



STRATEGIC PLAN

2014-2018

NMISA-13-00186

FOREWORD BY THE MINISTER

Job creation (especially through manufacturing), the move towards green industries, addressing health and safety issues for the nation and effective law enforcement all requires Standardisation, a collective term for a system comprised of voluntary (paper) standards, compulsory specifications, regulations and subsequent conformity assessment (accredited testing and calibration facilities that need accurate, internationally comparable and legally acceptable measurement –in other words scientific and legal metrology). **The dti's** Technical Infrastructure (TI) provides these functions through the SABS for voluntary (paper) standards and conformity assessment, the NRCS for compulsory specifications, regulations and legal metrology, SANAS for accreditation and the NMISA for scientific metrology –rendering internationally comparable and acceptable measurement.

Measurement is thus a cornerstone of a successful TI and NMISA is mandated to link the national measurement system to the international system by providing and maintaining the National Measurement Standards (NMS) for South Africa and see to the use and correct application of the International System of Units (the SI) and certain other units. The NMISA's role is further emphasised in the Industrial Policy Action Plan (IPAP) with specific mention of the dangers of technical barriers to trade and the responsibilities of the institute to assist the regulatory environment, standards and accreditation, thus as articulated in IPAP, “to prevent industrial decline and support the growth and diversification of South Africa's manufacturing sector”.

With the slow economic recovery in the traditional export markets, South Africa is increasingly looking towards new trade opportunities within the BRICS framework. To be successful and become the next growth story, the South African TI needs to be on par with that of its peers in this group and other main trading partners. This has been acknowledged by **the dti** and the strategies of the institute to modernise its infrastructure over the next five years is strongly supported.

The role of NMISA to assist priority sectors is an integral part of its strategy. Programmes have been developed to upgrade and develop measurement capabilities and standards in support of especially Green Industries, Agro-Processing and Automotive. Other focus sectors that will receive assistance include Pharmaceuticals and Cosmetics, Chemicals, Advanced Manufacturing, Clothing and Textiles, Plastics and ICT. Measurement support will continue for mineral beneficiation, metals fabrication and issues of national concern such as food safety, health care and law enforcement. Long-term multi-disciplinary research programmes in accurate measurement are being developed to support innovation and emerging technologies, as well as national and government initiatives such as the Square Kilometre Array (SKA).

Health and safety is an important element needed to underpin economic development, and the NMISA will work closely with the Departments of Health and Environmental affairs to provide for the accurate measurement needs of the health and environmental sectors. Various measurement capabilities will also be upgraded in support of food safety.

The dti's Technical Infrastructure also has an important role to play in human capital development to underpin job creation and economic growth. Specific interventions to

increase the level of measurement expertise and to address the skills shortage in metrology are high on the agenda.

The dti endorses the Five Year Strategic Plan of NMISA in support of the 12 key national outcomes and **the dti** key performance areas.

OVERVIEW BY THE CHAIRPERSON

NMISA embarked on an intensive planning and prioritisation process in the preparing of this Strategic plan and re-evaluated its strategy direction and long term vision to align with national priorities and industry requirements. The management team with the assistance of the Board and with the input of the external Consultative Forum, the technical advisory forums, industry and stakeholders, developed new strategic, recapitalisation and business plans to reposition the organisation.

To respond effectively to the challenges, the NMISA executive team has been strengthened and realigned towards a more corporate structure with the task to ensure not only the effective functioning of the institute and proper governance, but also to ensure the alignment of activities to national priorities. The Audit & Risk and Human Resources Committees of the Board were also instrumental in the alignment and streamlining of the organisational structure.

With the assistance of **the dti**, management is actively engaging with the National Treasury towards securing funding for the recapitalisation of the national measurement standards. A proposal which includes the recapitalisation of the national measurement standards, building of new accommodation for NMISA, human capital development and rightsizing of the organisation, has been registered with the Public Private Partnership (PPP) division of National Treasury. The aim is to at least bring the NMISA on par with NMIs in its main trading partners, for example the BRICS where some of these countries have invested strongly in their national measurement infrastructure, resulting in a significant return on investment for their national economies.

In addition to support of the National Industrial Policy Framework (NIPF) and especially IPAP objectives, the entity will focus on cross-cutting measurement research, development and innovation programmes, collaborating with local universities and the national metrology institutes of the other BRICS countries. New technology platforms will create opportunities for studentships and bursaries, building capacity in the scarce skills and technology base in South Africa towards creating much needed high quality jobs.

An expansive programme will be rolled out to assist SMEs with general measurement in support of compliance to standards and specifications, with the aim to improve the quality of their products and services and in general to improve their competitiveness and acceptance in the market. The focus for 2014 to 2018 will be to provide expert measurement assistance to SMEs with the potential to export, and in collaboration with SEDA, to provide training in basic measurement skills to SMEs and SMMEs in rural areas.

OFFICIAL SIGN-OFF

It is hereby certified that this Strategic Plan:

- Was developed by the management of NMISA under the guidance of the NMISA Board and **the dti**;
- Takes into account all the relevant policies, legislation and other mandates for which NMISA is responsible;
- Accurately reflects the strategic outcome orientated goals and objectives which the NMISA will endeavour to achieve over the period 2014 – 2018.

Directors
(Involved in planning)

Signature:

Ms Irene Mathatho
Chief Financial Officer

Signature:

Mr Ndwakhulu Mukhufhi
Accounting Officer

Signature:

Dr Prins Nevhatalu
Accounting Authority

Signature:

Approved by:

Dr Rob Davies
Executive Authority

Signature:

EXECUTIVE SUMMARY

The work done by NMISA is highly technical in nature and fundamental to South Africa's society and industry. Metrology, the science of accurate measurement, affects the daily lives of every South African, from the moment an alarm goes off in the morning, a light is switched on, and electricity is billed, to cooking a meal in the kitchen. It also underpins the confidence in food safety, assists that radiation therapy at hospitals is of the right dose, and is a crucial component in the chain to ensure that the quality of goods and products produced and manufactured in South Africa are of an international standard and competitive.

Measurements play a fundamental part in sustaining fair trade, efficient industry sectors (manufacturing processes, etc.), health (food safety, clean air and water, etc.) and safety (law enforcement, etc.). To develop new products, services and processes, companies need to measure quantities, ensuring quality and performance. In order to trade successfully, companies utilise a regulatory framework, based upon measurement confidence, thus guaranteeing access to global markets where trade is fair, open and free of technical barriers. Supporting this is an established measurement infrastructure providing traceable measurements linked seamlessly to internationally recognised metrology standards.

Ever since its establishment, NMISA has sought to provide measurement capabilities that underpin South Africa's industry, the regulatory sector and the quality of life of every citizen. To ensure a sustained contribution, NMISA will continue to develop national measurement standards (NMS), certified reference materials (CRM's), maintain the international equivalence of the NMS, disseminate traceability to industry sectors and to provide reference values for proficiency testing schemes (PTS).

This strategic plan is informed through discussions with our partners in government, industry, academia, sister SQAM institutes and other NMIs, both within the country and internationally. This level of interaction will fuel the advancement of innovation in the science of measurement.

NMISA believes that future measurement challenges in metrology are driven by:

- Sustainable and renewable energy (green industries include here the BIG project and build on it and detail projects to this)
- Achieving reduction in (carbon) emissions (air quality)
- Recycling initiatives
- The health, safety and quality of life of citizens and the environment
- Advancement of technology (Innovation and R&D)
- Government initiatives to industrialise the country (add value to products)

During the 2013/14 financial year, NMISA received an additional R50 million of transfer funds from the national fiscus (and it is projected that an additional R100 million will be received in 2014). The main portion of the additional funds in 2013/14 are to be invested in the PPP project registered at National Treasury; to appoint a Project Offer, Transaction Advisor and to conduct a feasibility study. The feasibility study will be inclusive of infrastructure (building and plant) and equipment (adequate NMS, standards and equipment)

needs. The funding in future years will be utilised towards the further implementation of the PPP project. This will ensure the future sustainability of NMISA.

The institute is in the process of adequately capacitating its financial administration team and this and the deployment of adequate, integrated financial systems is expected to be completed during the 2014/15 financial year. Systems policies and procedures are being further developed to ensure an efficient and properly controlled financial environment. A focus area will be the development and stabilisation of the Supply Chain Management to ensure NMISA adheres to all compliance requirements and that our financial resources are utilised in the most economical and optimal way.

In the medium term, Internal Audit will focus on reviewing the adequacy of internal controls throughout the organisation with particular emphasis to those that have financial implications. Emphasis will be on providing assurance on the integrity of both operational and financial information such as organisational performance information and financial reporting.

To execute its mandate NMISA needs a competent and sustainable workforce; the focus will be to raise the qualification profile of the institute to ensure it is equipped to meet the continuously more stringent measurement requirements both locally and internationally. The organisation will invest significantly into the skills development of employees and the revised human capital development plan indicates an aggressive increase in the intake into the undergraduate bursary programme, studentship (postgraduate bursary programme) and internship programme. The plan also emphasises continued support to current staff to enhance their qualifications and to gain technical experience through exchange and secondment projects with other national measurement institutes (NMIs). The human capital development programmes play a significant role in the transformation of the organisation and the institute is committed to building an organisation which reflects the profile of the South African population.

A strong research and development component is critical for enhancing the NMS and to ensure the successful initiation and execution of innovation and technical development programmes. NMISA is establishing long-term multi-divisional research programmes which will serve the South African community, from measurement science to support product development from the design stage to advanced contributions for national innovation projects in environmental monitoring, nanotechnology, advanced materials and ICT, such as the SKA. Stronger ties will be fostered, with both national and international science institutes and other NMIs.

Certified reference materials and accurate measurements are critical components in safeguarding the food we eat and the environment we live in, and will be continually developed and improved. South Africa's export and local trade will be supported by assistance to meet the measurement requirements from international laws and regulations that stipulate ever stricter limits on pesticides, dioxins, mycotoxins, toxic elements, contaminants and other hazardous substances. Existing reference materials and measurements support the agricultural, manufacturing and trade sectors by being available to commercial laboratories that provide industry with reliable measurement values to ensure the quality and international acceptance of their measurement results.

Business Process Servicing (BPS) has the potential to attract investment and create employment opportunities in the economy. An affordable and reliable Information and Communications Technologies (ICT) infrastructure is the most important prerequisite to ensure South Africa a successful BPS destination. NMISA contributes to the current and future expansion of South Africa's Information and Communications Technology (ICT) industry by developing and maintaining standards to regulate optical fibre and wire-less communication systems and to perform diagnostic network tests with higher accuracy.

In support of government's drive to reduce national energy consumption due to inefficient energy use in buildings, the use of energy inefficient lighting systems, wasteful industrial energy consumption and inaccurate billing, standards in these fields will be enhanced. These standards will provide users with reliable measurement values to establish whether lighting products and building materials satisfy the properties, performances and technical specifications required by regulations aimed at improving energy efficiency.

NMISA is well established as a regional measurement and traceability hub to enable accurate ionising radiation measurements to support trade, energy efficiency, environmental, health and safety requirements. It is also a designated regional training centre for English speaking countries under the African Regional Cooperative Agreement for Research, Development and Training related to Nuclear Science and Technology (AFRA)/IAEA. The radiation and nuclear industries need traceable measurements of all levels of radioactivity in order to ensure requirements of efficiency, safety and security are met. During the next five years, the NMISA will substantially improve the NMS for dosimetry and radioactivity standards and assist the National Nuclear Regulator to establish national monitoring laboratories.



...towards a happy future for our children – this is our heritage, our legacy, our South Africa

The institute strives to increase the impact of metrology at all levels of society, to manage the relationship and obligations within the Metre Convention and related international bodies, ensure the inclusion and participation of metrology in the Technical Infrastructure and to develop and foster metrology amongst its stakeholders and clients. There is a specific drive to develop new business through assistance to large industry and all exporters to meet measurement needs. In addition, an expansive programme will be rolled out to assist SMMEs with general measurement in support of compliance to standards and specifications,

with the aim to improve the quality of their products and services and in general to improve their competitiveness and acceptance in the market. Technical cooperation with the metrology institutes of the other BRICS countries will be improved on issues of joint concern, such as to provide accurate measurement for biofuels and nanotechnology. Specific metrology development projects are also planned with other NMIs in SADC and Africa to assist intra-regional trade.

