributes to the current and future expansion of South Africa's ICT industry, by developing and maintaining standards to regulate optical fibre and wireless communication systems and to perform diagnostic network tests at high accuracy levels. Its technologies form the basis of the Energy Efficiency research programme and supports development of Advanced Measurement Solutions in support of national priority projects such as the Square Kilometre Array (SKA).

Chemistry and Materials Metrology

Chemistry and Materials Metrology (ChemMAT) focuses on developing traceable methods to underpin reference analysis. Dissemination of its capabilities is done through reference analysis, the development of reference methods (national measurement standards in Chemistry), providing proficiency testing schemes (PTS) and the production of certified reference materials (CRMs) in support of testing in agriculture, chemicals, energy, climate change and clean air, food safety, health and environment, pharmaceuticals, metals, law enforcement and the manufacturing and mining industry sectors. All

development and research outcomes align with the objectives of the Reference Material and Green Economy programmes. ChemMAT also provides materials characterisation and surface analysis support for metals beneficiation, manufacturing and advanced technologies, such as nano and additive manufacturing in support of manufacturing competitiveness and the green economy.

ChemMAT contributes to Regional Integration through the African Feed and Food Reference Material Programme and commercially, through contract research projects (mainly in support of green energy, consumer protection and agricultural food and feed) and limited contract analysis to increase external funding needed to substantiate the relevance of the measurement services offered to industry.

Research, International and Infrastructure Development (RIID)

Research that underpins the national measurement standards involves collaborative associations and projects with Governments, Science Institutes and Academia and sources external revenue through these collaborative associations and projects. RIID is the enabler for the eight thematic thrusts, aligned with IPAP and national priorities, and drives the Regional and International Integration.

The technical strategic objectives of NMISA can be linked to the strategic thrusts and are delivered by the research programmes.

RIID ensures that NMISA is appropriately linked to the international metrology fraternity, fosters collaboration with other NMIs and source funding from development partners. It coordinates the activities of NMISA in the other Technical Infrastructure institutions and manages the relationship with the sub-regional (SADCMET) and regional (AFRIMETS) metrology organisations.

2. REVISIONS TO LEGISLATIVE AND OTHER MANDATES

NMISA was established and is fulfilling its legal mandate under the Measurement Units and Measurement Standards Act, Act no. 18 of 2006.

In accordance with the Act, during 2016, NMISA Gazetted the updated Measurement Units and National Measurement Standards. With the pending revision of the SI in 2018, NMISA is responsible to update the Measurement Units to comply with the revised SI. The updated Units will be Gazetted in 2019 and an annual review will be implemented to ensure that all international developments in units are appropriately legislated.

The National Regulator for Compulsory Specifications (NRCS) has revised the Trade Metrology Act, Act no. 77 of 1973 to include measuring instruments in the area of health, safety and environment. This is because the Trade Metrology Act, Act No.77 of 1973 only covered the area of mass, volume and length involving monetary transactions.

The revised Trade Metrology Act is now known as the Legal Metrology Act, Act No. 9 of 2014 and has been enacted by the Parliament of the Republic of South Africa, Government Gazette

No: 37661 dated 19 May 2014 to replace the Trade Metrology Act, Act 77 of 1973.

These developments meant that, not only instruments used in trade for mass, volume and length require verification but an additional scope of instruments in health, safety and environment. NMISA is involved in the process to draft regulations (through the NRCS) to address the additional scope and with its special capabilities, may be requested to provide some of the verification activities.

The dti has embarked on a revision of the Measurement Act to align it with the latest developments internationally and locally. During the period, it is expected that an update to Act No. 18 of 2006 will be enacted. Main issues to be addressed include the role of NMISA in providing measurement traceability to government department measurement facilities (police forensics, department of health forensic laboratories, department of transport law enforcement agencies, etc.) and the legality of traceability to other national metrology institutes. Finally, alignment is necessary with the Legal Metrology Act.

3 OVERVIEW OF 2018/19 BUDGET AND MTEF ESTIMATE

3.1 2018/19 TO 2020/21 BUDGET ESTIMATES

NMISA CONSOLIDATED BUDGET 2017/18-2019/20

	2018/19 R'000	2019/20 R'000	2020/21 R'000
	5.7% (existing)	5.6% (existing)	5.5% (existing)
Revenue	273 156	288 453	304 318
Transfers received	232 784	245 820	259 340
Rendering of service	31 561	33 328	35 161
Investment income	8 811	9 304	9 816
Expenditure	273 156	288 453	304 318
Administrative and operating expenditure	68 558	72 397	76 379
Employee cost	122 653	129 522	136 645
Repairs and maintenance	8 312	8 777	9 260
Recapitalisation project	72 753	76 827	81 053
Audit fees	880	929	980

3.2 EXPENDITURE ESTIMATES

R thousand	AUDITED OUTCOME			REVISED ESTIMATE	AVERAGE GROWTH RATE (%)	EXPENDITURE TOTAL: AVERAGE (%)	MEDIUM-TERM ESTIMATE			AVERAGE GROWTH RATE (%)	EXPENDITURE TOTAL: AVERAGE (%)
	2014/15	2015/16	2016/17	2017/18	2014/15– 2017/18		2018/19	2019/20	2020/21	2017/18– 2020/21	
Administration	59 090	63 804	84 391	67 930	4.8%	45.5%	71 802	75 822	79 992	5.6%	36.9%
Keep, maintain and disseminate national measurements	54 173	77 727	91 677	116 332	29.0%	54.5%	122 962	129 847	136 988	5.6%	63.1%
	113 263	141 531	176 068	184 262	17.6%	100.0%	194 764	205 669	216 980	5.6%	100.0%

[illegible][illegible]

3.3 RELATING EXPENDITURE TRENDS TO STRATEGIC OUTCOME ORIENTED GOALS

NMISA has re-organised its activities into Thematic Research Programmes as multi-disciplinary programmes, coordinated by a research project office, that will deliver outcomes such as improved national measurement standards (NMS) or measurement solutions to industry. The matrix organisational structure also provides opportunities for staff in the functional divisions and sections to pursue career development through assignment to various types of projects within the programmes. This will also allow for easier coordination of student development projects such as the NMISA post-graduate bursary programme. Figure 2 below presents the matrix nature of the NMISA technical divisions, with RIID serving the research project coordination function. Programme Managers will be metrologists appointed from the leading technical divisions. They receive support from the research project coordinator for budgeting, execution and reporting.

Future research and development projects, where a large part of the organisation needs to be involved and play a role, will require resourcing from more than one division utilising the skills base within both the technical and support areas. An example is the Reference Material programme that requires resources from all four divisions and all support functions. The various measurement solutions for IPAP may need resources from 2-3 Divisions and these projects will be considered in a holistic manner.

Projects in support of national priorities, i.e., projects that contribute to manufacturing competitiveness, agro-processing, the nuclear build, infrastructure development, etc., will be reported under the sector or thematic theme (programme). The matrix approach will also include projects to maintain and improve national measurement standards (NMS) or establish new NMS and services/ products in a specific section or division that include limited resources from other divisions (e.g., to establish traceability for solid state lighting or in support of special projects that require expertise residing in the software development group).

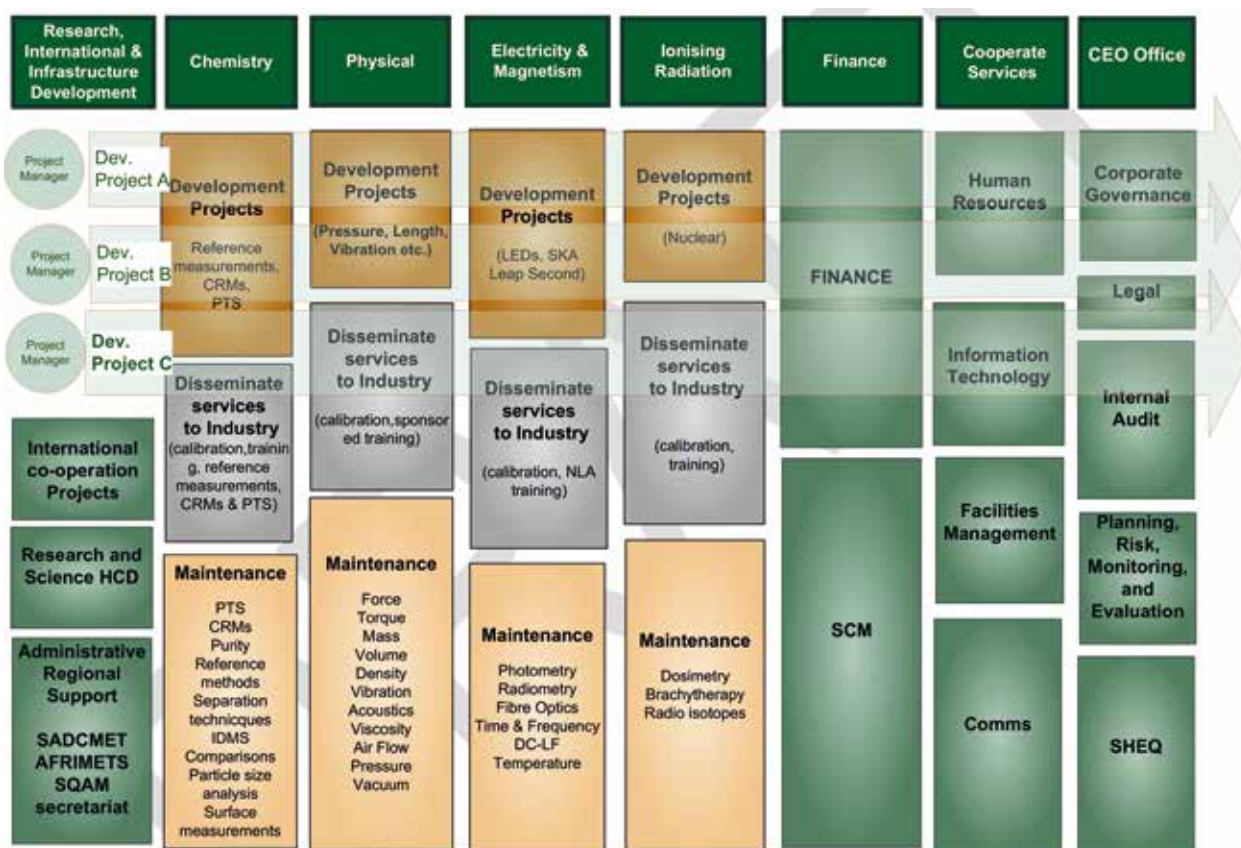


Figure 2. Technical Organisational Structure

Benchmarking at international level to establish the initial equivalence of a standard or services will also be captured per thematic project. Projects under the research programmes will be approved annually to be included in the annual performance plan (APP). In addition to the research programmes, the dissemination and measurement services are coordinated in commercial services and the quality infrastructure, international liaison and regional integration, within International and Regional Integration.