Mr Ndwakhulu Mukhufhi

NMISA CEO

CONTENTS

EXECUTIVE SUMMARY	6
ACRONYMS AND ABBREVIATIONS	12
1 VISION	14
2 Mission	14
3 Values.....	14
4 Legislation, Policy and Functional Mandates.....	14
4.1 Legislative Mandate	14
4.2 Policy Mandates	14
4.2.1 The dti Industrial Policy Action Plan – Developmental Trade Policies.....	14
4.3 Functional Mandate	15
5 SITUATIONAL ANALYSIS	16
5.1 Performance Environment	16
5.1.1 The International and Regional Environments and their Requirements.....	16
5.1.2 The National Environment.....	18
5.2 Organisational Environment.....	19
5.2.1 Internal Business Review.....	20
5.2.2 International Benchmarking	22
5.3 Description of the strategic planning process.....	24
6 strategic outcome oriented Goals of nmisa	25
6.1 Products	26
6.2 Services.....	26
7 alignment of PROGRAMMES to national initiatives.....	27
7.1 Strategic objectives.....	27
7.1.1 Physical Metrology Division	35
7.1.2 Ionising Radiation Division.....	36
7.1.3 Electricity and Magnetism Division.....	37
7.1.4 Chemistry Division	38
7.1.5 Research & Technology Development (RTD)	38
7.1.6 Technical Infrastructure Development (TID).....	40
7.1.7 Finance and Corporate Services.....	40
7.1.8 Internal Audit Unit	41
7.1.9 NMISA Balanced Scorecard	42

7.2	Resource Considerations.....	48
7.2.1	Financial Plan	48
7.3	Integrated Human Resource strategy.....	53
7.2.2	Organisational Growth and Development.....	53
7.3.5.1	Plan to address the identified critical issues and challenges.....	57
7.3.8	Initiatives to facilitate talent retention.....	59
7.3	Risk Management.....	59
7.4.1	Risk register	60
8	Links to the Long-term infrastructure and other capital plan	62

ACRONYMS AND ABBREVIATIONS

AFRIMETS	Intra-Africa Metrology System
AC	Alternating current
AMI	Advanced Metals Initiative
ARMC	African Resources Management Constellation
APMP	Asian Pacific Metrology Programme
BIPM	International Bureau of Weights and Measures
CC	Consultative committee
CCTF	Consultative Committee for Time and Frequency
CCPR	Consultative Committee for Photometry and Radiometry
CGPM	General Conference on Weights and Measures
CIE	International Commission on Illumination
CIPM	International Committee for Weights and Measures
CMC	Calibration and Measurement
CMM	Co-ordinate Measuring Machine
COTII	Committee of Trade and Industry Institutions
CRM	Certified Reference Material
DCLF	Direct Current – Low Frequency Electrical
the dti	Department of Trade & Industry
EE	Employment Equity
EM	Electricity and Magnetism
FO	Fibre Optics
GDP	Gross Domestic Product
HCD	Human Capital Development
HEI	Higher Education Institutions
IAEA	International Atomic Energy Agency
ICT	Information and Communication Technology
IEC	International Electro-technical Committee
IPAP	Industrial Policy Action Plan
IR	Ionising Radiation
ISO	International Standards Organisation
JCRB	Joint Committee of Regional Metrology Organisations and the BIPM
KCDB	Key Comparison Database
KPI	Key Performance Indicator
LED	Light Emitting Diode
MC	Measurement capability
MRA	Mutual Recognition Arrangement
MTEF	Medium Term Expenditure Framework
MSc	Master of Science
NEDLAC	National Economic Development and Labour Council
NMI	National Metrology Institute
NMISA	National Metrology Institute of South Africa
NMS	National Measurement Standard

NNR	National Nuclear Regulator
NRCS	National Regulator for Compulsory Specifications
NRL	National Reference Laboratory
NRF	National Research Foundation
OEM	Original Equipment Manufacturer
OIML	International Organisation of Legal Metrology
PFMA	Public Finance Management Act
PhD	Doctor of Philosophy
POP	Persistent Organic Pollutant
ppp	Purchase Power Parity
PPP	Public Private Partnership
PPPFA	Preferential Procurement Policy Framework Act
PRM	Primary Reference Mixtures
PT	Proficiency Test
RISDP	Regional Indicative Strategic Development Plan
RMO	Regional Metrology Organisation
SA	South Africa
SAAQIS	South African Air Quality Information System
SABS	South African Bureau of Standards
SADC	Southern African Development Community
SADCMET	SADC Cooperation in Measurement Traceability
SANAS	South African National Accreditation System
SANS	South African National Standards
SAST	South African Standard Time
SBD	Supporting Bidding Documents
SCM	Supply Chain Management
SHEQ	Safety, Health, Environment and Safety
SI	International System of Units
SME	Small and Medium Enterprise
SQAM	Standards, Quality Assurance, Accreditation and Metrology
SKA	Square Kilometre Array
STD	Standard
TBT	Technical Barrier to Trade
TC	Technical Committee
TEI	Tertiary Education Institute
TQMS	Total Quality Management System
UNIDO	United Nations Development Organisation
UTC	Coordinated Universal Time
WG	Working Group

PART A: STRATEGIC OVERVIEW

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.

2 MISSION

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

3 VALUES

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

4 LEGISLATION, POLICY AND FUNCTIONAL MANDATES

4.1 Legislative Mandate

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

To provide for the use of measurement units of the International System of Units (SI) and certain other measurement units; to provide for the designation of the national measurement units and standards and to provide for the keeping and maintenance of the national measurement standards

NMISA sees to the application of the SI units in South Africa, the gazetted NMS and offers certified reference materials to industry. NMISA continues to improve and expand the NMS to enhance and expand the services it offers industry and stakeholders.

4.2 Policy Mandates

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”.

It further states that the Technical Infrastructure should continue to reprioritise their activities in support of development, accreditation and enforcement of standards in assistance to create, scale up and resuscitate certain industries, while simultaneously contributing to broader social benefits. Other specific statements and objectives that guided the preparation of this document include:

<p>A sound Technical Infrastructure thus plays a significant role in the economy in two ways</p>	<ul style="list-style-type: none"> • assists firms to adopt and meet the quality standards necessary to compete in global markets • assists in ensuring that low-quality imports do not undercut the productive base of the South African manufacturing sector
<p>Technical Infrastructure institutions are required to support more actively export markets access by assisting exporting firms to meet the increasing demanding standards of advanced countries</p>	<ul style="list-style-type: none"> • need to play an increasing role in addressing energy and water-efficiency imperatives, at the household and industry level
<p>The ability to manufacture to specific requirements is critical in many advanced sectors</p>	
<p>It is these measurement-based capabilities that are key criteria for potential players to become members of the global supply chains</p>	

4.3 Functional Mandate

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

5 SITUATIONAL ANALYSIS

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

The modern demands necessitate modern equipment and advanced skills and this places huge demands on the financial resources. The equipment for the NMS and dissemination need to be upgraded or replaced every three to ten years. Scientists and technologists need to be trained in metrology to a level where they can successfully compete with those of developed and advanced developing countries; our main trading partners. The institute is actively pursuing opportunities for collaboration with its peers in order to pool resources.

5.1 Performance Environment

5.1.1 The International and Regional Environments and their Requirements

A signatory to the Metre Convention, South Africa follows the SI system, per the rules laid down for the base units, derived units, use of references and other matters by the General Conference on Weights and Measures (CGPM).

The International System of Units (SI)

The **seven base units** are a choice of units defined in an absolute way (based on constants of nature), as a basic set from which all other SI units are derived:

- the metre, the kilogram, the second, the ampere, the kelvin, the mole and the candela

Derived units are those formed by combining base units according to the algebraic relations linking the corresponding quantities. The names and symbols of some of the units thus formed can be replaced by special names and symbols which can themselves be used to form expressions and symbols of other derived units.

The CIPM has established 10 Consultative Committees (CCs) to oversee and arrange for the comparison of NMS. The 10 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 NMS. NMISA has full membership to 9 of the 10 CCs. Membership of a CC is open to institutions of Member States of the BIPM that are recognised internationally as experts in that particular field. This normally requires that they;

- be national laboratories charged with establishing NMS in the field;
- realise, keep and maintain primary standards;
- be active in research and have a record of recent publications in research journals of international repute;
- have demonstrated competence by a record of participation in international comparisons organised either by the Consultative Committee, the BIPM or a regional metrology organisation.

The degree of equivalence and the comparability of the NMS are maintained through comparisons of the standards internationally against other national measurement standards through comparisons organised by the CIPM CCs and/or other NMIs under the Regional Metrology Organisations (RMOs) networks. The results of these comparisons and the CMC claims based on the results are published in the BIPM's Key Comparison Database (KCDB), which is accessible for everybody to check and verify a country's capabilities. The relationship between the CIPM MRA, the NMIs and the publication of the CMCs in the KCDB is presented diagrammatically in figure 1.

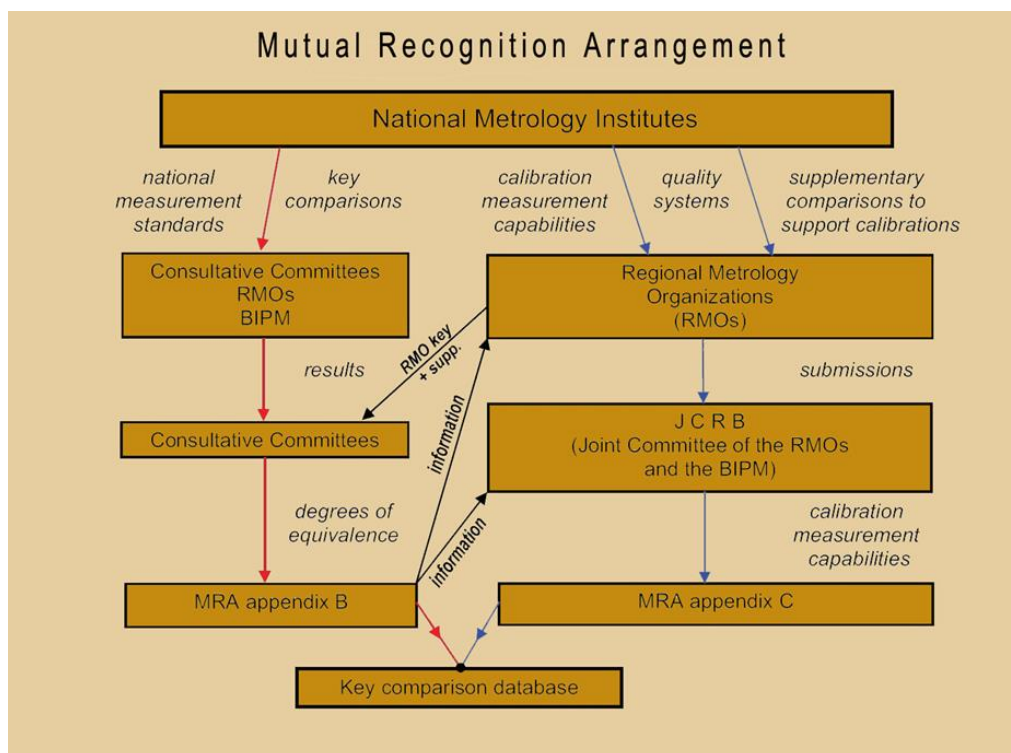


Figure 1. Relationship between the CIPM MRA, the NMIs and the publication of CMCs in the KCDB

NMISA furthermore plays a leading role in the development of metrology infrastructure in Africa, especially in support of South Africa's immediate neighbours in SADC. Sound measurement structures are critical to the successful implementation of regional free trade agreements and elimination of TBTs. This role is emphasised in **the dti's** strategic goals. The institute has established itself as the leader in metrology in Africa, where it provides the

link to the international measurement system (measurement traceability) to most of sub-Saharan Africa.

5.1.2 The National Environment

As one of **the dti's** Technical Infrastructure (TI) institutes, NMISA's activities are critical to the success of the other TIs. Standardisation, metrology, conformity assessment and accreditation are the key issues in the implementation of free trade agreements between countries/economic trade blocks. Together the TIs work towards '*measured once, accepted everywhere*' (see figure 2).