RECAPITALISATION

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. "Typically the accuracy required of national measurement standards doubles every ten years." With doubling requirement, modern metrology laboratories need to be custom built with advanced environmental control; clean power supplies; surgical grade clean rooms and anti-vibration flooring. Infrastructure should further be designed and planned in such a way that it can be upgraded at regular intervals to meet increasing stringent environmental conditions and to stay

abreast of technology developments in measurement sciences. The result is that the equipment replacement strategy of NMISA needs to take cognisance of not only the replacement of aged equipment, but also that instrumentation procured now may also be obsolete in three to five years.

NMISA is located on the CSIR's Scientia Campus in Pretoria. NMISA still occupies the metrology laboratories, as when the CSIR National Metrology laboratory, the forerunner of NMISA, took occupation of the site in the 1960's. With no major building infrastructure investment in its history (NMISA became a tenant to the premises in 2007) the building infrastructure has reached its technical limit of modifications.

In response, NMISA motivated for a recapitalisation of the NMS and new building infrastructure and a project was registered at National Treasury as a PPP Project, the transaction advisor and the project officer were appointed for preparation of a feasibility study towards re-capitalisation. With the assistance of the PPP unit of National Treasury, a feasibility study has been finalised for the best model for the new building infrastructure, and for a sustainable model for the continuous upgrade and maintenance of the NMS. A Feasibility study report was finalised and submitted to National Treasury for approval. It has since been referred back to the dti as the new facilities need to be funded from the current allocations and the dti has indicated a continued contribution for the period towards the recapitalisation of NMISA. A due diligence will be performed to ascertain what can be achieved with the indicated contribution and if land can be procured for a new "NMISA" campus.



PART B

PROGRAMME AND PROJECT PLANS

4 SUB-PROGRAMMES AND PLANS

4.1 RESEARCH PROGRAMME CONTRIBUTIONS

4.1.1 REDEFINITION OF THE SI

The International System of Units (SI) defines the system of measurement globally and for a country to be connected to the international measurement system, it must adhere to and apply the SI. The 7 base units of the SI (kilogram, metre, kelvin, ampere, candela, mole and second) each has a definition of how to realise the unit in a primary way and thus to establish a national measurement standard directly traceable to the SI.

The international General Conference on Weights and Measures (CGPM) has approved a plan to redefine four of the seven base units of the International System of Units (SI) in terms of fixed values of natural constants. The initiative would make possible new worldwide levels of consistency and accuracy, simplify and normalise the unit definitions, and liberate the system from dependence on the international prototype kilogram (the IPK) as the unit for mass. If the proposed redefinition is accepted, the metric system (SI) will, for the first time, be wholly derivable from nature. The proposal can be summarised as follows:

There will still be the same seven base units (second, metre, kilogram, ampere, kelvin, mole, and candela). Of these, the kilogram, ampere, kelvin and mole will be redefined by choosing exact numerical values for the Planck constant, the elementary electric charge, the Boltzmann constant, and the Avogadro constant, respectively. The second, metre and candela are already defined by physical constants and it is only necessary to edit their present definitions. The new definitions will improve the SI without changing the size of any units, thus ensuring continuity with present measurements. The revised formal definitions of the SI base units are expected to come into force on May 20, 2019.

The international definition of the kilogram has not changed since 1889. The kilogram (unit of mass) is defined as the mass of a Pt-Ir alloy cylinder (the IPK) that is kept at the International Bureau of Weights and Measures (BIPM) in Paris. When a country signs the Metre Convention and become a Member of the BIPM, it procures a copy of the IPK. All mass measurements done under the SI are traceable through the copy to the IPK. The kilogram is the only SI unit still based on an artefact.

The future definition of the kilogram will be in terms of Planck's constant. Two approaches have been adopted to obtain this value, one is to use an electro-mechanical device called a Kibble (Watt) balance, and the other is to derive the constant from Avogadro's number, by counting the number of silicon atoms in

a 1 kg silicon sphere. The final date for the re-definition is 2018. NMISA decided to invest in the two technologies that will be used in the redefinition, namely the Kibble (Watt) balance and the Si-sphere. Three other units are also redefined at the same time with their realisations being modernised, the ampere, kelvin and mole. NMISA will update its realisation of the ampere and kelvin. Research projects are being started for a primary gas thermometer (with NMIJ of Japan) and the determination of the electron charge (UCT, NPL and NIST). These projects will culminate in new standards only in the next period, i.e. 2021 to 2023

The Programme is actively exploring research collaboration opportunities with other NMIs to establish the new primary realisations. For the Kibble (Watt) balance, the National Institute of Standards and Technology (NIST) in the USA and the National Research Laboratory (NPL) of the UK have been approached to fast-track the research work at NMISA to ensure a working Kibble (Watt) balance at NMISA by end of the financial year 2019/20.

The Programme is also actively involved, through a collaborative project with the PTB, in the Avogadro project. It has on loan from the PTB a Silicon sphere that has been well characterised regarding its volume and density. To determine the mass of a silicon sphere, the number of atoms in the Si-sphere needs to be determined. This is then also a primary realisation of the unit for amount of substance, the mole.

4.1.2 QUALITY OF LIFE

The Programme will focus on supporting South Africa with traceable measurements for environment monitoring, health and safety of humans and also extensively supporting the ionising radiation regulatory bodies in the country. It will also assist its personnel with furthering their studies thus improving the qualification profile of the organisation.

The technical areas of focus for the period include the implementation of the audit programme for radiotherapy. This programme is currently at a testing stage for onsite audits, with only five centres participating. It is anticipated that within the time period covered by this plan, the audit will be rolled out to all centres that desire to participate. The Programme will also focus on dissemination of the re-established x-ray capabilities, absorbed dose to tissue using Beta emitting sources, and neutron capabilities. All these are required for ensuring safety of radiation workers. For health application, measurement

capabilities will be the newly established brachytherapy high dose rate measurements, used for treatment of cancer. The programme will continue developing methods needed to be used in a radio-analytical laboratory for environmental samples that is being set up together with the National Nuclear Regulator, to ensure compliance with all South African laws by the license holders of different facilities, including mines. These will help ensure the safety of South Africans when working in areas where they could be exposed to ionising radiation and also where they might be undergoing treatment using ionising radiation techniques. The division will continue with the recapitalisation project and replace the aged infrastructure.

As new technology in the treatment of cancer has been introduced over the last few decades, the dosimetry section will investigate the impact this has on current dosimetry and put plans in place to support the industry in small field dosimetry. Increasing capacity building through the integrated HCD program will also align with the development projects planned.

4.1.3 REFERENCE MATERIALS AND THE GREEN ECONOMY

The Reference Material programme will focus on the production of high purity calibration solutions and the certification of matrix reference materials, initially focusing on the food and feed industry. An intensive stakeholder engagement with the food testing laboratories in South Africa indicated a clear need for traceability in food contaminants, residues, additives and labelling. Currently the main focus of the programme is mycotoxins and pesticides in various food matrices with the intention to expand the scope to proximate analysis. A highlight for the period 2018/19 will be NMISA hosting the Africa Food Safety Network Workshop, 4-8 June. This event will see representatives from NMIs and DIs across Africa and other developing economies, together with the IAEA food safety network commercial and regulatory testing laboratories participating in a collaborative effort towards ensuring food safety and accurate measurement.

The Green Economies programme will focus on the reference measurements required in support of reference material production and environmental, industrial, and applied monitoring as well as the development of alternative technologies. The research outputs from these programmes will directly support the production of reference materials, certified reference materials, quality control standards and the maintenance of reference measurements (also Gazetted as national measurement standards), new and improved NMS and proficiency testing schemes (PTS) offered to industry.

Resourcing the laboratories and increasing capacity building through the integrated HCD program will also align with the research thematic projects planned. Key collaborative efforts with NIM China's Cooperation Framework Agreement on matrix reference material production, the BIPM Capacity Building and Knowledge Transfer programme, IAEA international and AFRA regional projects will position NMISA as the leading reference material producer for Africa.

The inherent global risk posed by persistent organic pollutants (POPs) culminated in the development of the Stockholm Convention whose primary aim is to protect humans and the environment from chemicals that are persistent, bio-accumulate, and tend to become geographically widely distributed. South Africa has signed the Stockholm Convention, making the analysis of environmental pollutants a legal obligation. Currently there is no laboratory in South Africa providing this advanced measurement as a routine service and NMISA is receiving an increasing number of requests from industry to assist with these measurements and provide traceability. To ensure traceability for these complex measurements, NMISA has developed sensitive, accurate and cost effective technologies to identify, measure and accurately quantify dioxins, brominated flame retardants and related persistent organic pollutants with similar toxic properties. NMISA is thus well positioned to support the Reference Material programme, as well as fill a niche prospective market that includes providing these measurements for the food and feed industry (required to comply with environmental regulations), national forensic services and academia. Due to the complexity of the measurement and the associated cost, continued method improvements and expanding the measurement capabilities will rely on sourcing adequate funding to provide this service.

NMISA will continue to develop and improve national measurement standards for primary reference gas mixtures (PRGMs) for air pollution monitoring. Existing gas mixtures will be improved in support of air quality measurements, indoor air quality, and law enforcement sectors by being available to laboratories that provide industry with reliable measurements to ensure the quality and to meet international requirements in their measurement results. NMISA will also focus on the preparation of stack emission reference gas mixtures which include automotive emissions and stationary source. The program for the Global Atmospheric Watch (GAW) is supported by the production of greenhouse gases, ozone and volatile organic compounds which underpin the trends of air pollutants at background level (air that is free from anthropogenic pollution).

Materials characterisation fulfils a cross-cutter research infrastructure support role to NMISA with collaborative initiatives extending to universities, research institutions and industry. The process of materials characterisation examines and measures the physical, chemical, mechanical, micro- and nanostructural properties of materials. With its hi-tech instrumentation, it offers advanced materials measurement services to diverse industries such as additive manufacturing, metals/ alloy beneficiation and processing, packaging, electronics, and advanced material research areas such as polymers, composites and nanomaterials. Some of the key projects include the design and fabrication of cost effective solar cell devices. These devices will prove to be beneficial to the country as they will be used in rural areas to generate electricity, using only the sun's energy to power the device. The industrial and air monitoring project will consider method development and validation of the highly specialised particle size service offering at NMISA. The Focused Ion Beam Scanning Electron Microscope (FIBSEM) characterisation technique will be further developed to expand service offerings to the semi-conductor and biological sectors. Lastly, Time-of-Flight Secondary Ion Mass Spectroscopy (TOF-SIMS) application will also be interrogated to determine a market mix for the characterisation technique.

4.1.4 ENERGY EFFICIENCY

The NMISA Energy Efficient Solutions (EES) programme was identified from national government needs and priorities, particularly those related to reducing the national energy consumption. The current IPAP document declares a Green Industries sectoral focus area, which involves establishing a Strategic National Smart Vision for the South African Electricity Industry. This vision will facilitate broad penetration of energy-efficient solutions for electrical energy producers and consumers nation-wide. In support of IPAP, the NMISA's "Energy Efficient Solutions" programme aims to develop and promote measurement capabilities that enable the efficient usage and saving of electrical energy.

4.1.5 MANUFACTURING COMPETITIVENESS

The Manufacturing Competitiveness program was established in support of the South Africa manufacturing industry, to be an enabler role-player particularly for the export market. The program supports the mandate of NMISA which is to maintain, research and develop and to disseminate the National Measurement Standards, with a focus on metrology services to be provided for the manufacturing industry. The target market,

the broader manufacturing industry, was studied from the dti annual report, the dti APP and IPAP. The overall size of the market over the last years shows that the industry contributes more than 25% of South Africa's GDP and is the largest single industry sector in the country. The automotive industry alone had R150bil exports in the 2015/16 financial year.

The manufacturing sector has experienced some challenges over the last few years. However, it is still one of the focus sectors to revive South Africa's economy. Recent studies project that the industry has the ability to grow to over R500 000 million (R500 milliard). The areas of the manufacturing industry which have the largest markets are:

- Automotive
- Metal fabrication
- Ship and boat building
- Advanced manufacturing (Aerospace and Defence)

4.1.6 ADVANCED MEASUREMENT SOLUTIONS

Metrology applications in industry increasingly demand ultra high accuracy and sophisticated designs while keeping costs at a minimum. The common drivers of current demands include miniaturisation, high volume and increased accuracy. Recent scientific advancements in the field of metrology provide accurate, fit-for-purpose, yet cost-effective solutions. The Advanced Measurement Solutions programme was established to find new and innovative solutions to existing measurement problems experienced by the client. It comprises projects delivering new realisation solutions for reference time, gas flow and pressure measurements, amongst others. Systems design engineering principles are embedded in the development processes.

4.1.7 REGIONAL AND INTERNATIONAL INTEGRATION

For 2018 to 2020, there will be a continued drive and focus to support the regional integration goals of IPAP, and to position NMISA appropriately in the regional and international arena. Other focus areas will include the development of new business through consultancy to NMIs in Africa and assistance to SMEs with the potential to export. Further, targeted assistance will be given to rural SMEs with basic training in metrology.

Cooperation with the metrology institutes of the BRIC countries will be improved on issues of joint concern, such as to provide accurate measurement for biofuels, nanotechnology and

advanced manufacturing. Specific metrology development projects are also planned with other NMIs in the region to assist intra-regional trade and in support of the Continental Free Trade Area (CFTA). This will also include a special focus on assistance to exporters to negate technical barriers to trade with main trading partners, both regionally and internationally.

Activities in support of SADC and SADC MET, Africa and AFRIMETS and the CIPM MRA, such as attendance of meetings, training, benchmarking of NMISA capabilities against other countries, and organising of comparison of national measurement standards of regional NMIs, will continue, but there will be a special focus to leverage our position in these structures to increase external revenue.

Research collaborations with universities and research institutions (including the top NMIs) will be increased in support of the research programmes and especially the redefinition of the SI. It will also provide the basis for NMISA to access more funding from the NRF and DST for research.

4.1.8 COMMERCIAL SERVICES

All NMS maintenance and product development is captured under the various research programmes. Once the product has matured and is ready to be offered to industry as a service, the projects are captured under the Commercial Services

programme. These projects then include all dissemination services associated with traceability to the national measurement standards (NMS) that generate revenue and comprise the services for which NMISA is accredited, and offered as a service to industry either as a reference measurement, or certified reference material (aqueous, calibration solution or matrix), instrument calibration, proficiency testing schemes, consultancy, training and/ or technical assessments. In special cases where industry is not able to provide a measurement service or calibration, this service can be then offered by NMISA (pending resources and affordability). If a measurement service is not routine and includes innovation or advanced interpretation, the service will be captured under the research programmes for development until such service can be offered to industry. Consultancy, (nationally, regionally and internationally), is also reported here.

4.2 PROGRAMME BUDGETS

Research programme budgets and outputs are shown for the MTEF period, i.e. 2018 to 2020. These budget totals are only indicative and will differ from the NMISA budget figures per programme as the budgets only include the compensation hours planned per project and not the overheads. The project details with specific deliverables and dates will be available in the Scientrix planning system and the Research Programme business plans for 2018/19.

Description	2018/19 R'000	2018/19 Main Deliverables	2019/ 20 R'000	2020/21 R'000
Realisation of the redefinition of the SI The future definition of the kilogram will be in terms of Planck's constant. Two approaches have been adopted to obtain this value, the Kibble (Watt) balance and Avogadro's number. Three other units are also redefined at the same time with their realisations being modernised, the ampere, kelvin and mole. The Programme is actively exploring research collaboration opportunities with other NMIs to establish the new primary realisations. For the Kibble (Watt) balance, a collaborative project the National Research Laboratory (NPL) of the UK and for the Avogadro's number a collaborative project with the PTB has been initiated. NMISA will update its realisation of the ampere and kelvin. Research projects are being started for a primary gas thermometer (with NMJ of Japan) and the determination of the electron charge (UCT, NPL and NIST). These projects will culminate in new standards only in the next period, i.e. 2021 to 2023	21 154	New national measuring standard for mass as per the redefinition of the kilogram, Kibble (Watt) balance. Establish a facility to determine mass in vacuum and develop metrology expertise and techniques to perform mass calibrations in vacuum.	43 980	14 650
<ul style="list-style-type: none"> Watt balance (Kibbel project) Establish vacuum weighing capability Gas thermometry International Integration 				

Description	2018/19 R'000	2018/19 Main Deliverables	2019/ 20 R'000	2020/21 R'000
Quality of Life A cross cutter that will cover the quality of life, assessing what needs to be established to support the different regulatory requirements that have been put in place in the country for health, covering for example Bio diagnostics, measurements for pressure, temperature, radiation (ionising and non-ionising), and medical gases.	23 860	NMISA aims to support the regulators in the implementation of the legal metrology Act; assist in improving the delivery of health care in South Africa through accurate measurements solutions and to develop metrology expertise and techniques to support medical diagnostic, and treatment of diseases.	36 945	36 360
<ul style="list-style-type: none"> Primary health care Pharmacology Occupational health and safety Cancer care 				
Reference Materials (RMs) <ul style="list-style-type: none"> service-oriented supplier; knowledgeable on exactly what our stakeholders require and efficiently optimise those requirements to provide fit-for-purpose Africa-relevant reference materials. Certified Reference Materials, Reference materials for Quality Control and Proficiency Testing Scheme purposes Be accessible, sustainable and affordable 	33 438	NMISA will provide fit-for-purpose Africa-relevant reference materials, that enable intra-regional trade and support our quality of life, answering the challenges of accessibility, sustainability and affordability	44 960	48 480
<ul style="list-style-type: none"> Matrix RMs (incl. African Food and Feed RMs) Materials processing IT High purity calibrators 				
<ul style="list-style-type: none"> Forensic RMs Mineral Beneficiation RMs 				
Green Economies Defined as the sampling of the various matrices within the different biomes to derive information on the potential impact of anthropogenic activities. The monitoring activities are generally not aimed to determine the effect of a specific point source but rather the overall impact to the environment. Routine environmental monitoring is often undertaken in air, rivers and in sentinel species such as birds and invertebrates. When it is known that a specific industry can generate a specific environmental impact, industrial monitoring is used to determine the effect of the industry on the environment. The most common form of industrial monitoring undertaken in South Africa is stack emission monitoring that includes air monitoring for specific pollutant classes as well as other types of pollution such as heat and noise generation.	24 692	Reference measurement solutions tailored to support environmental monitoring, industrial and applied monitoring and alternative technologies (solar).	26 770	28 140
<ul style="list-style-type: none"> Air, terrestrial and aquatic monitoring Industrial and applied monitoring Alternative technologies (incl nano) 				
Energy Efficiency The Energy Efficient Solutions programme will facilitate broad penetration of energy-efficient solutions for electrical energy producers and consumers nation-wide. In support of IPAP, this programme aims to develop and promote measurement capabilities that enable the efficient usage and saving of electrical energy	23 856	Development of new or improved NMS supporting (electrical) energy efficiency**	23 970	15 720