Figure 2. The dti's Technical Infrastructure Institutes

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

5.2 Organisational Environment

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

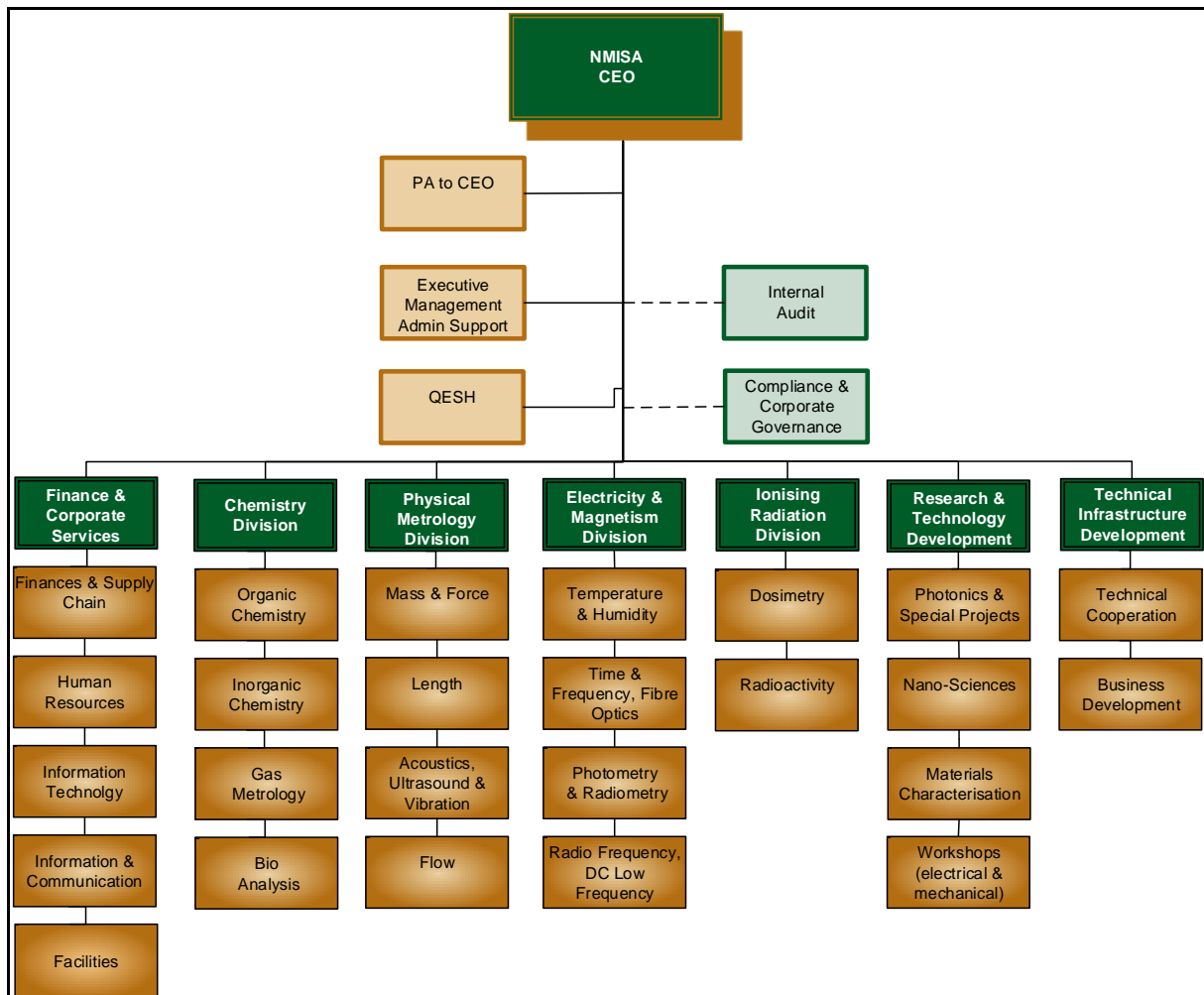


Figure 3. NMISA Corporate Structure

NMISA manages its technical activities through four technical divisions, namely Physical Metrology, Electricity and Magnetism, Ionising Radiation and Chemistry, that is assisted by two cross-cutter divisions namely Research & Technology Development and Technical Infrastructure Development, and that is supported by Finance and Corporate Services. The corporate structure is mapped out in figure 3.

The technical activities of the NMISA are mapped onto the international metrology structures, especially the 10 CCs of the CIPM. Cross-cutting research initiatives such as materials metrology and environmental metrology allows for the use of expertise from different technical divisions to contribute to national priorities such as nanotechnology and environmental monitoring in support of climate change programmes.

NMISA adheres to a total quality management system and almost all of the laboratories are accredited to ISO/IEC 17025. The Safety, Health, Environment and Quality (SHEQ)

Department handles all matters relating to health and safety of staff, from ensuring a safe working environment and environmental sustainable practises.

NMISA has identified the regulatory requirements applicable to its services operations and products in order to ensure compliance. NMISA received certification of its OH&S and EMS management system to ISO 14001 and OHSAS 18001, which specifies requirements for Environmental management system and an occupational health and safety (OH&S) management system.

5.2.1 Internal Business Review

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

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

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

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

Almost 60% of the equipment that makes up the NMS is ten years old or older; many NMS are not only becoming obsolete, but non-functional and inefficient and cannot achieve the measurement levels that our industry requires. In the chemistry division the life-cycle of instruments is short due to the rate at which technology changes internationally, and the rate at which allowable residue values of contaminants in foodstuffs and other products are being decreased. The measurement needs and tolerances of the fast-advancing ICT industry also increase exponentially. The result is that if not renewed, at least 70% of the instruments at NMISA will be obsolete in the next three to five years.

The aged NMS impacts negatively on the NMISA's ability to fully deliver on its mandate, and results in the following challenges which need to be addressed in the next few years:

- **Inability to perform measurements at the required accuracy and measurement uncertainty level:** Technology advances allow industry to improve their measurements, increasing the pressure on the metrology institute to have

measurements of a higher order (higher accuracy) as industry to ensure that it can provide traceability.

- **Lack of support by suppliers:** Suppliers typically will support equipment for 5 years, where-after they consider the electronics and software too out-dated for them to maintain.
- **Increased maintenance cost and time:** With equipment not supported by suppliers, or any other external party, metrologists have to maintain instruments themselves. Sourcing of parts also becomes a challenge as equipment becomes older.
- **Longer calibration / service delivery times:** Technology advances usually increases productivity as the equipment is more efficient than previous. Older equipment can thus lead to calibration or analysis taking much longer than it should.
- **IT compatibility issues:** Software platforms require regular period updates. While there are minor incompatibilities from one version to another, this can escalate to complete incompatibility over a few generations of software if the office and equipment software are not both updated.

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

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

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

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

To address the aged infrastructure issue, NMISA management has motivated strongly for a re-capitalisation project to modernise the institute and a project was registered at National Treasury for a feasibility study towards re-capitalisation and additional funding of R50 million allocated for 2013/14 and R100 million for 2014/15 was secured.

5.2.2 International Benchmarking

To assist in developing a well-informed strategic plan, the current NMISA profile was compared with sister NMIs to evaluate resources, inputs and outputs. A number of NMIs were selected based on their similar status than NMISA, population or gross domestic product (GDP) can be compared, or because they are main trading partners to South Africa. The survey included staff compilation, budgets, resources, outputs and more.

Total budget and total staff are compared in figure 4. The budget/ staff comparison shows that NMISA has the lowest effective budget per staff member. The total budgets are in US\$ as provided by the participating NMIs, but for the budget/ staff comparisons, a purchasing power parity (ppp) conversion was applied (as per World Development Indicator Database) to allow for a more direct comparison. Also, for Brazil (INMETRO) the total institute staff and budget is used, not only the scientific metrology department, and the data for Germany (PTB) is only inclusive of permanent staff and exclusive of 'project money'. For USA (NIST) the data is only for permanent staff (excl. post-docs and guest workers) and total NIST budget.

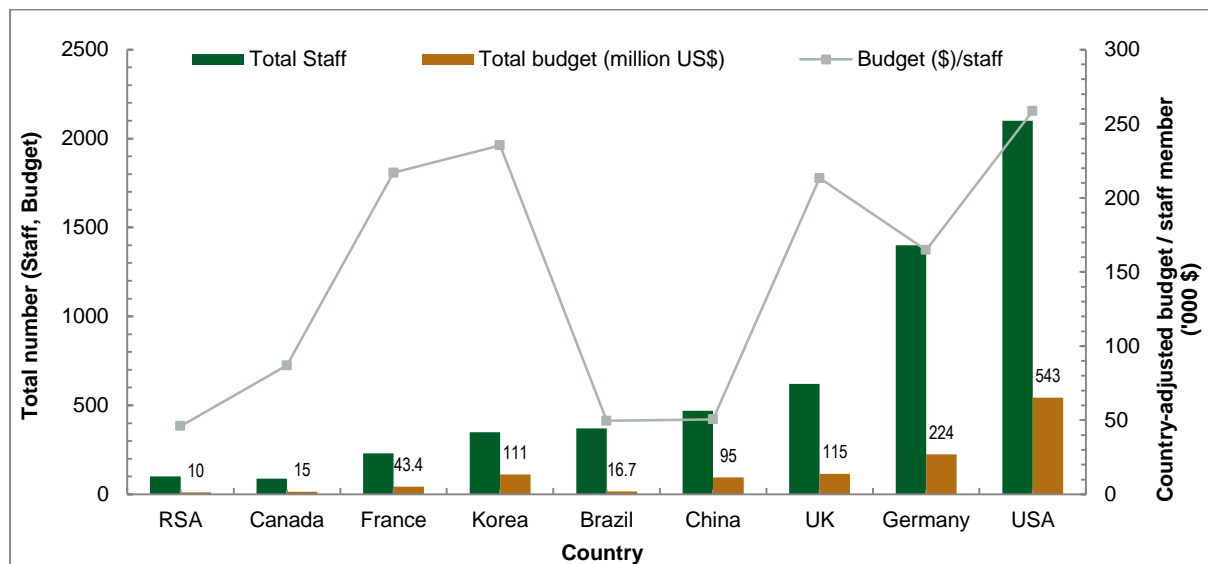


Figure 4. Comparison of Total Staff and Total Budget of selected NMIs, with budget/staff adjusted by the purchasing power parity for each country

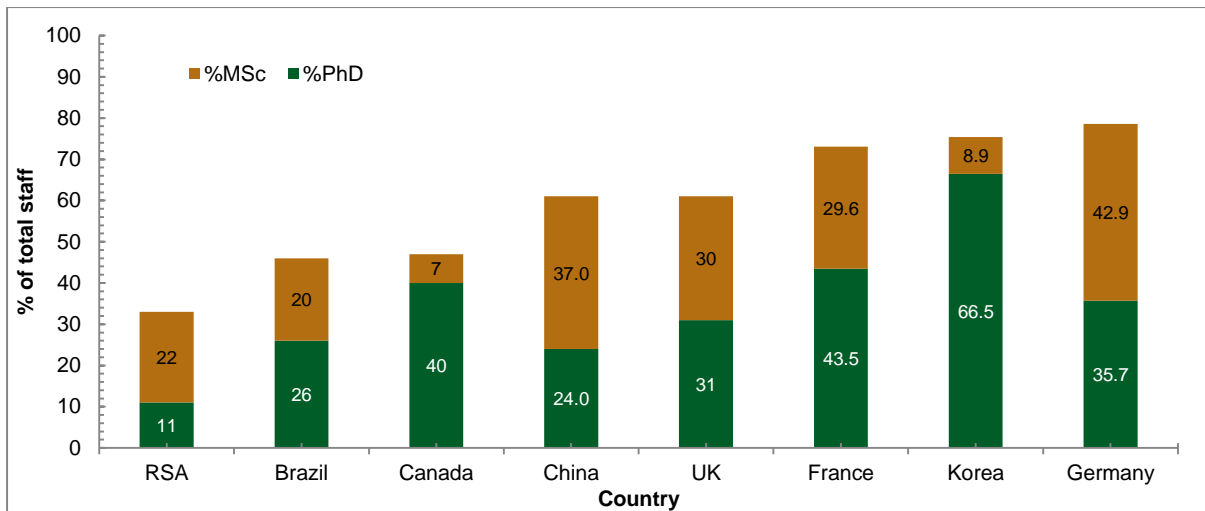


Figure 5. Staff qualification profile (% of total staff with MSc and PhD degrees).

Staff qualification profiles are compared in figure 5. The data is presented as percentage of total staff with MSc and PhD degrees. With only 33% of the total staff at NMISA holding a MSc or PhD degree, NMISA is trailing these NMIs. South Korea (KRISS), with its population of 49 million the same as South Africa, has 66% of its total NMI staff holding PhD's. It must however be considered that the NMISA operates in an advanced developing economy where the demands on metrologists are different to that of developed countries or countries with a large manufacturing industry such as South Korea. NMISA staff performs less advanced research than these NMIs and renders more calibration services.

Technical outputs are compared in Figure 6. Considering that NMISA is one of the smaller NMIs and that it has the smallest effective budget, NMISA's CMCs compares well with the other NMIs, but falls short in terms of peer reviewed publications –a symptom of the different role of a NMI in a developing country or region.

The international benchmarking confirmed that NMISA compares well with similar NMIs in some areas, but lacks behind in others.

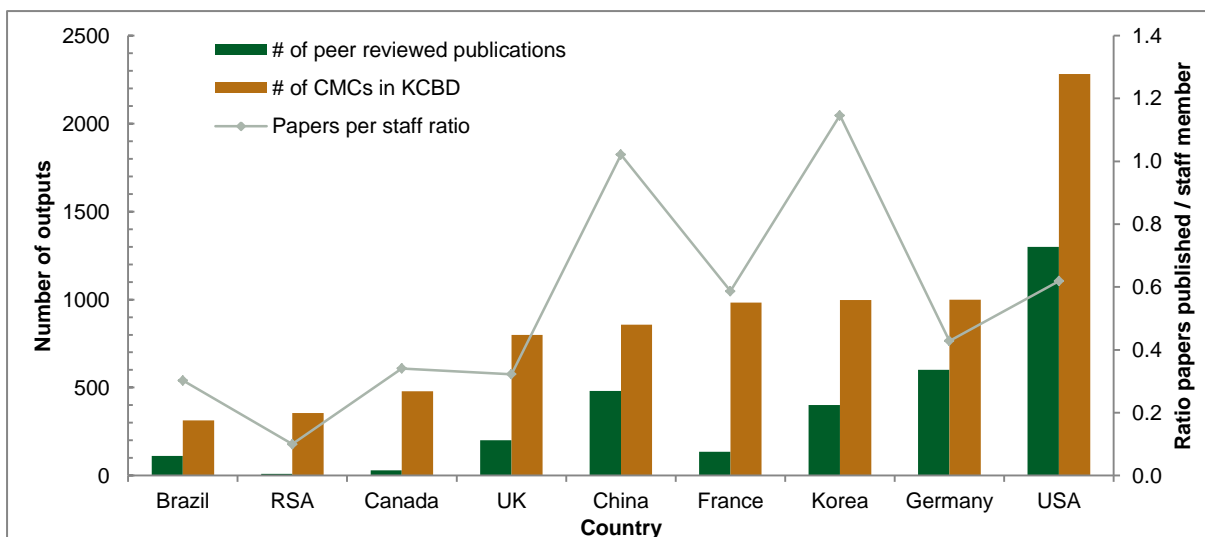


Figure 6. Comparison of technical outputs: CMCs in the KCDB and peer reviewed publications per year

5.3 Description of the strategic planning process

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

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

- National, with input from stakeholders and associates in South Africa
- Regional and Continental, with input from stakeholders across the African continent
- International, where, due to the mandate of NMISA, work inherently requires liaison with other NMIs and the BIPM/CIPM.

This strategic review specifically included

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

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

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

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

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

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

6 STRATEGIC OUTCOME ORIENTED GOALS OF NMISA

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

Goal 1	Keep, maintain and develop the national measurement standards 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

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.

6.1 Products

National Measurement Standards (NMS): NMISA maintains the gazetted national measurement standards. These standards underpin the South African measurement system and facilitate national traceability of measurements to the SI, or to other international agreed references.

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

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

6.2 Services

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

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

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

Training: The expertise residing in NMISA staff is an important contribution to the development of a skilled and capable workforce through training in measurement science.

Where and when required, NMISA assists especially SANAS and the NLA with training courses. NMISA staff is also involved as invited lecturers in graduate and post-graduate academic courses.

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

PART B: STRATEGIC OBJECTIVES

7 ALIGNMENT OF PROGRAMMES TO NATIONAL INITIATIVES

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

- Trade
- Quality of Life
- Health and Safety and
- Safety and Security

NMISA makes a contribution to all government key priorities and the 12 national outcomes.

In the 2014-2018 planning horizon, the NMISA will be implementing projects to develop new NMS, produce CRM's critical to trade and industry, maintain the international equivalence of the NMS, disseminate traceability to industry sectors and provide reference values for proficiency testing schemes. All the projects will be implemented in support of the goals of the NDP, the IPAP and other government priority projects such as the transport (rail) infrastructure development programme and the drive to a greener, energy efficient economy.

The contribution of metrology (the science of measurement) to some selected sectors (such as green industries, agro processing, pharmaceutical and cosmetics, advance manufacturing, automotive, ICT, environmental protection, food safety, safety and security, and regional development) and proposed expansion of activities are highlighted in the next few sections.

7.1 Strategic objectives

The goal of the National Industrial Policy Framework is to *“prevent industrial decline and support the growth and diversification 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 –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 our mandate, NMISA measurements link the national measurement system to the international measurement system and ensure its comparability with our main trading partners. This is achieved by establishing and maintaining NMS, by comparing the NMS to those of other nations, by ensuring their comparability and by the dissemination of the NMS to local (and regional) trade and commerce. The NMISA also assists industry to successfully implement accurate measurement systems.



Figure 7. IPAP sectors and other areas supported

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, measurements taken in different parts of the world needs to be equivalent to each other, and accepted by each other. Important decisions (economic, social and medical-) are based on measurement results. NMISA makes a contribution to all government key priorities and the 12 national outcomes and has aligned its key programmes to the IPAP priority sectors.

Without a measurement infrastructure it is difficult to manufacture to international specifications and tolerances to ensure the integrity of export commodities. Measurement assists with the improvement of the competitiveness of the South African industry in support of the national strategic initiatives. Important decisions (economic, social and medical) are based on results of measurements. Measurements are part of our daily lives and wrong or inaccurate measurement can result in losses, disagreement between trading partners and it

can also cause harm to people and the environment; our *very survival* depends on the ability to measure accurately. 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 considered in the broadest sense, contributes to the general quality of life. NMISA projects are in support of:

- Monitoring greenhouse gasses towards clean air;
- Protecting people against heavy metals in maize;
- Assist with accurate blood alcohol measurements;
- Ensure accurate measurement of amino acids in food and biopharmaceuticals;
- Determine contaminants in food and beverages to which people may be allergic;
- Monitoring dioxins and pesticides in sediment, soil and water;
- Assessing the purity of raw chemical substances to prevent harmful substances entering products;
- Classification of biodegradable plastics to ensure correct labelling, recycling, 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 is proactively supported by the technical divisions and is 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.

The technical strategic objectives of NMISA can be linked to the following strategic thrusts and are delivered by the Technical Divisions and coordinated by Research & Technology Development for cross-cutting projects. There is a clear distinction evident to highlight maintenance of the primary and secondary SI units, dissemination to industry through calibration, training and technical support and the development and research projects that will contribute towards clear deliverables against strategic objectives, publications and human capital development.

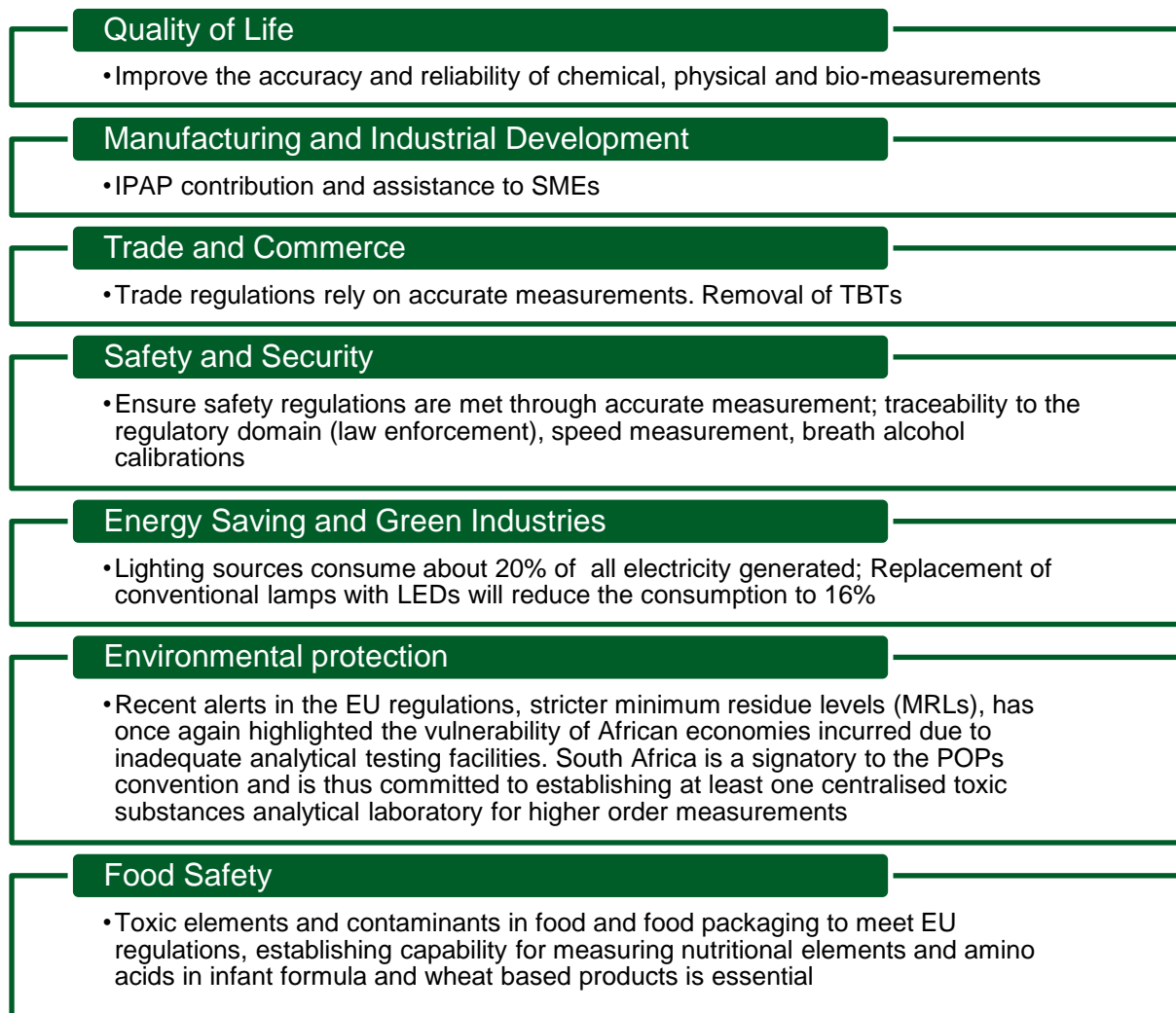


Figure 8. Alignment with the National outcomes

To ensure proper coordination of priority projects of national interest and monitoring and evaluation of deliverables in research and development projects, the technical divisions are structured in a matrix organisational structure. The matrix type organisation is a type of 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 projects will be organised as multi-disciplinary projects across technical divisions that will deliver outcomes such as new/improved NMS. The outcomes of the cross cutting projects will then be handed over to the technical divisions for maintenance and dissemination to industry. Project managers are responsible for project results while functional managers are responsible for providing the resources needed to achieve the results.

The matrix organisational structure also provides opportunities for people in the functional divisions and sections to pursue career development through assignment to various types of projects. This will also allow for easier coordination of student development projects such as

the NMISA post-graduate bursary programme. Figure 9 below presents the Matrix nature of the NMISA technical divisions with the Research and Technology Development division serving as the project coordination function. Project managers will be metrologists appointed from the lead technical divisions.

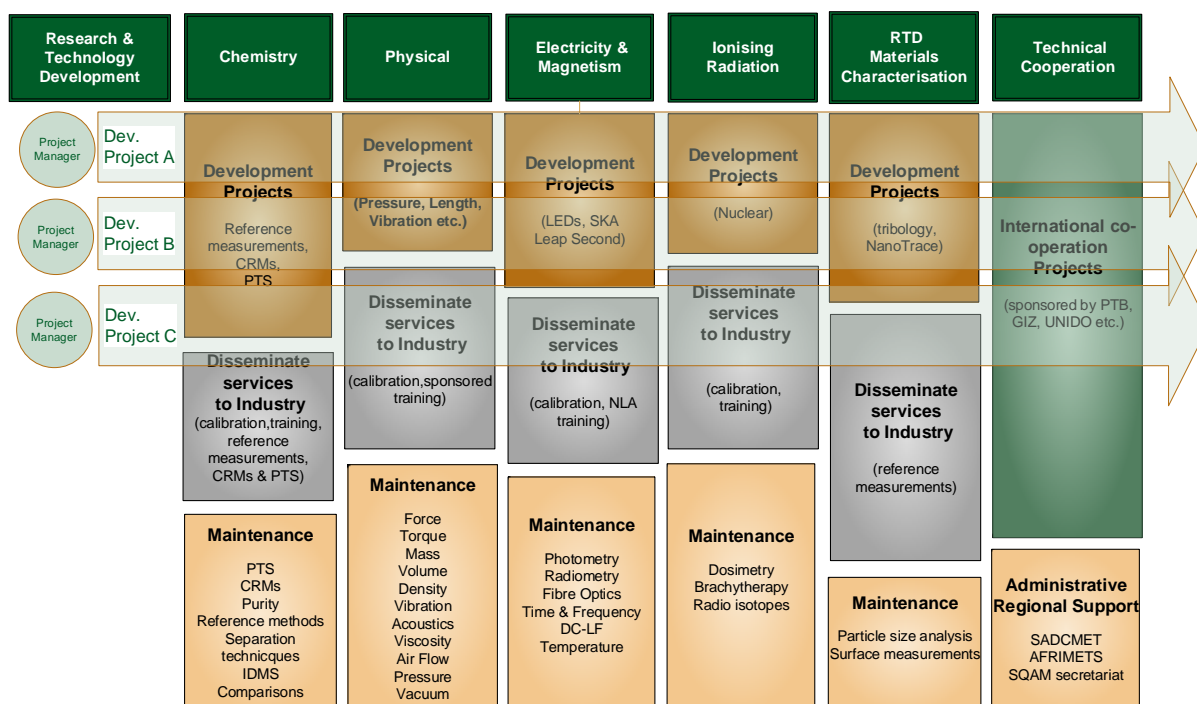


Figure 9. Technical organisational structure

Projects will be approved annually to be included in the business plan and annual performance plans (APP). Project teams and project managers will be appointed. Some of the cross cutting projects to be considered in the 2014-2018 planning horizon are presented in Table 1 below.