Description	2018/19 R'000	2018/19 Main Deliverables	2019/ 20 R'000	2020/21 R'000
<ul style="list-style-type: none"> Power and energy Solid state lighting Smart grids Thermometry Electrical quantities International Integration 				
Manufacturing Competitiveness The Manufacturing Competitiveness program was established to support the South Africa manufacturing industry to be a competitive role-player particularly for the export market. The target market, under the broader manufacturing industry of the projects was studied from the dti annual report, the dti APP and IPAP. The overall size of the market over the last years shows that the industry contributes more than 25% of GDP and is the largest single industry. The manufacturing market is vital to the country's GDP and for South Africa to succeed, the manufacturing industry must grow.	12 150	Improved capabilities in dimensional, torque and pressure measurements, in support of the automotive industry. Establishment of the Machine Tool Calibration facility that will focus on the preventive action during manufacturing process. Creation of large torque and force facilities in support of large ship and boat building as well as the drive train of renewable energy systems.	40 700	39 380
<ul style="list-style-type: none"> Force, torque and hardness measurements Machine and tool evaluation Additive manufacturing Traceability for length, pressure and flow measurements Development of measuring instruments 				
Advanced Measurement Solutions The Measurement Solutions Programme combines research and development projects where a new measurement technique or system requiring substantial innovation is required to meet scientific or industrial challenges	9 890	New measurement capabilities for specialised applications, including high accuracy time synchronisation	23 965	18 190
<ul style="list-style-type: none"> Structured light Time reference signals (SKA) System Design Group and special projects 				
Regional and International Integration NMISA links the SA and regional measurement system to the international measurement system through participation in the Metre Convention and its organs, the CIPM and BIPM. The expanding global trade and pressure to eliminate technical barriers to trade and open up free trade areas creates a constant demand for greater accountability and demonstrated competence in NMIs and plays a leading role in the development of a sound metrology infrastructure in Africa, especially support of SA's immediate neighbours in SADC and the envisaged CFTA.	14 885	To meet the obligations of an NMI as stipulated in the Measurements Act and the Metre Convention and to provide the measurement component of the Quality Infrastructure.	15 852	16 724
<ul style="list-style-type: none"> International Integration (BIPM, CIPM, etc.) Regional Integration (SADC, CFTA, QI, AFRIMETS, etc.) 				
Commercial Services All developed reference materials and measurement and calibration services that are offered to industry; these services also include e-commerce, IT, proficiency testing schemes, consultancy and technical assessments.	23 150	To ensure dissemination of traceability for SA and the African continent where possible in support of the Quality Infrastructure.	19 500	27 750

Description	2018/19 R'000	2018/19 Main Deliverables	2019/ 20 R'000	2020/21 R'000
• Law enforcement				
• Sale of PRGMs/ CRMs and PTS				
• Environmental and Industry Reference measurements and calibration				
Office of the CEO, Corporate Services and Finance	59 264	HR, IT, Facilities, Marketing and Comms, Internal Audit, Planning, Risk, Monitoring and Evaluation monitoring, Legal, Compliance and Governance, SHEQ	62 583	66 025
Support services required to ensure business continuity for NMISA				

4.3 MODERNISATION OF THE NATIONAL MEASUREMENT STANDARDS

In the development towards a more modern NMI with a strong research and development component the qualification profile of NMISA has to be addressed. Projects to enhance the profile include both the internal development of staff, as well as dedicated bursary and post-graduate studentship schemes.

NMISA will continue to focus on recruiting black professionals as the institute's employment equity profile is lagging behind set targets. This is due to a limited pool of suitably trained black professionals, as well as an outflow of newly trained metrologists to 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 provincial and national economically active population,

as illustrated in Figure 4. Evaluating past trends in staff turnover percentages, the demographics of the resignations, upcoming retirements and ability to appoint skilled black professionals, a growth rate of 3 to 4% per year is projected, leading to a transformed workplace by 2020/21. Efforts will also be made to improve the representivity of female professionals at all levels and focus on recruitment of people with disabilities where the target was set at 2%.

The success of the modernisation of the NMISA and to shorten the traceability chain for Africa is directly centred on secured funding for resources, (both human and infrastructure and equipment) and skills transfer of retiring scientists to the younger less experienced scientists. Due to the fiscal constraints and the concurrent enforced savings, specific modernisation projects will have to be reprioritised or deferred until suitable funding is secured.

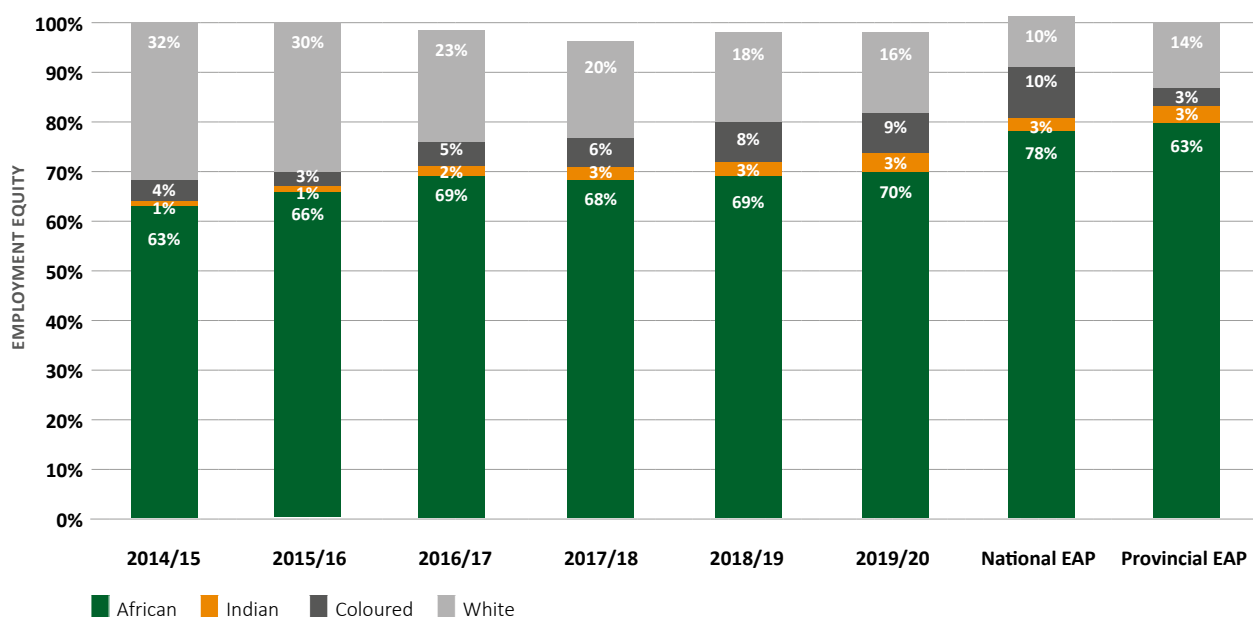


Figure 4. Employment Equity/Staff Demographics

4.4 NMISA PERFORMANCE INDICATORS

An updated performance matrix has been included below, covering the period 2018/19 to 2020/21.

NMISA has adopted the balanced scorecard approach to set and measure performance targets. This scorecard addresses the maintenance of the national measurement standards and the administrative support provided to ensure the outputs of the organisation. Four key components, are addressed, namely International agreements and participation, stakeholder/customer (technical), organisational development (learning and growth) and financial and business process perspective.

National obligations: NMISA provides for the use of the measurement units of the SI and certain other units, the designation of national measurement standards and units, and for keeping and maintaining the national measurement units and standards. This also includes improving existing NMS and methods and developing new NMS, secondary standards and new reference methods.

International participation and equivalence: As part of the Metre Convention system, NMISA ensures international measurement comparability by participating in the activities of the CIPM. This includes active participation in the Consultative Committees and demonstrated measurement capabilities as published in the BIPM Key Comparisons Database (KCDB).

Internal organisation (learning and growth) perspective: Internal growth perspective addresses human resources, thereby demonstrating the organisation's capacity to deliver on its mandate by maintaining a skilled, competent and transformed work force. Key priorities include:

- Improve core skills and qualifications
- Reduce employee turnover
- Transformation
- Improve job satisfaction
- Improve internal communications in the HR function

Stakeholder/customer perspective (technical): includes scientific and technical outputs, products and services developed to support the South African commerce and industry in a fast-paced global economy.

Financial and business process perspectives: The focus is on the financial performance and sustainability of the organisation. Key priorities that are addressed include:

- Financial growth and stability is ensured by broadening the revenue mix
- Effective financial controls
- Develop and update policies and procedures
- Improving of internal processes, aligning and integrating systems and processes
- Improving internal communications
- Establishing long-term multi-divisional research programmes
- Implementing systems to manage and protect NMISA's intellectual property

The performance indicators of the balanced scorecard are supported by Divisional Annual Performance/ Business Plans and deliverables. The main activities, in line with the strategy that has been presented to attain these key performance indicators, are summarised in Annexure A

4.5 PERFORMANCE INDICATORS AND PERFORMANCE TARGETS PER PROGRAMME

4.5.1 NATIONAL OBLIGATIONS

As mandated, NMISA provides for the use of the measurement units of the International System of Units and certain other units, the designation of national measurement standards and units and for keeping and maintaining the national measurement units and standards. This also includes improving existing national measurement standards and methods and developing new national measurement standards, secondary standards and new reference methods.