Table 1: Cross-cutter Research projects anticipated for the period

RTD	Chemistry	Physical	EM	IR	MAT	TC	
Project	Development Projects						Outcomes
A	Develop reference measurement capabilities, CRMs and PRGMs in support of Agro - Processing, environmental monitoring, Chemicals, Plastics, Pharmaceuticals and	Improve Mass standards by adding density and magnetism measurements	Improve Temperature and humidity standards	Environmental Radiation monitoring capability in support of NNR	Nano structures, particle size and homogeneity	International Collaboration projects: PTB (Germany), INMETRO (Brazil), LGC (UK), NIM (China), NPLI (India)	Primary: Purity and trace level analysis, Matrix CRMs for Pesticides in water, wine, etc., Mycotoxins in maize. Reference Gas mixtures for Volatile Organic Carbons and

	cosmetics						<p>BTEX.</p> <p>PhD and MSc graduates</p> <p>Secondary:</p> <p>Primary humidity standards for the range -75 °Cdp to +20 °Cdp,</p> <p>Mass standards improved to class E1</p>
B	-	Improve Dimensional standards in support of Automotive and manufacturing	<p>Photonics-laser calibration,</p> <p>NMS for high temperatures (radiation thermometry)</p>	-	Surface textures	<p>Regional collaboration projects with NMIs; Zambia, Botswana, Namibia, Malawi, Tanzania, Mozambique:</p> <p>National: SME training</p>	<p>Primary:</p> <p>Improved End gauges, gauge blocks, roundness standard and 3D (CMM)</p> <p>PhD and MSc graduates</p> <p>Secondary:</p> <p>Laser standards,</p> <p>Traceability for surface texture,</p> <p>NMS for high temperature measurements,</p> <p>SMEs trained in Dimensional analysis</p>
C	Capability to characterise and certify trace levels in alloys	Develop NMS for Metal Fabrication, Capital and Transport Equipment in support of beneficiation and railway infrastructure built programmes, nuclear built programmes,	Improved power and energy standards	Measurement traceability for radiation	Measurement capability and Traceability for Tribology (wear and tear)	Training for SME component manufacturers	<p>Primary:</p> <p>NMS for large dimensional measurements (Laser tracker) and primary NMS for pressure.</p> <p>Traceability for Tribological measure-</p>

		etc. (also in collaboration with DoT)					ments. Secondary: Advanced surface and structural, measurement capability, Improved standards for power and energy
D	-	-	Improve performance of fibre optics and wireless telecommunication systems (also in collaboration with DoC)	-	-	Collaboration with PTB, Russia, Tunisia, etc. Collaboration with SMEs in communication sector	Primary: Primary standard for Fibre optic responsivity, Optical Frequency Standard, PhD and MSc graduates Secondary: Fibre-based Polarisation Mode Dispersion emulator (PMD)
E	-	Dimensional and Force measurements for building materials (tubing, insulation, concrete, etc.)	NMS for energy efficiency measurement (also in collaboration with DoE)	-	-	Training for local manufacturers and customs officials	Primary: NMS and facility to measure photometric properties of LEDs. PhD and MSc graduates Secondary: Improved power and energy standard to 160 A Facility for measuring thermal properties of building materials

F	Calibration solutions for radioactivity standards	Volume standards	-	Diagnostic radiology and brachytherapy dosimetry traceability in collaboration with DoH	-	Regional comparisons for IR; SADC, Kenya, Egypt, Tunisia	Primary: X-ray standard for radiation therapy and radiation protection level, Audits and calibration services for hospitals in radiation therapy, diagnostic radiology, protection and nuclear medicine
G	Bio -thin layers for sensors	Nano-scale dimensional and length measurements traceable Atomic Force Microscopy, Interferometry	-	-	Measurement capability and Traceability for Nanotechnology (Nano-Trace)	Collaboration with PTB, NPLI (India), INMETRO (Brazil), NIM (China), NMIJ (Japan), METAS (Switzerland)	Primary: NMS for particle size and thin film analysis. PhD and MSc graduates Secondary: Capability to characterise organic/bio thin layers
Disseminate Services to Industry							
	Proficiency Testing Services (PTS) for pesticides in water, ambient air permanent gases, mycotoxins, amino acids. Reference measurements for pesticides, POPs, food safety. Calibration of breath alcohol and gas analysers, CRMs and	3D Dimensional measurements for Automotive and manufacturing, Calibration of Mass, Volume, Force, Acoustics, Vibration Pressure, Length standards	Calibration of power and energy, DC-LF, Communication, RF, Temperature, lighting standards	Calibration of Dosimeters Calibration standards for Radio-analytical measurements for NNR, Audit and calibration services for hospitals in radiation therapy, protection, nuclear medicine	Reference measurements for nanotechnology particle size analysis, thin layers (paint and coatings in Automotive, bio thin layers, pharmaceuticals), Petrochemical (catalysis)	Measurement training for SMEs, training for SADC NMIs	Direct support or assistance to more than 5000 measuring facilities and indirect support of the whole manufacturing and export industry, law enforcement, food safety, environmental monitoring, Quality of life

	PRGMs for Food safety, law enforcement and environmental monitoring						
	Maintenance						
	CRMs PRGMs PTS Reference methods and measurements (purity, trace levels, food safety) Gas measuring equipment	Force Torque Mass Volume Density Vibration Acoustics Vibration Viscosity Air flow Pressure Vacuum	Photometry Radiometry Fibre Optics Time and Frequency DC-LF Temperature	Dosimetry (diagnostic and therapy) Radiation (monitoring and protection) Nuclear Medicine (radioactive solutions)	Particle size analysis (nano-technology, paints, catalysts, etc.) Surface measurements (thin layers, corrosion, catalysis, etc.)	SADCMET, AFRIMETS Secretariats, participation in TI, regional TBT and Tri-partite forums, RMO and JCRB reporting, etc.	

7.1.1 Physical Metrology Division

Physical Metrology is critical to **Manufacturing and Industrial Development**. Accurate physical measurements enable manufacturers to manufacture high quality commodities, manufactured to international specifications and tolerances, thus ensuring the integrity of commodities. It allows the framework in which manufacturers can demonstrate compliance with specifications within an international harmonised system and provides the basis for industrial development (e.g. manufacturing processes, product testing, etc.).

The division contributes to **Trade and Commerce**, it provides for fair trade and consumer protection, health and safety and environmental monitoring. All trade transactions in South Africa are measured in weight, volume, length (inclusive of area) or number. Legal metrology depends on the division for the traceability (and calibration) of speed trapping equipment, weighbridges (prevention of overloading), fuel dispensers, etc.

The division supports the **automotive Original Equipment Manufacturers (OEMs)** by the measurement (validation) of master moulds and prototypes to ensure local manufactured components comply with mother company specifications and tolerances. The dimensional laboratory provides the necessary traceability, and upgrades and developments to the national measurement standards to meet these stringent industry requirements.

The division supports **the dti's initiative to build capacity in metrology** and testing in the **SADC region and Africa**. It is actively involved in the calibration of standards, the training of metrologists, the peer review of quality systems of SADC NMIs by the Southern African Development Community Accreditation Services (SADCAS), the development of fit-for-

purpose measurement standards for SADC and African NMIs and it plays a leading role in AFRIMETS and SADC MET regional metrology initiatives.

The division contributes to **Environmental Protection** as the range of measurements to protect our environment is huge: for example; noise pollution and vehicle emissions from busy highways can have a detrimental effect on the environment if not monitored and regulated. Confidence that the correct measurement is being made, infers that sound assessments should be conducted, reliable models constructed, and policy decisions that are based on universally accepted facts nationally and internationally are made.

The division contributes to **Safety and Security** of the workers in industry, by insuring accurate noise and vibration measurement standards. Noise is often ignored as a threat to safety, but for the workplace there is set limits to protect workers in different environments and Vibration measurements are critical to the safety of mine workers.

The division maintains two of the seven primary SI Units and is a member of three of the consultative committees (CC) of the CIPM. The national measurement standards will continuously be further developed through research and to reduce the uncertainty of measurement. CMCs will be improved and maintained to ensure international equivalence of measurements at a level of accuracy that is suitable for the South African industry, as well as the regional market. The division is challenged by **ageing equipment**, more than 40% of the standards and other critical equipment being older than 10 years. A second challenge the division is facing, is the ageing skills base, lack of appropriately skilled metrologists and insufficient staff depth. A strong training program and succession planning are priorities in the division.

7.1.2 Ionising Radiation Division

The Ionising Radiation (IR) division, comprising the Dosimetry Standards (DS) and Radioactivity Standards (RS) sections, provides traceability and specialised measurement services for users of radiation products and techniques in the country and the region. The division ensures that the national measurements standards and units maintained by the divisions are internationally comparable and scientifically valid. This, in turn, allows for correct diagnoses and medical doses to be administered to patients, facilitates quality control in the manufacture of radioactivity solutions and ensures safety of the public.

The main priorities of the DS section are the development and upgrading of standards in radiation therapy including brachytherapy, diagnostic radiology and radiation protection. The application of accurate doses, determined for each patient through careful evaluation and calculations, is of utmost importance for the effectiveness of the application of radiation. The section will organise regional comparisons to harmonise dosimetry measurements in Africa, to assist nuclear medicine departments and will, with the IAEA as partner, coordinate an audit programme which focuses on linear accelerators in radiation therapy centres to ensure correct doses are administered to cancer patients. The section will also seek funding for setting up a national audit programme for dosimetry in radiation therapy centres. Having this capability nationally will allow the hospitals to be audited yearly and at any time there is a need from a hospital to independently validate doses.

Research in dosimetry is supported by Monte Carlo simulation and the PTB (German NMI) has agreed to train a NMISA employee on Monte Carlo. To develop research capabilities in this section, there will be collaboration with other NMI's or their designated institutes who are responsible for research, development and maintenance of standards.

The RS section is of critical importance to the South African community that uses radioactivity. A large number of radionuclides are in use today, with many different modes of decay. The section will submit new radionuclide standards to the International Reference System (IRS), run a project to support accurate radioactivity measurements in hospitals in South Africa, assist the National Nuclear Regulator (NNR) with the establishment of a radio-analytical laboratory for environmental monitoring and establish the capability to search for and measure radioactive impurities.

The SABS standards division launched a technical committee on Nuclear energy, nuclear technologies, and radiological protection in 2012. For the planned years, the IR Division will actively participate in this committee and its working groups as these standards enhance the competitiveness of South Africa, and are the basis for consumer protection, health, safety, and environmental issues.

7.1.3 Electricity and Magnetism Division

The Electricity and Magnetism Metrology division ensures accuracy and traceability for all electrical, temperature, light transmission, radio frequency, time and non-ionising radiation measurements in South Africa. From ubiquitous quantities such as temperature to the rapidly advancing technologies of high-speed digital communication, the measurement expertise maintained by the division is of vital importance to the South African economy.

The division strive to maintain a broad spectrum of capabilities, rather than specialising in specific sub-fields and is active in the fields of optical radiation, fibre optics, time and frequency, radio frequency and DC/low frequency electrical, temperature and humidity. As measurement infrastructure in physical and EM metrology is well-developed in South Africa, dissemination of traceability is dominated by calibration of measurement standards for commercial calibration laboratories and regional NMIs, rather than calibration of instruments directly for industrial users.

Key focus areas include support the ICT industry in providing improved broadband access at reduced costs for individuals and businesses and contribution to government's drive to reduce national energy consumption due to inefficient energy use in buildings, the use of energy inefficient lighting systems, wasteful industrial energy consumption and inaccurate billing. Measurement standards that contribute to the accuracy of data collected by Earth Observation satellites and sent to space agencies, providing decision makers with the information needed to understand and protect our environment will also be enhanced.

The Division's research, development and innovation strategy is informed by the key focus areas for the next five years, and includes the development of optical frequency standards, primary standards for electrical power and energy, improved standards for radiometry and fibre optics, new standards for energy efficient lighting and thermo-physical properties and improved realisation of the South African time scale.

7.1.4 Chemistry Division

Ensuring the quality of life, health and safety of all South African's and promoting the reliable quality of South African export commodities is essential for economic growth and development. Towards this end, the Chemistry division develops certified reference materials and accurate measurements that safeguard the food we eat and the environment we live in. Together with this, we endeavour to support South Africa's export and local trade so that it is not hindered, by meeting the international laws and regulations that stipulate stricter limits on pesticides, dioxins, mycotoxins, toxic elements, and other hazardous substances in various South African commodities, including manufactured goods.

The existing reference materials and measurements, in addition to those that are being developed or enhanced, will support the agricultural, manufacturing and trade sectors by being available to commercial laboratories that provide industry with reliable measurement values to ensure the quality and international acceptance of their measurement results.

To effect the development of these measurements is thus reliant upon a secure technical infrastructure, high-end accurate instrumentation, experienced scientists and the availability of certified reference materials and standards. Through proper planning, availability of base funding (and alternate funding sources) and through extensive collaborations with academia, science institutes, other NMIs and expert scientists in their respective fields, these measurement goals can be achieved and concomitantly will also serve to augment the current scarce skills base in the Analytical Sciences in South Africa.

The strategy for Chemistry is focussed towards the establishment of comprehensive analytical capabilities to provide support and measurement traceability for chemical analysis. The division develops traceable methods to underpin reference analysis in support of industry aligned with the IPAP, participates in research projects of national interest and provides industry with reference materials and proficiency testing schemes. Dissemination of its capabilities is further done through reference analysis and the development of reference methods in support of the agriculture, chemicals, energy, climate change and clean air, food safety, health and environment, pharmaceuticals, metals, law enforcement and the manufacturing and mining industry sectors.

With the emphasis on ensuring that the division's activities remain sustainable and applicable within a challenging economy, the division will also focus on contract research projects and contract analysis to increase external funding needed to substantiate the relevance of the measurement services offered to industry.

7.1.5 Research & Technology Development (RTD)

Research is a fundamental component of any technological organisation, and in the case of NMISA, research is essential for staying relevant and competitive in the long run; for the effective development and upgrade of the NMS; and is required to address national measurement traceability needs as matter of urgency.

Research thrust areas are identified from national government needs and priorities, national science focus areas, international trends and stakeholder requests. These platforms are supported by position papers, which underpins the establishment and nurturing of special

projects into new metrology areas. Special attention is also given to the needs of SMEs, researchers at universities and collaborative projects with African NMIs.

In practise, research in NMISA is conducted at two distinct levels.

- Experimental development of national measurement standards and methods of analysis,
- Cross-cutter research for the development of new standards, as a contribution to national priority projects and/or to develop measurement equipment in support of rural development programmes.

For the experimental development, the exact level of current measurement standards and an estimation of the future requirement by the South African community are determined and the NMS is developed accordingly. Input to this process is from the Technical Advisory Forums (industry specific), the Consultative Forum of the Board (sector representation), the Technical Committee of the Board and the international network of technical working groups of the regional metrology organisations and the consultative committees of the CIPM. Where possible, the experimental development is conducted in collaboration with national research institutes and/or other national metrology institutes.

For the Strategy period, the research focus is on:

- The improvement of the current NMS, the development of certified reference materials and methods of analysis and input to standards and regulations in support of the priority IPAP sectors (Green industries, Agro-processing, Automotive, Pharmaceuticals and cosmetics, Advanced Manufacturing and Metals fabrication),
- Replacement of secondary standards at NMISA (calibrated at other NMIs) with realisation of the unit at the NMISA, to shorten the traceability chain and thus improve the uncertainties that can be delivered to industry,
- Collaboration with HEIs on research projects to provide high level measurement solutions for priority projects (SKA, Space, Nuclear, Nanotechnology, Biofuels, etc.),
- Increase the measure of research outputs through publication both nationally and internationally,
- Access funding for experimental development in support of national priorities (other than IPAP) from DST, DOE, DOH and other relevant government departments,
- Enable participation in the European Metrology Programme for Innovation and Research (EMPIR),
- Improve research output through increased collaboration with Science councils and HEIs,
- Find donor funding for applied research in measurement science,
- Initiate a special project (NanoTrace) in accurate measurement in nano-science,
- Develop a capability to provide traceability for materials measurement (tensile strength, tribology, etc.) as a pre-cursor for a new technical division in support of manufacturing,
- Find dedicated funding for development of measuring instruments and equipment for rural conditions and SMEs, and
- Involve HEIs in rural areas in measurement development programmes,

Research and development is furthermore driven by the projected traceability needs of customers and stakeholders that require NMISA's staff to develop specific skills and expertise. Collaboration with larger NMIs is occasionally exploited to circumvent limitations in resources.

Cross-cutting research and development programmes also allows for addressing internal needs, the shortages in specialised skills necessitated special strategies to alleviate the pressure on certain laboratories. The removal of boundaries between laboratories is thus being pursued to improve capacity by exploiting synergies and utilising the complementary skills sets of available staff.

The RTD division is also responsible for the knowledge management systems and is custodian of the Intellectual Property portfolio. These functions will continuously be reviewed and enhanced to meet the needs of the institute and to ensure compliance to national regulations and guidelines, and to facilitate a culture of continuous improvement in the institute.

7.1.6 Technical Infrastructure Development (TID)

The primary role of the Technical Infrastructure Development division of NMISA is to increase the impact of the institute and metrology at all levels of society, manage the relationship and obligations within the Metre Convention and CIPM MRA, ensure the inclusion and participation of metrology in the Technical Infrastructure, develop and foster metrology amongst the stakeholders and clients and to identify and grow new business opportunities. TID coordinates the maintenance of the NMISA's CMCs in the BIPM's KCDB as well as the continued membership to 9 of the 10 CIPM CCs. TID also manages NMISA's relationships with other NMIs and international organisations and co-ordinate participation in metrology within SADC MET, AFRIMETS and other regional metrology organisations. The division assists in leveraging funding from regional and international sources for metrology consultancy, calibration, collaborative development projects and specialised measurement consultancy to industry.

For the period 2014-2018, collaboration with NMIs in SADC and Africa will be improved, with bilateral agreements foreseen with NMIs of key regional countries such as Ghana, Tunisia, Egypt and Ethiopia. Internationally, increased collaboration will be sought with NMIs from the BRICS countries with a special focus on Brazil and India. Nationally, cooperation with SEDA will be sought to provide improved measurement assistance to SMEs and closer coordination on standardisation will be established with the other TI institutes.

7.1.7 Finance and Corporate Services

The division provides an array of different services in six units to meet corporate, statutory and compliance requirements, along with transactional, administrative and professional services to the business and delivers financial and management reporting to aid an informed decision making process. The Information Technology (IT) unit on the other hand ensures that NMISA's IT infrastructure is available to users at all times. Documentation of policies and procedures in line with International standards and best practices will remain a focus area for this unit. The IT unit will continue to work hand in hand with the Information & Communication unit to enhance the NMISA website to be an effective tool of communication. Human Resources (HR) management focuses on ensuring that the human capital within

NMISA is well equipped to meet the strategic mandate of the institute. The HR unit will work with Information & Communication to position the NMISA as an employer of choice to be able to attract young scientists. Facilities management mainly focuses on the stability of internal electricity supply, air conditioning and general maintenance.

The strategic objectives of the various divisions and units are aligned with the strategic oriented goals and objectives of the organisation and are detailed in the following tables.

7.1.8 Internal Audit Unit

Strategic objective of Internal Audit Unit is to provide an independent objective assurance and consulting activity designed to add value and improve NMISA's operations. To help NMISA accomplish its objectives by bring a systematic disciplined approach to evaluate and improve the effectiveness of risk management, controls and governance processes.

Aligning the Internal Audit Annual Plan to NMISA Strategic Objectives and Plans together with other oversight activities is a continuous process, to ensure adequate audit coverage of key business initiatives informed by high risk areas as determined in the NMISA Risk Assessment exercise.

Building and strengthening co-ordination and cooperation with other oversight / assurance bodies within NMISA is also priority, to the Internal Audit Unit in order to ensure coherence and improve efficiencies on assurance services and eliminate duplications.

7.1.9 NMISA Balanced Scorecard

NMISA Balanced Scorecard							
National Obligations							
Strategic Outcome Oriented Goal 1	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
Keep, maintain and develop the national measurement standards and provide for the use of the national measurement units	1. 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	Annual report to the dti on national measurement units	Updated Units Gazette	Relate changes to the SI, Advise on units outside the SI for use in South Africa, Update equivalents of units	Annual report received by the dti and Gazetted schedule of Units
	2. Maintain the Schedule of National Measurement Standards	2	Perform the maintenance of the standards in the Schedule of National Measurement Standards	Number of gazetted national measurement standards	54	Gazetted NMS categories (per parameter) are counted as per 1a, b, 2a, b, c, etc., in the schedule, except where it is a definition	Gazetted schedule of NMS
	3. 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 and new national measurement standards and secondary standards, reference materials and methods	30	Improved and/ or new NMS, secondary standards, reference materials and methods	New 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

National Equivalence							
Strategic Outcome Oriented Goal 2	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
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)	4.To ensure internationally recognised and comparable national measurement standards and units by participating in the Metre Convention, CIPM MRA and AFRIMETS activities	4	Membership of and active participation in the CIPM and its consultative committees (CCs)	Continued membership of CIPM and its CCs	10	Membership of CIPM and its CCs	CC Membership as listed on the BIPM website plus membership of the CIPM
	5.Establish confidence in the accuracy of the national measurement standards by suitable and documented quality and management system	5	Maintain the TQMS at internationally acceptable level (peer-reviewed quality system)	Accredited and/or maintained quality system	Maintain SANAS Accreditation	SANAS accreditation and/or peer-review	SANAS schedule of accreditation and/ or documented peer-review
	6.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 Calibration and Measurement capabilities (CMCs) published in the KCDB	As published in KCDB	The criteria are specified in the CIPM MRA and checked through regional and international CMC review processes overseen by the Joint Committee of the RMOs and the BIPM (JCRB)	Official number of active CMCs published in the KCDB for South Africa as at 31 March (screen print and time)

Recapitalisation and Modernisation of NMISA							
Strategic Outcome Oriented Goal 3	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
3.To modernise NMISA's infrastructure and equipment through recapitalisation	7.Recapitalise and modernise the NMISA to ensure that the national measurement standards support international trade, health, environmental and safety requirements	7	A newly designed NMISA with appropriate infrastructure to serve the measurement needs of South Africa (PPP project)	Percentage of budget spent (see note*)	100%	Draft report of objectives achieved against project plan and the budget (roll over budget)	Statement of financial performance
Technical Infrastructure Support							
Strategic Outcome Oriented Goal 4	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
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	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	8	Participate in and contribute to national technical infrastructure institutions	Membership of SANS and ISO committees, NRCS regulatory bodies, and SANAS STCs	35	Membership of national TI committees	Proof of membership
			9	Demonstrated competence and excellence in measurement through science outputs	Number of refereed and/or peer-reviewed publications, articles, application or technical notes on the development or improvement of measurements and measurement standards in journals and conference proceedings	30	Papers accepted for publication in peer-reviewed journals, including reviewed popular articles and application/ technical notes
		Number of presentations given at conferences and workshops on the improvement and development of measurements and measurement standards			40	Oral/poster presentations at conferences, workshops or technical committee meetings	Abstract in official conference programme or agenda for workshops/TC meetings Oral/poster: PowerPoint (or other) presentation and actual poster T&M, TAFs, ChromSA, etc presentations included

Organisational (learning and growth) Perspective							
Strategic Outcome Oriented Goal 5	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
Provide an integrated human capital development programme for metrology	9.To maintain and ensure continued expertise and establish the necessary skills according to internationally acceptable standards	10	Skilled, competent and transformed NMISA personnel	Number of staff with post graduate qualifications	45	Number of post-graduate staff undertaking official studies as active HCD programme	Certificate on completion
				Number of Post-graduate and undergraduate bursars	12	Number of post-graduate and undergraduate students undertaking official studies as active HCD programme	Signed student contracts and performance reviews
				Training expenditure as a % of personnel cost	2%	Total cost incurred on training compared to personnel expenditure	Statement of financial performance
				Number of Interns and in-service trainees hosted	10	Interns and in-service trainees appointed	Signed contracts and performance reviews
				Percentage of Performance Agreements in place	100%	Availability of performance agreements (KPIs)	Actual performance agreement signed off and copy filed with HR

Stakeholder and Customer Perspective							
Strategic Outcome Oriented Goal 6	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
Provide essential support to South African public and private enterprises through dissemination of the national measurement standards, units and expertise	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	Dissemination of NMS and measurement capabilities	Income generated from dissemination activities (see note*)	R12 729k	Income generated through calibration, services, sales, consultation, research funds and donor projects (REVENUE)	Report from Finances on revenue invoiced
		12	External client satisfaction	Number of customer complaints in Quality System	≤ 5%	Review of customer complaints not adequately/ timeously cleared	Report on the review of customer complaints
	13	11. Provide appropriate technology and skills transfer to the South African industry, especially to SMEs	Skilled and capable labour force for measurements in industry	Number of industry and/or regional metrologists trained in accurate measurement	59	All external technical professionals formally trained (excluding courses)	An official report or a NMISA Certificate of Training; official agreement (contract)
				Number of courses presented to industry	14	Formal courses presented by NMISA staff members on behalf of TEIs, NLA or other training providers (inclusive of SMEs). Count each occurrence during the period	Official attendance list, official course material, or official letter from organisers, contract and/or official accepted quotation, etc.

Financial and Business Perspective

Strategic Outcome Oriented Goal 7	Strategic Objectives	KPI	Key performance outputs	Key performance Indicator/ Measure	2018/19 Target	Criteria	Evidence
Adhere to the regulatory requirements of a type 3A public entity and sound corporate governance	12. Comply to government directives, the PFMA, treasury regulations and regulatory issues in terms of Government regulations	14	Establish systems and processes to ensure compliance to regulatory frameworks	Actual expenditure to revenue received	98%	Actual spending of funds received	Statement of Financial Performance
				Percentage of total budget spent on CAPEX	20%	Actual CAPEX spent	PPE note to the financial statement
				Unqualified audit opinion	Clean audit	External audit opinion (unqualified with no emphasis of matter)	External audit report
		15	Reasonable assurance on the adequacy, effectiveness, efficiency of internal controls, risk management and governance matters	Completed Annual Audit Plan and follow-up audits as approved by Audit and Risk Committee	20	Internal audits conducted according to the approved annual audit plan as approved by Audit and Risk Committee	Signed off (by IA) audit reports

7.2 Resource Considerations

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

With scientific inflation estimated at more than 10%, NMISA's baseline funding effectively declined over the last few years. This is evident in the decline of the capital investment allocation, with the exception of 2008/09 and 2011/12 when additional funding was secured as part of mid-year adjustment budget process specifically for capital investment.