Strategic Outcome Oriented Goal 1	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
Keep, maintain and develop the national measurement standards and provide for the use of the national measurement units	Provide for the national measurement units by maintaining the SI units, units outside the SI and equivalents of units	1	Update South Africa through the dti on units defined by the CIPM (SI); advise on the use of units outside the SI and maintain equivalents of units	Gazette National Measurement Units	New KPI	New KPI	Update schedule 3 (equivalents of units) submitted in Q1	Update Schedule 3 (SI units) and submit to the dti to Gazette	100	Develop and submit annual report to the dti to Gazette	Develop and submit annual report to the dti to Gazette	Develop and submit annual report to the dti to Gazette	Yearly target
	Maintain the Schedule of National Measurement Standards	2	Maintained National Measurement Standards	Number of national measurement standards maintained submitted to the dti to Gazette	50	50	56	58	24 050	58	59	60	Yearly target
	Keep, maintain and develop measurement systems for bringing national measurement standards and reference methods into being	3	Improved and new national measurement standards, secondary standards, reference materials and methods	Number of improved national measurement standards and secondary standards, reference materials and methods	5	10	18	15	16 410	19	20	20	Yearly target

4.5.2 NATIONAL EQUIVALENCE

As part of the Metre Convention system, NMISA ensures international measurement comparability by participating in the activities of the International Committee for Weights and Measures. This includes active participation in the Consultative Committees and demonstrated measurement capabilities as published in the International Bureau of Weights and Measures (BIPM) Key Comparisons Database (KCDB).

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
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)	To ensure internationally recognised and comparable national measurement standards and units by participating in the Metre Convention, CIPM MRA and AFRIMETS activities	4	Maintain membership of and active participation in the CIPM and its consultative committees (CCs)	Number of membership of International committee for Weights and Measures CIPM and Consultative Committees (CC)	9	9	10	9	3 600	9	10	10	Yearly target

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
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)	Establish confidence in the accuracy of the national measurement standards by suitable and documented quality and management system	5	An internationally accepted Quality System through SANAS accreditation	Number of accredited laboratories accredited to ISO 17025 ,ISO 17034,ISO 17043 and/ or peer reviewed quality system	New KPI	New KPI	20	20	1 200	21	21	22	Reported per Quarter
	To maintain the calibration and measurement capability (CMC) claims in KCDB as evidence of South Africa's measurement capability	6	Demonstrated measurement capabilities through published CMCs	Number of CMCs as published in the Key Comparison Database (KCDB)	366	382	475	480	15480	497	500	500	Yearly target

4.5.3 TECHNICAL INFRASTRUCTURE SUPPORT

As the foundation of the South African measurement system, provide technical measurement expertise and support for public policy objectives, accreditation, standardisation and regulatory affairs.

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
Provide measurement knowledge and expertise as a key component of the Technical Infrastructure with regard to public policy objectives measurement compliance issues in terms of health, safety and the environment	As the foundation of the South African measurement system, provide technical measurement expertise and support for public policy objectives, accreditation, standardisation and regulatory affairs	7	Demonstrated competence and excellence in measurement through science outputs	Number of refereed and/or peer-reviewed publications	New KPI	New KPI	New KPI			10	10	10	Reported per Quarter
				Number of articles, application, conference proceedings or technical notes published	New KPI	New KPI	New KPI	New KPI		12	14	17	Reported per Quarter

4.5.4 ORGANISATIONAL (LEARNING AND GROWTH) PERSPECTIVE

NMISA strives to support the Technical Infrastructure by providing measurement knowledge and expertise, and a key function is reflected in its scientific and technical outputs. The Human Resources Department has developed measures to increase core skills and staff capability, reduce employee turnover and ensure a fair and equitable work force. Included are targets to develop and increase the pipeline of staff especially for the core functions where skills are not readily available in the market, and improve the qualification profile to foster more research and development on a par with developed metrology institutes.

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
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	8	Skilled, competent and transformed NMISA personnel	Number of Interns and in-service trainees hosted	5	5	20	15		15	15	15	Yearly target
				Percentage of filled funded vacancies	New KPI	New KPI	7%	6%		95%	96%	97%	Reported per Quarter

4.5.5 STAKEHOLDER AND CUSTOMER PERSPECTIVE

For its stakeholders and customer perspective, NMISA ensures dissemination to industry through traceability, measurement expertise and services. Technical key performance areas and outputs have been developed for each strategic objective of the organisation.

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
Provide essential support to South African public and private enterprises through dissemination of the national measurement standards, units and expertise	Disseminate traceability, measurement expertise and services to South African public and private enterprises by means of calibration, measurement or analysis, certified reference materials	9	Dissemination of NMS and measurement capabilities	Income generated from dissemination activities	R 11 690k	R 10 083k	R12 089k	R 20 010k	R 20 010	R31 000 k	R107 000k	R154 000k	Reported per Quarter
		10	External client satisfaction	Percentage customer satisfaction	<10%	<10%	0.33%	≤ 5%	tba	95%	95%	95%	<10%
	Provide appropriate technology and skills transfer to the South African industry, especially to SMEs	11	Skilled and capable labour force for measurements in industry	Number of industry and/or regional metrologists trained in accurate measurement	14	49	146	66	tba	96	97	98	Reported per Quarter
				Number of courses presented to industry	5	6	17	14		16	17	17	Reported per Quarter

4.5.6 FINANCIAL AND BUSINESS PERSPECTIVES

These perspectives include measures that ensure effective financial controls, financial growth and stability and improve the quality of internal processes, and align and integrate systems and processes.

Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2014/15	2015/16	2016/17	2017/18 Baseline	2018/19 Budget R'000	2018/19 Targets	2019/20 Targets	2020/2021 Targets	Reporting milestone
Adhere to the regulatory requirements of a type 3A public entity and sound corporate governance	Comply to government directives, the PFMA, treasury regulations and regulatory issues in terms of Government regulations	12	Establish systems and processes to ensure compliance with regulatory frameworks	Actual expenditure to Budget	New KPI	New KPI	New KPI	New KPI	tba	98%	98%	98%	Reported per Quarter

4.6 QUARTERLY MILESTONES (2018/19)

KPI	Performance Indicator/ measure	2017/18 Baseline	2018/19 Annual Target	Quarterly Milestones				Reporting Milestone
				1st Quarter	2nd Quarter	3rd Quarter	4th Quarter	
1	Gazetted National Measurement Units	Update Schedule 3 (SI units) and submit to the dti to Gazette	Develop and submit annual report to the dti to Gazette	Develop and submit annual report to the dti to Gazette				Yearly target
2	Number of national measurement standards maintained submitted to the dti to Gazette	58 maintained	58	58 maintained	58 maintained	58 maintained	58 maintained	Yearly target with quarterly progress reported
3	Number of improved national measurement standards and secondary standards, reference materials and methods	15	19	0	0	0	19	Yearly target with quarterly progress reported
4	Number of memberships of international committees (CIPM and its CC's)	10	9	9				Yearly target with quarterly progress reported
5	Number of accredited laboratories accredited to ISO 17025, ISO 17034, ISO 17043 and/or peer reviewed quality system	20	21	20 maintained	20 maintained	20 maintained	21 maintained	Reported per quarter
6	Number of Calibration and Measurement capabilities (CMCs) published in the KCDB	As published in KCDB (480)	497	497				Yearly target (BIPM KCDB
7	a) Number of refereed and/or peer-reviewed publications .	New KPI	10	2	2	2	4	Reported per quarter
	b) Number of articles, application, conference proceedings or technical notes published	New KPI	12	0	2	2	8	Reported per quarter
8	a) Number of Interns and in-service trainees hosted	7	15	15				Yearly target with quarterly progress reported
	b) Percentage of funded vacancies	6 %	5 %	95%				Yearly target
9	Income generated from dissemination activities	R 20 010k	R 31 000 k	R 7.75 k	R 7.75 k	R 7.75 k	R 7.75 k	Reported per quarter
10	Percentage customer satisfaction	≤5 %	≥95 %	≥95 %	≥95 %	≥95 %	≥95 %	Reported per quarter
11	Number of industry and/or regional metrologists trained in accurate measurement	66	96	10	25	40	21	Reported per quarter
	Number of courses presented to industry	13	16	3	3	5	5	Reported per quarter
12	Actual expenditure to Budget	98 %	98 %	98 %				Yearly target but reported per Quarter

4.7 RISK MANAGEMENT AND FRAUD PREVENTION PLAN

4.7.1 RISK MANAGEMENT PROCESS

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.

4.7.2 RISK ASSESSMENT APPROACH

4.7.3 IDENTIFICATION OF RISKS

Risk was defined as: "The possibility of an event occurring that will have an impact on the achievement of objectives, measured in terms of impact and likelihood." All risks including financial risks (loss of assets); compliance risks (laws, regulations and policies) risks impacting on the reputation of NMISA, as well as

any other risks (such as political, external, litigation risks, etc.) were considered.

4.7.4 RATING OF RISKS

Relative ratings have been allocated to each specific risk on the following scales:

- Likelihood (the probability of the occurrence of the risk event) and
- Impact (the potential effect on the organisation of the risk event).

Rating is on a 1 to 5 scale.