Parallel to the decline in capital investment, the staff compensation bill increased as a percentage of total budget. This was partially due to the necessary expansion of the support staffs complement after the establishment of NMISA from the CSIR in May 2007 to fulfil the essential financial and HR functions, as well as staff to ensure compliance to national regulations and directives.

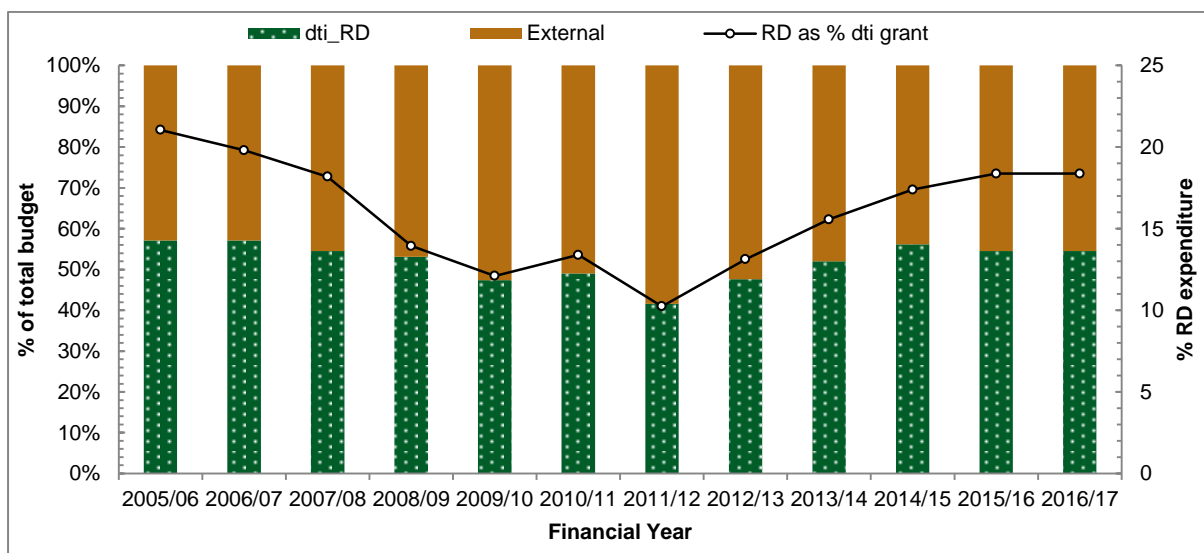


Figure 8. Research investment at the NMISA

As a result of the abovementioned factors, NMISA's investment into research and development also declined over recent years (figure 10). Since research is critical to the further development and improvement of the current national measurement standards to continuously meet the national needs, NMISA plans to actively increase the research funding allocation.

7.2.1 Financial Plan

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

Over the five year strategic plan period NMISA is projected to grow its grant allocation funding from R202,5 million (2014/15) to R304,9 million (2018/19).

The main contributor is the additional funding that is earmarked for the re-capitalisation of NMISA in support of the NMS. Over the years, as baseline funding did not increase with scientific inflation (that is significantly higher than normal inflation), and funding lost from the CSIR was not fully compensated when NMISA was established, funding available for capital investments on equipment for hosting the NMS drastically decreased from 55% of the transfers received in 2001/02 to an unprecedented low level of 5% in 2010/11. This was going to lead to discontinuation and abandonment of some NMS in contravention with the entity's mandate. To avert the situation, the organisation has embarked on a drive to recapitalise the operations.

The table below illustrates the funding needs of NMISA over the five year strategic plan period. These are pure financial estimates and pose a risk to NMISA if they cannot be met. Issues factored in include that the increase in spending on recapitalisation, i.e. buying of equipment, lead to an increase in operating expenditure as a result of maintenance cost.

NATIONAL METROLOGY INSTITUTE OF SOUTH AFRICA
CONSOLIDATED BUDGET ESTIMATES 2014 TO 2018

	2014/15 R'000	2015/16 R'000	2016/17 R'000	2017/18 R'000	2018/19 R'000
Revenue	214 378	264 118	278 606	304 674	323 351
Transfers received	202 565	250 895	264 193	288 820	304 911
Rendering of service	8 667	9 534	10 487	11 536	13 690
Investment income	3 146	3 689	3 926	4 319	4 751
Expenditure	214 378	264 118	278 606	304 674	323 351
Administrative and Operating expenditure	36 116	68 030	66 909	67 407	71 356
Employee Cost	64 900	71 390	75 529	86 382	89 020
Repairs and Maintenance	2 843	3 127	3 440	3 784	4 163
Recapitalisation project	100 000	110 000	120 000	133 100	143 410
Audit fees	902	992	1 091	1 200	1 320
Depreciation and Amortisation	9 617	10 579	11 637	12 801	14 081
Surplus/Deficit for the period	-	-	-	-	-

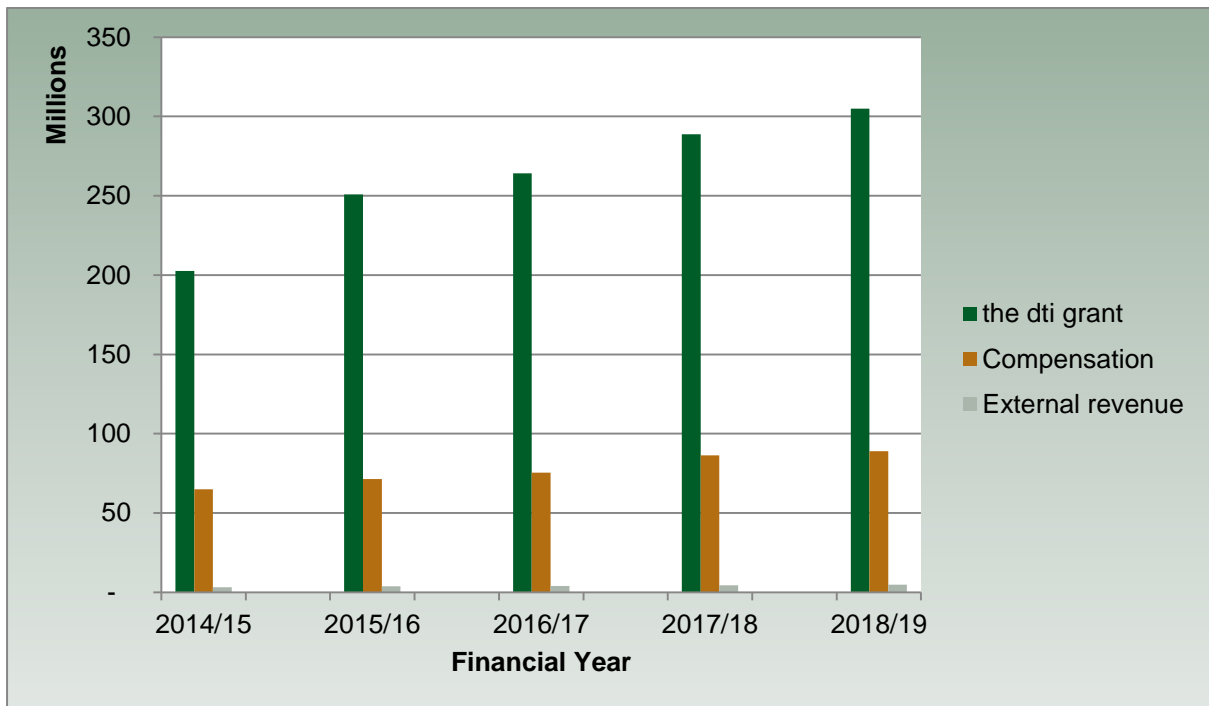


Figure 9. Revenue - dti grant and external, and staff compensation bill

The graphs below illustrate the projected revenue and expenditure over the five year strategic plan period:

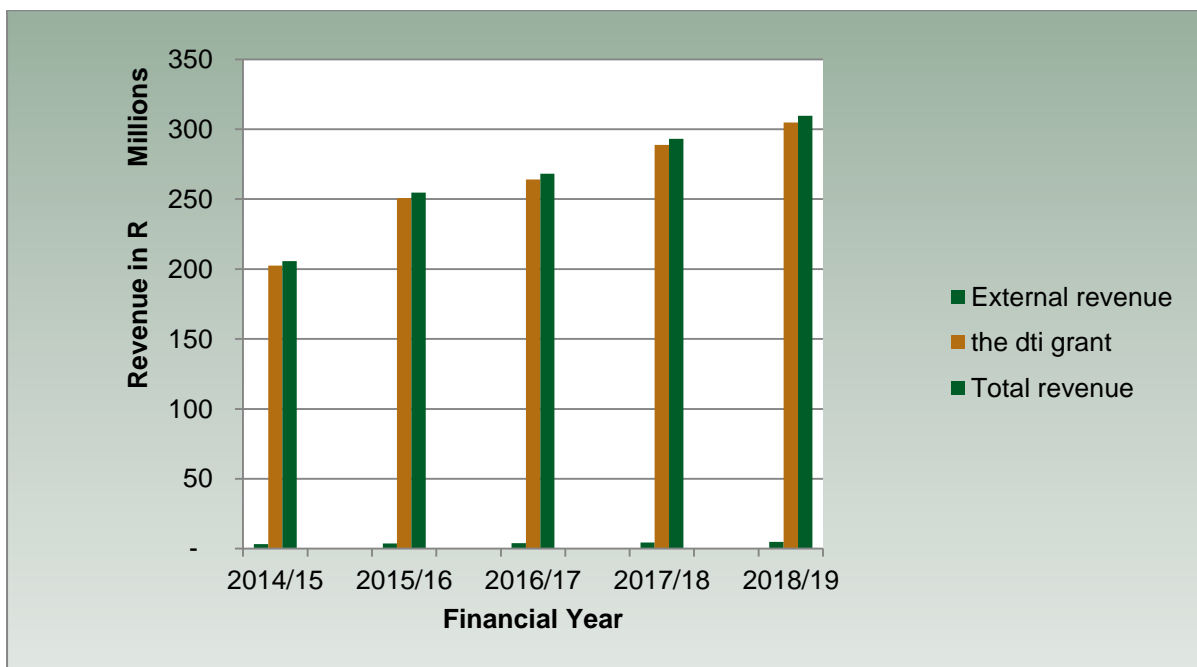


Figure 10. Projected revenue.

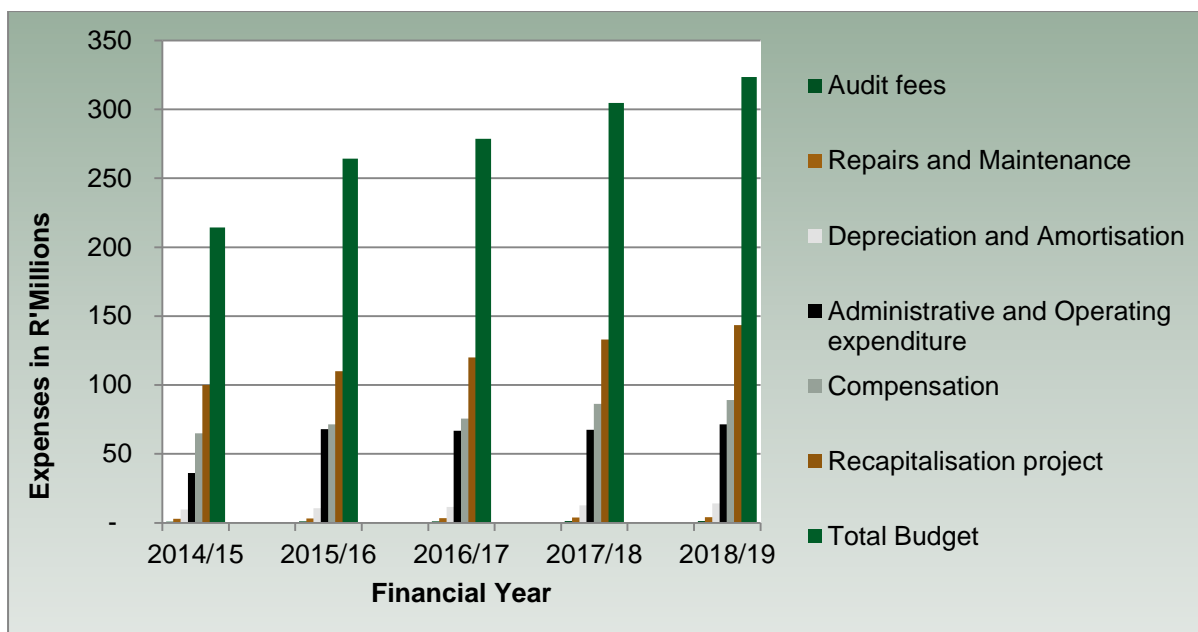


Figure 11. Projected expenditure

7.2.1.1 Capital expenditure projects

NMISA is currently operating with old equipment that requires frequent maintenance. Below is a table that reflects the replacement value as well as the value of new equipment required for NMISA laboratories to be able to carry out its mandate:

Table 2. Capital Expenditure per Division

Division	Current Equipment value as at 31 March 2013 (Rand)	Estimated value of maintenance, upgrades and replacement (Rand)	Estimated value of New Equipment (Rand)
Chemistry	16 092 738	9 930 000	40 650 000
Electricity and magnetism	28 519 816	11 720 000	22 165 000
Ionising Radiation	1 061 417	1 000 000	6 935 000
Physical Metrology	17 647 723	15 530 000	19 430 000
Research Technology and Development	249 149	2 400 000	34 500 000
Total	63 570 843	40 580 000	123 680 000

7.3 INTEGRATED HUMAN RESOURCE STRATEGY

7.3.1 Introduction

The shortage of science, engineering and technology skills and especially the lack of suitably trained metrologists in South Africa is posing the single biggest threat and limitation to the maintenance of the NMS. NMISA previously relied on graduates from universities and trained metrologists from accredited laboratories for skills.