Likelihood

Likelihood is the probability that the identified risk will occur within a specified period of time, before taking into account existing mitigating controls, rated as follows:

Likelihood Rating	Measurement Criteria	Qualification Criteria
Almost Certain 5	The risk is already occurring, or has a high likelihood of occurring more than once during the next 12 months	The risk is almost certain to occur in the current circumstances
Likely 4	The risk will easily occur, and is likely to occur at least once during the next 12 months	More than an even chance of occurring
Possible 3	There is an above average chance of the risk occurring more than once during the next 3 years	Could occur often
Unlikely 2	The risk has a low likelihood of occurring during the next 3 years	Low likelihood, but could happen
Rare 1	The risk is unlikely to occur during the next 3 years	Not expected to happen - event would be a surprise

Impact

Impact is the potential loss to the organisation should the risk materialise, rated as follows:

Impact Rating	Continuity of Service Delivery	Safety & Environmental	Technical Complexity	Financial
Catastrophic (Note: Also considered as Critical) 4	Risk event will result in widespread and lengthy reduction in continuity of service delivery to customers for a period greater than 48 hours	Major environmental damage. Serious injury (permanent disability) or death of personnel or members of the public. Major negative media coverage.	Use of unproven technology for critical system / project components. High level of technical interdependencies between system components.	Can lead to the termination of business activity
Critical 4	Reduction in service delivery or disruption for a period ranging between 24 & 48 hours over a significant area	Significant injury of personnel or public. Significant environmental damage. Significant negative media coverage.	Use of new technology not previously utilised by the organisation for critical systems / project components.	Increase in costs/ Decrease in revenue > 10%

Impact Rating	Continuity of Service Delivery	Safety & Environmental	Technical Complexity	Financial
High 3	Reduction in service delivery or disruption for a period between 8 & 24 hours over a regional area	Lower level environmental, safety or health impacts. Negative media coverage	Use of unproven or emerging technology for critical systems / project components.	Increase in costs/ Decrease in revenue: 5%- 10%
Moderate 2	Brief local inconvenience (work around possible). Loss of an asset with minor impact on operations	Little environmental, safety or health impacts. Limited negative media coverage.	Use of unproven or emerging technology for systems / project components.	Increase in costs/ Decrease in revenue < 5%
Low 1	No impact on business or core systems	No environmental, safety or health impacts and/or negative media coverage	Use of unproven or emerging technology for non-critical systems / project components	Minimal or no impact on costs/ revenue

4.7.5 INHERENT RISK

Inherent risk is defined as the exposure arising from risk factors in the absence of deliberate management intervention(s) to exercise control over such risk factors. *Inherent risk rating = impact x likelihood (in the absence of mitigating controls)*

4.7.6 INHERENT RISK RATING SCALES

Description	Thresholds	Threshold Interpretation
Catastrophic/ Critical	between 16 and 25	Unacceptable – Very high Inherent Risk
High	between 11 and 15	Unacceptable – High Inherent Risk
Moderate	between 6 and 10	Cautionary- Medium Inherent Risk
Low	between 1 and 5	Acceptable- Low Inherent Risk

4.7.7 RESIDUAL RISK RATING SCALES

Description	Thresholds	Suggested Action	Suggested Timing
Catastrophic/ Critical	between 16 and 25 – Unacceptable	Management should take immediate action to reduce risk exposure to an acceptable level.	Immediate action required
High	between 11 and 15 – Cautionary to Unacceptable	Management should take immediate action and constantly monitor the risk exposure and related control adequacy.	Immediate action to Medium-term, within three months
Moderate	between 6 and 10- Cautionary	Management should constantly monitor the risk exposure and related control adequacy.	Medium-term, within three months
Low	between 1 and 5- Acceptable	Management may consider reducing the cost of control.	Monitor, no action required

4.7.8 PERIODIC REVIEW OF RISKS

At least once a year NMISA will undertake a thorough re-assessment of its risks.

4.8 FRAUD PREVENTION PLAN

4.8.1 INTRODUCTION

NMISA acknowledges the fact that the incidence of economic or commercial crime is an increasing phenomenon and has become an integral part of the current corporate and business environment. In this regard the entity commits itself to –

- Become one of those participants in the economy that will actively and proactively protect all of its assets against threats of crime like fraud, corruption, theft, bribery and others.
- Pursue and bring to justice any perpetrator, whether inside or outside NMISA, who commits any criminal activities against assets or interest of the organisations.

Apart from material financial implications, economic crime has further detrimental effects on organisations, such as loss of reputation, the undermining of competitiveness and erosion of credibility. NMISA subscribes to the national drive to eradicate fraudulent activities and has adopted a strategic approach to the management of economic crime prevention, detection and resolution by:

- Unequivocally communicating to internal and external stakeholders its stance against, and its policy to prevent and deal with instances of economic crime;
- Practicing and upholding good corporate governance;
- Developing and instituting an ethical business environment that will cultivate an anti-crime culture within the entity;
- Conducting regular assessments to identify risks;
- Adopting risk based audit approach
- Strengthening internal controls;
- Implementing proper fraud reporting and whistle-blowing structures; and
- Developing a fraud response plan.

4.8.2 POLICY STANCE

NMISA is committed to protecting all its monetary, physical and human assets under its custodianship from attempts by any individual to gain a financial benefit or otherwise in an unlawful, dishonest or unethical manner.

All individuals within and dealing with NMISA must believe that:

- The entity is honest and ethical in its business dealings;
- They are treated with respect, reward and disciplined in a fair and just manner;
- The fight against commercial crime is of paramount importance to the organisation, and that they are part of that fight and their efforts will be acknowledged;
- The stance of zero tolerance will be taken against any employee who commits a crime;
- Violations will be investigated and disciplinary action and or criminal prosecution will be instituted; and
- Board members and management are bound by the same ethics.

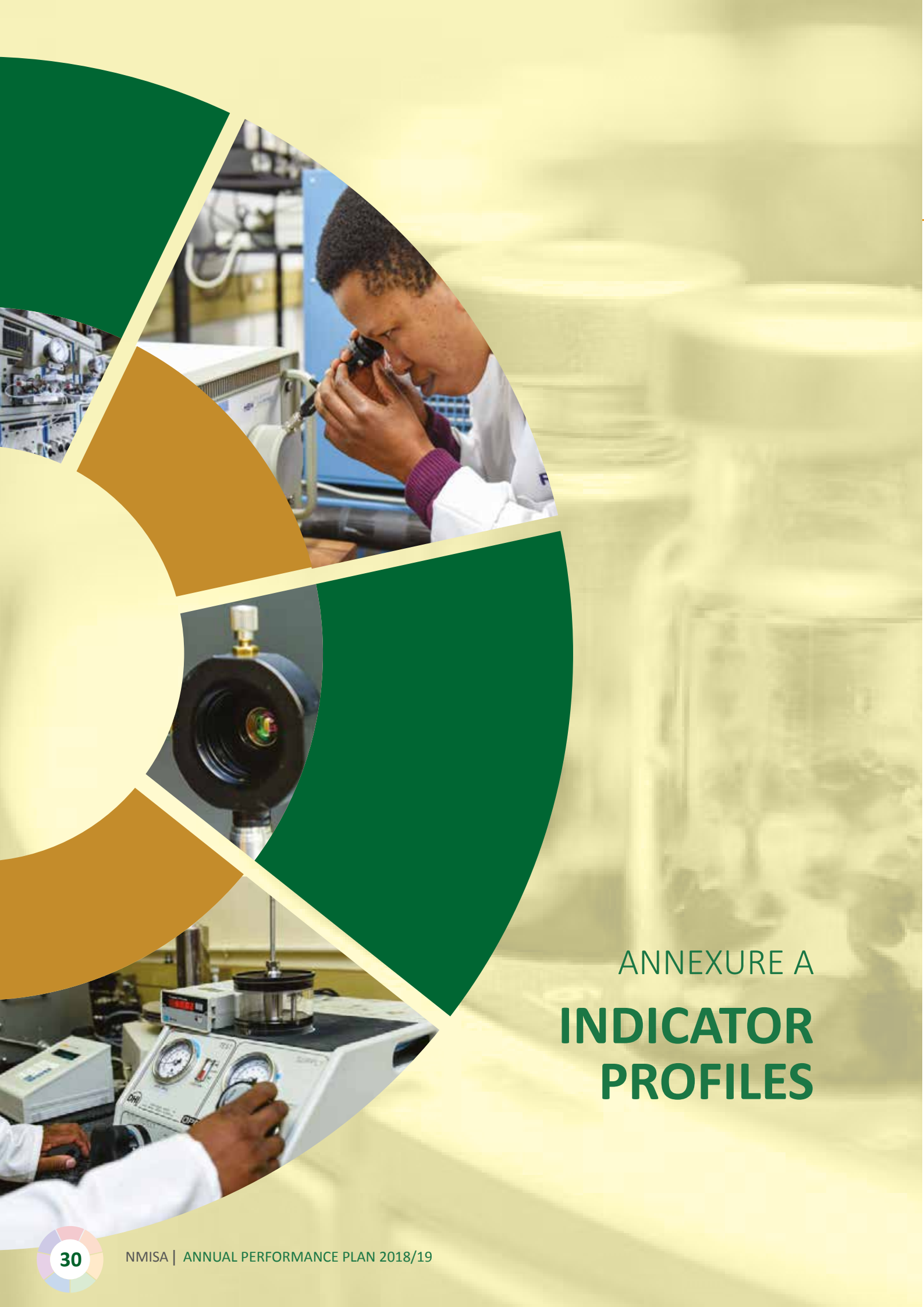
The Audit and Risk Committee, established in terms of the PFMA will be responsible for the administration, revision and interpretation of the Fraud Prevention Plan. It is therefore the responsibility of each EXCO member to ensure that potential fraud risk pertaining to his/her functional area of responsibility are continuously monitored and managed.

The Fraud Prevention Committee, which will be constituted as a special task team from time to time, shall comprise the Chief Executive Officer, Chief Financial Officer, HR Manager, Compliance & Corporate Governance Manager, and Internal Audit will be convened on an ad hoc basis to deal with any matters that may require immediate action.

All instances of fraud, alleged fraud or similar irregularity, will be pursued by thorough investigations and, if guilt is established,

- Appropriate disciplinary action will be taken against any perpetrator;
- Criminal prosecution will be initiated if appropriate;
- Civil action will be instituted if appropriate; and
- Any other appropriate legal action or remedy will be initiated.

If any employee has any doubt regarding a questionable situation that may arise, such employee should immediately consult with any member of the Fraud Prevention Committee.



ANNEXURE A

INDICATOR PROFILES

5 ANNEXURE A: INDICATOR PROFILES

A summary of Performance Indicators developed for NMISA appear in table 4, with a more detailed overview in the following sections:

TABLE 1. PERFORMANCE INDICATORS

KPI	Performance Indicator/ measure	2017/18 Baseline
1	National measurement units	Keep, maintain and develop the national measurement standards and provide for the use of the national measurement units
2	National Measurement standards gazetted	
3	Number of improved national measurement standards and secondary standards, reference materials and methods	
4	Number of memberships of international committees (CIPM and its CC's)	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)
5	Accredited and/ or maintained quality system	
6	Number of CMCs published in the KCDB	
7	Participate in and contribute to national technical infrastructure institutions	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
8	Demonstrated competence and excellence in measurement through science outputs	
9	Skilled, competent and transformed NMISA personnel	Provide an integrated human capital development programme for metrology
10	Dissemination of NMS and measurement capabilities	Provide essential support to South African public and private enterprises through dissemination of the national measurement standards, units and expertise
11	External client satisfaction	
12	Skilled and capable labour force for measurements in industry	
13	Financial system to ensure compliance with regulatory frameworks	Adhere to the regulatory requirements of a type 3A public entity and sound corporate governance

5.1 DETAILED INDICATOR DESCRIPTIONS

Indicators were defined according to the Framework for Strategic Plans and Annual Performance Plans document, published by National Treasury.

TECHNICAL INDICATOR DESCRIPTIONS

KPI 1: GAZETTED NATIONAL MEASUREMENT UNITS	
Indicator output	National measurement units
Short definition	Update South Africa through the dti on units defined by the CIPM (SI), advise on the use of units outside the SI and maintain equivalents of units
Purpose/importance	Legislative mandate of NMISA
Source/collection of data	NMISA draft schedules, associated with the National Measurement Units, submitted to the dti for publication in the Government Gazette
Method of calculation	Simple count
Baseline	Current Gazetted Schedule of National Measurement Units
Target and target date for the indicator (31 March 2019)	Develop and submit annual report to the dti to gazette
Data limitation	Published gazette is sent to the Minister of the dti. Final sign off outside NMISA control
Quality assurance strategy	Periodically reviewed against the updates of the SI units, units outside the SI and equivalents of units
Type of indicator	Output
Calculation type	Non-cumulative
New indicator	Yes
Reporting cycle	Annual
Desired performance	Adherence to the Act ensuring that the South African measurement units and internationally equivalent
Indicator responsibility	Director RIID

KPI 3: NUMBER OF IMPROVED NATIONAL MEASUREMENT STANDARDS AND SECONDARY STANDARDS, REFERENCE MATERIALS AND METHODS	
Indicator title (Output)	Number of improved national measurement standards and secondary standards, reference materials and methods
Short definition	Improved national measurement standards, secondary standards, reference materials and methods
Purpose/importance	Legislative requirements for NMISA
Source/collection of data	Improved NMS and/or procedure and/or validation report developed to the point of completed verification/validation as evidence in an NMI report and/or the Chemistry Reference Materials and Measurements register
Method of calculation	Simple count
Baseline	18
Target and target date for the indicator (31 March 2019)	19
Data limitation	Entries must conform to a set of rules such as verification/ validation and in some instances international benchmarking of capabilities. Final benchmarking reports at the international level can be delayed if there are disputes, but will not inhibit publishing the new procedure or improved procedure in the Chemistry Register once it is ready for dissemination to industry
Quality assurance strategy	The process is underpinned by accreditation to ISO 17025 and/or ISO Guide 34
Type of indicator	Output
Calculation type	non-cumulative
New indicator	No
Reporting cycle	Annual
Desired performance	Does not necessarily increase from year to year. This indicator is in response to industry requirements from year to year, for new CRMs and reference methods to be developed and for NMS to be improved
Indicator responsibility	Technical Divisions

KPI 4: NUMBER OF MEMBERSHIP OF INTERNATIONAL COMMITTEES FOR WEIGHTS AND MEASURES CIPM AND ITS CONSULTATIVE COMMITTEES (CC)

Indicator title (Output)	Continued membership of CIPM and its CCs
Short definition	Membership of and active participation in the CIPM and its 8 consultative committees (CCs)
Purpose/importance	Legislative mandate of NMISA
Source/collection of data	CC membership as listed on the BIPM website, plus membership of the CIPM
Method of calculation	Simple count
Baseline	10
Target and target date for the indicator (31 March 2019)	9
Data limitation	Withdrawal of participation in a CC due to lost competence
Quality assurance strategy	Demonstrated expertise qualifies for membership
Type of indicator	Output
Calculation type	non-cumulative
New indicator	No
Reporting cycle	Annual
Desired performance	Maintained memberships of CCs and CIPM
Indicator responsibility	Technical Divisions

KPI 5: NUMBER OF ACCREDITED LABORATORIES ACCREDITED TO ISO 17025, ISO 17034, ISO 17043 AND/OR PEER REVIEWED QUALITY SYSTEM

Indicator title (Output)	Accredited and/or maintained quality system
Short definition	Maintain the TQMS at internationally acceptable level (peer-reviewed quality system)
Purpose/importance	Quality Assurance requirement for NMISA
Source/collection of data	Confirmation of continued accreditation; or peer review reports or schedule of accreditation
Method of calculation	Simple count
Baseline	20
Target and target date for the indicator (31 March 2019)	21
Data limitation	Total Quality Management System not updated
Quality assurance strategy	Total Quality Management System and maintained SANAS schedule of accreditation
Type of indicator	Output
Calculation type	non-cumulative
New indicator	Yes
Reporting cycle	Quarterly
Desired performance	Maintained Total Quality Management System and maintained SANAS schedule of accreditation
Indicator responsibility	SHEQ Manager

KPI 6: NUMBER OF CALIBRATION AND MEASUREMENT CAPABILITIES (CMCs) PUBLISHED IN THE KCDB	
Indicator title (Output)	Number of Calibration Measurement Capabilities maintained in the International Key Comparison Database (KCDB)
Short definition	A measurement capability claim that has been reviewed and accepted by international peers, and then published in an international database
Purpose/importance	Gives customers confidence that a claimed measurement capability is internationally accepted and internationally proven.
Source/collection of data	Appendix B of the International (BIPM) Key Comparison Database (KCDB), published at www.bipm.org
Method of calculation	Count the official number of active CMCs published in the KCDB for South Africa as at 31 March (screen print and date) simple count
Baseline	494
Target and target date for the indicator (31 March 2019)	497
Data limitation	It takes time for international approvals to take place, which is sometimes outside NMISA control to be specific
Quality assurance strategy	Quality assurance is inherent in this KPI, as the values are internationally peer reviewed and published
Type of indicator	Output
Calculation type	non-cumulative (annual number)
New indicator	No
Reporting cycle	Annual
Desired performance	Capabilities that meet local and international requirements
Indicator responsibility	Technical Divisions

KPI 7a: NUMBER OF REFEREED AND/OR PEER REVIEWED PUBLICATIONS AND CONFERENCE PROCEEDINGS	
Indicator title (Output)	Demonstrated competence and excellence through scientific outputs
Short definition	Number of refereed and/or peer reviewed papers, manuscripts, articles, application or technical notes, book chapters, etc. accepted for publication in peer-reviewed journals, books or appropriate media
Purpose/importance	Proof of the scientific competence, excellence and standing of the NMISA, as well as effective and relevant application of research funding
Source/collection of data	Number of refereed and/or peer-reviewed papers, manuscripts, articles, application or technical notes, book chapters, published.
Method of calculation	Count the number of publications as either the actual published paper or an official letter from the publisher stating acceptance of the paper for publication (take care not to count both)
Baseline	New KPI
Target and target date for the indicator (31 March 2019)	10
Data limitation	Delays in projects for outputs, financial constraints for attendance of conferences, identification of IP which prohibits publication, long review timelines at some journals, slow response for conference proceeding publications
Quality assurance strategy	These outputs are peer reviewed, a process which ensures quality.
Type of indicator	Output
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Increase the number of publications and investigate opportunities for students and staff to attend national conferences to encourage research outputs
Indicator responsibility	Director RIID together with Technical Divisions

KPI 7b: NUMBER OF ARTICLES, APPLICATION OR TECHNICAL NOTES PUBLISHED

Indicator title (Output)	Demonstrated competence and excellence through scientific outputs
Short definition	Number of presentations given at conferences, workshops and TAFs on the improvement and development of measurements and measurement standards and applicable scientific research
Purpose/importance	Proof of the scientific competence, excellence and standing of the NMISA, as well as effective and relevant application of research funding
Source/collection of data	Acceptance of abstract and/or, conference/work programme or proceedings or Technical Advisory Forum (TAF)
Method of calculation	Count the number of orals or posters presented and check against accepted abstract and/or the listings in the conference/ work programme or proceedings or TAF
Baseline	New indicator
Target and target date for the indicator (31 March 2019)	12
Data limitation	Delays in projects for outputs, financial constraints for attendance of conferences, identification of IP which prohibits publication, long review timelines at some journals, slow response for conference proceeding publications
Quality assurance strategy	These outputs are peer reviewed a process which ensures quality.
Type of indicator	Output
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Increase the number of publications and investigate opportunities for students and staff to attend national conferences to encourage research outputs
Indicator responsibility	Director RIID together with Technical Divisions

KPI 8b: PERCENTAGE OF FILLED FUNDED VACANCIES.

Indicator title (Output)	A skilled, competent and transformed workforce
Short definition	Percentage of filled funded vacancies.
Purpose/importance	Enhance the qualification profile to build a modern NMI with a strong research and development component.
Source/collection of data	Certificates, financial statements, employment contracts, Board approved organisational structure and approved budget
Method of calculation	simple count, (total number of funded vacant positions/ total number of funded positions on the approved organisational structure
Baseline	7 %
Target and target date for the indicator (31 March 2019)	95 % (new method of calculation)
Data limitation	Shortage of appropriate graduates in SA
Quality assurance strategy	Academic record or research outputs of candidate
Type of indicator	Equity
Calculation type	Non-cumulative
New indicator	No
Reporting cycle	Annual
Desired performance	All funded vacancies filled.
Indicator responsibility	Human Resources

KPI 9: INCOME GENERATED FROM DISSEMINATION ACTIVITIES

Indicator title (Output)	Income generated through services (dissemination activities)
Short definition	Income generated through calibration, services (PTS and reference measurements), sales (CRMs), consultation, research funds and donor projects (REVENUE).
Purpose/importance	To provide measurement traceability to industry through calibration, measurement services, analysis, consultation, research grants and donor projects
Source/collection of data	A report of income is downloadable from NMISA financial system and provided by Finances
Method of calculation	Simple count
Baseline	R 20 010 k
Target and target date for the indicator (31 March 2019)	R31 000 k
Data limitation	Industry not sending units for calibration or analysis; downtime due to building infrastructure and equipment failures or regulatory processes such as the national acceptance of evidential breath alcohol results; the revenue received is not within NMISA's control
Quality assurance strategy	Calibration performed under accreditation to ISO 17025 and certificates are signed off by technical staff declared competent as signatories under ISO 17025
Type of indicator	Output
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Meet and exceed annual financial revenue target
Indicator responsibility	Commercial Services

KPI 10: PERCENTAGE CUSTOMER SATISFACTION

Indicator title (Output)	External client satisfaction
Short definition	Percentage of customer complaints against all jobs
Purpose/importance	To provide industry with a sense of ownership and confidence in NMISA measurements
Source/collection of data	Report on the review of customer complaints taken from the Quality System (Customer Action Requests-CARs)
Method of calculation	Number of customer complaints per quarter/ total jobs per quarter
Baseline	0.33%
Target and target date for the indicator (31 March 2018)	95% (new method of calculation)
Data limitation	Client complaints not raised as CARS in the Quality System and complaints not adequately addressed
Quality assurance strategy	Quality System
Type of indicator	Output
Calculation type	Non-cumulative
New indicator	Yes
Reporting cycle	Quarterly
Desired performance	Zero customer complaints is ideal; any customer complaints received to be timeously addressed and cleared satisfactorily to the client
Indicator responsibility	SHEQ Manager

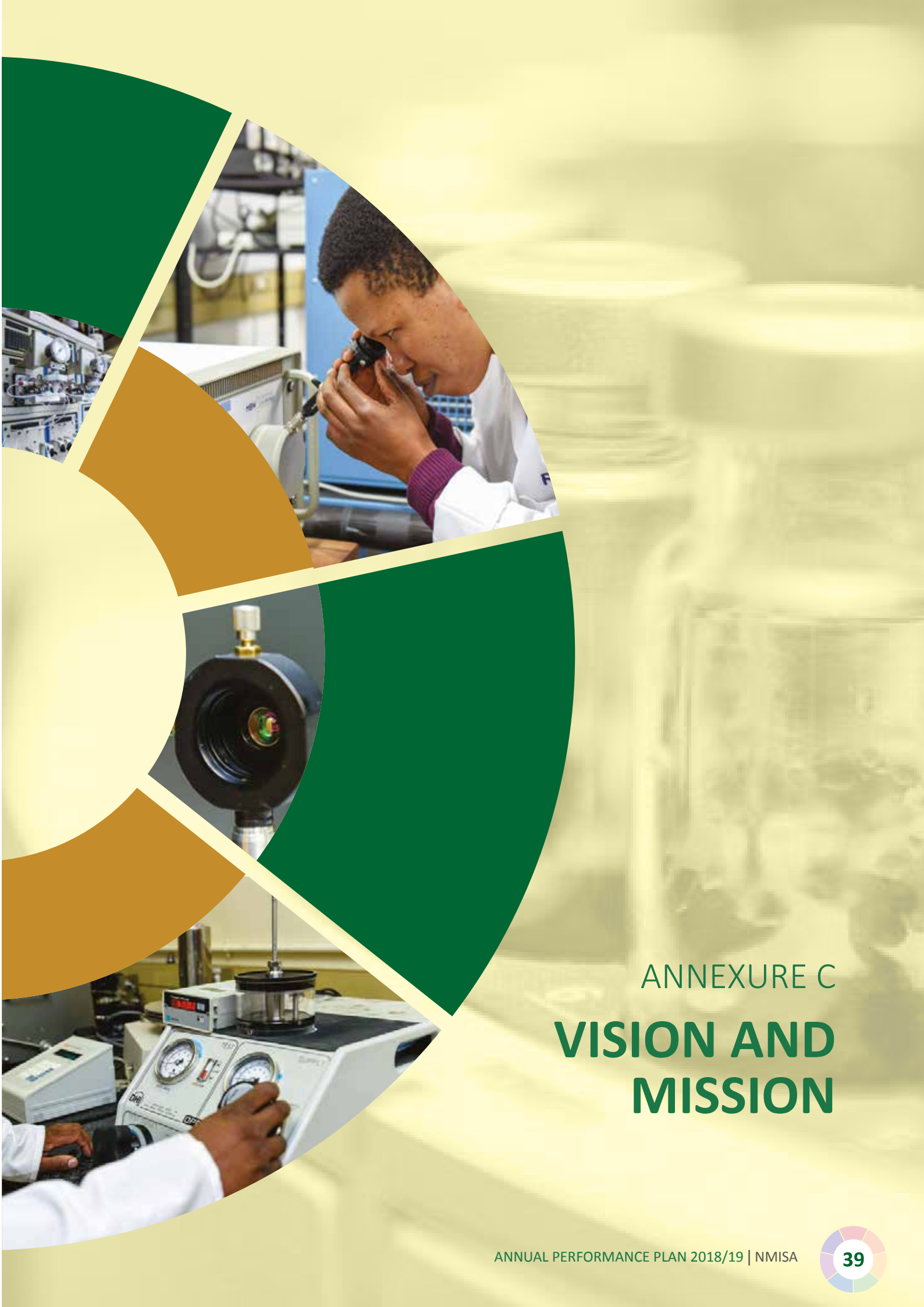
KPI 11a: NUMBER OF INDUSTRY AND/OR REGIONAL METROLOGISTS TRAINED IN ACCURATE MEASUREMENT

Indicator title (Output)	Number of industry and/or regional metrologists trained in accurate measurement
Short definition	To develop skills and competencies required to provide essential measurement support to industry.
Purpose/importance	To ensure skills transfer to industry and to assist SMEs to meet compliance
Source/collection of data	NMISA Certificate of Training or an official report or official attendance list
Method of calculation	Simple count (people)
Baseline	66 metrologists/ scientists trained
Target and target date for the indicator (31 March 2019)	96
Data limitation	Decision to train SMEs is not only in NMISA 's control; Courses are presented in partnership with other institutions like SEDA and NLA
Quality assurance strategy	Signed MoU with SEDA detailing work plan and schedule for training; Collaboration with NLA for presenting courses using NMISA experts
Type of indicator	Output
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Increased metrologists and SMEs trained in industry
Indicator responsibility	Director RIID together with Technical Directors

KPI 11b: NUMBER OF COURSES PRESENTED TO INDUSTRY

Indicator title (Output)	Number of courses presented to industry
Short definition	To develop skills and competencies required to provide essential measurement support to industry.
Purpose/importance	To ensure skills transfer to industry and to assist SMEs to meet compliance
Source/collection of data	Official signed attendance list of participants attending the course given or letter from institute hosting course
Method of calculation	Simple count (courses)
Baseline	14 courses presented
Target and target date for the indicator (31 March 2018)	16 courses presented
Data limitation	Decision to train SMEs is not only within NMISA 's control; Courses are presented in partnership with other institutions like SEDA and NLA
Quality assurance strategy	Signed MoU with SEDA detailing work plan and schedule for training; Collaboration with NLA for presenting courses using NMISA experts
Type of indicator	Output
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Increased metrologists and SMEs trained in industry
Indicator responsibility	Director RIID together with Technical Directors

KPI 12: ACTUAL EXPENDITURE TO BUDGET	
Indicator title (Output)	Establish financial systems and processes to ensure compliance with regulatory frameworks
Short definition	Percentage of revenue received expensed
Purpose/importance	Established systems and processes to ensure compliance to regulatory frameworks (PFMA)
Source/collection of data	Statement of financial performance and external audit opinion
Method of calculation	Actual spending including commitments/ grant funding received
Baseline	98%
Target and target date for the indicator (31 March 2019)	98%
Data limitation	Inadequate financial systems and inadequate controls for ensuring compliance with regulatory frameworks
Quality assurance strategy	Internal Audit
Type of indicator	Internal compliance to regulatory frameworks
Calculation type	Cumulative
New indicator	No
Reporting cycle	Quarterly
Desired performance	Full compliance with regulatory frameworks and unqualified audit report
Indicator responsibility	CFO



ANNEXURE C

VISION AND MISSION

6 ANNEXURE C: VISION AND MISSION

6.1 VISION

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.

6.2 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.

6.3 VALUES

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

6.4 LEGISLATION AND OTHER MANDATES

6.4.1 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. NMISA

continuously improve and expand the NMS to enhance and expand the services it offers industry and stakeholders.

6.4.2 POLICY MANDATES

6.4.2.1 The dti Industrial Policy Action Plan – Developmental Trade Policies

The dti Industrial Policy Action Plan (IPAP) 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”.

South Africa is a signatory of the Metre Convention, a treaty dating back to 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 (NMISA) 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 governs the activities of NMISA to ensure a proper measurement system for South Africa. This is then disseminated to industry according to local needs.

6.5 STRATEGIC OUTCOME ORIENTED GOALS

The NMISA is guided overall by seven goals, namely:

Goal 1	Keep, maintain and develop the national measurement standards and provide for the use of the national measurement units
Goal 2	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
Goal 4	Provide measurement knowledge and expertise as a key component of the Technical Infrastructure with regard to public policy objectives measurement, compliance issues in terms of health, safety and the environment
Goal 5	Provide an integrated human capital development programme for metrology
Goal 6	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

6.6 STRATEGIC OBJECTIVES

The 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, 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.

NOTES



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