NMISA requires the following skills in order to successfully deliver on its mandate:

- Scientists (Physics, mathematics, chemistry, biochemistry, etc.)
- Engineers (Mechanical, Electrical/electronic, etc.)
- Technologists
- Technicians

Technical staff in NMISA are traditionally referred to as “metrologists”, a term which refers to skilled professionals trained in the expert aspects of the science of accurate measurement (realisation of measurement units, traceability, uncertainty of measurement, calibration, primary methods, certified reference materials, reference analysis, audit and proficiency testing schemes, quality systems, etc.) that are applied in metrology laboratories.

Strategic perspective

A robust HCD strategy is required to enable the organisation to achieve its strategic goals and the overall goal of the HCD programme is to grow a pipeline of talent to address current and future skills needs, and advance transformation at all levels in the organisation.

The sustainability of NMISA’s activities and ability to deliver measurement solutions to South Africa lies in its people. With people the key asset of NMISA, human capital development (HCD) and the creation of a pipeline of skilled scientists, engineers and technologists that can be applied as metrologists are high on the organisational agenda. The growth of human capital in the disciplines of science, engineering and technology is essential for the transformation of NMISA’s science base to ensure that it can make a meaningful contribution to the national agenda. As a knowledge-based organisation which relies on its intellectual capital to grow, NMISA has to ensure that on-going learning opportunities are made available to its staff to facilitate expertise ahead of demand. The sustainability of the workforce furthermore depends on the development of a robust pipeline of students that can be absorbed into the organisation and be trained as metrologists, as part of the growth programme as well as for succession planning. The investment in staff needs to be protected with retention programmes to ensure that best talent stays at the institute.

7.2.2 Organisational Growth and Development

The sustainability of NMISA’s activities and ability to deliver measurement solutions to South Africa lies in its people. With people the key asset of the institute, human capital development (HCD) and the creation of a pipeline of future metrologists are high on the

organisational agenda. The projected growth incorporates three major components: enhancing the NMISA qualification profile, creation of a pipeline and addressing employment equity.

The organisation has grown in size as projects to develop and support NMS have grown in number and depth over the years. With measurement standard demands on-going and the need to further undertake projects to ensure that accurate measurements standards are developed and maintained, the organisation will continue to grow as it expands to meet new and more stringent requirements, as well as putting plans in place to expand into new metrology areas. The growth, as shown in Figure 14 that depicts the human resource growth over the five year strategic period taking into account the increase in the number of black professionals.

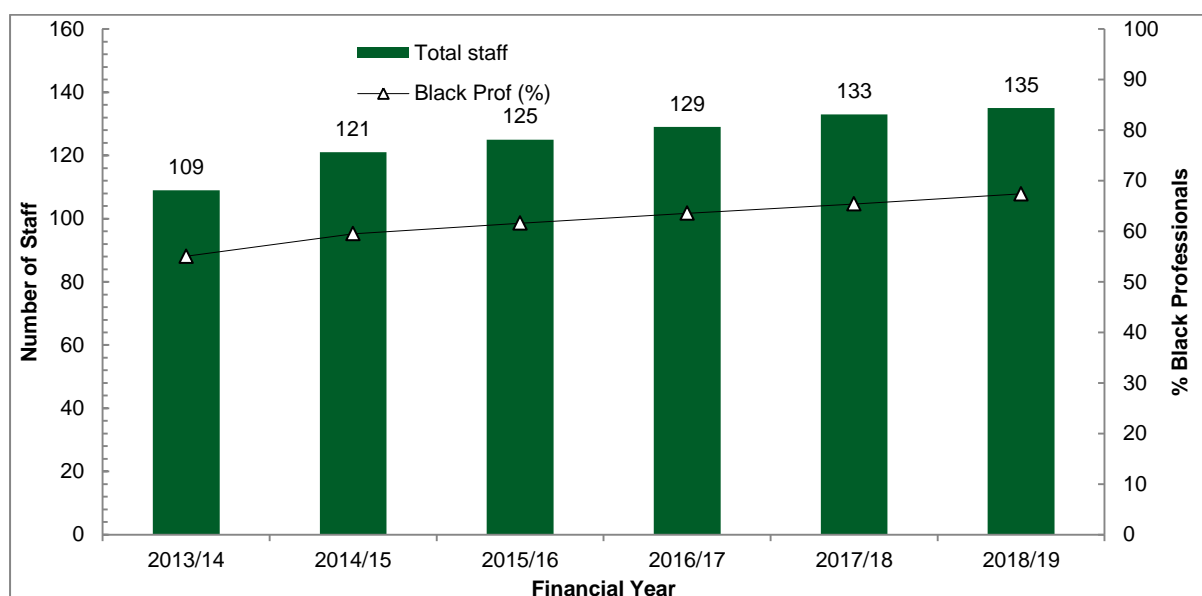


Figure 12. Organisational growth

7.3.3 Enhancing the NMISA qualification profile

In the development towards a modern NMI with a strong research and development component, the qualification profile 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 are being put in place. The target qualification profile is projected in **Error! Reference source not found.**Figure 15.

A recent international benchmarking study (NMISA-11-0151) indicated that NMISA lacks behind leading NMIs with percentage graduate and post-graduate technical staff. Although it has been explained that the skills requirements of the NMISA is different to that of developed country NMIs, the drive towards a modern NMI with a strong research and development component that could support industrial development necessitates that the qualification profile has to be improved. The NMISA aims to substantially increase the number of staff with PhD and MSc qualifications over the five year period (depending on additional funding to the institute).

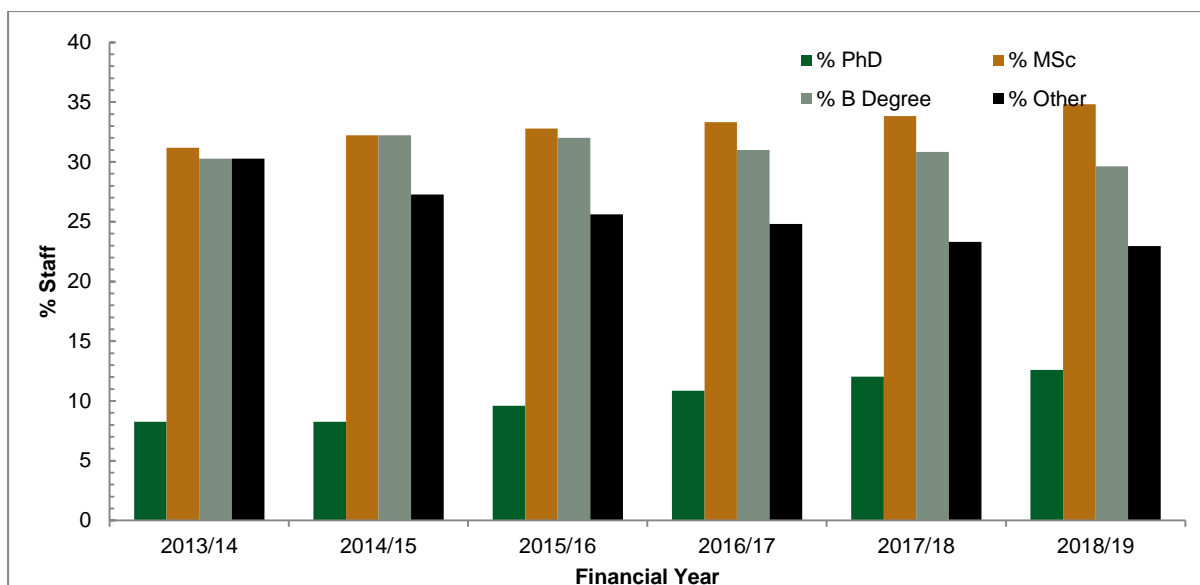


Figure 13. Projection of staff qualification profile

7.3.4 Addressing diversity and Employment Equity

NMISA will continue to focus on recruiting black professionals as the institute’s employment equity profile lags behind the targets set. This is due to a limited pool of suitably trained black professional, as well as an outflow of newly trained metrologists to the calibration laboratories and industry. Various programmes have been implemented to address employment equity and to boost the recruitment and retention of black professionals. The projected employment equity profile, based on the national demographic profile, is illustrated in **Error! Reference source not found.**Figure 16. 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 3-4% per year is projected, leading to a 66% total transformed workplace at the end of the Strategic plan period.

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

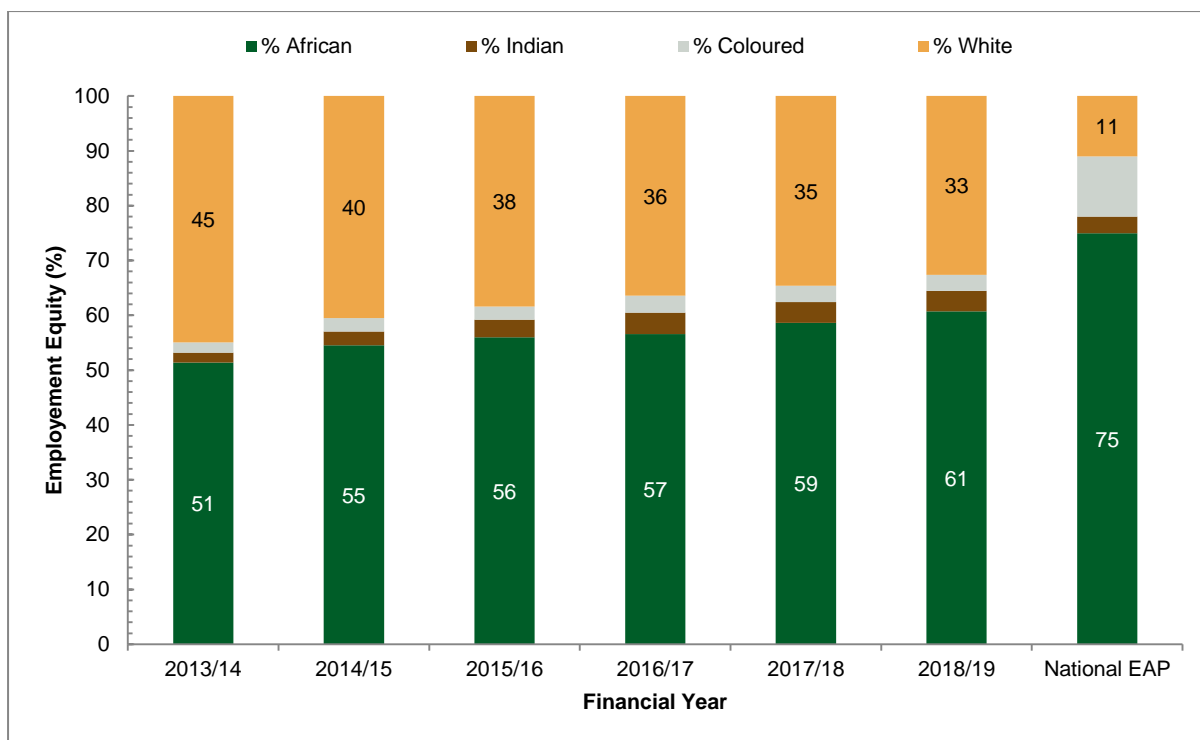


Figure 14. Employment Equity/ Staff demographics

7.3.5 Skills Development

An undergraduate bursary and post-graduate studentship programme was launched in 2011/12 to start the internal development of a pipeline of especially young black researchers who will be assigned to specific projects with senior NMISA researchers to mentor and guide them through their study programmes.

The HCD programmes include:

- Internship programme
- Contract researcher programme
- Post-graduate studentship programme
- 'Shadow' and mentoring programmes

Other programmes that will be implemented in the next few years include:

- Staff exchange opportunities
- Higher qualifications in metrology from international tertiary institutions
- Participation in national HCD initiatives
- Structured vacation work programmes

A pipeline constituting of interns, graduate and post-graduate bursaries has been developed. The institute hosts internally supported interns as well as those supported from other programmes of **the dti**, the DST and the NRF. Bursaries are effective tools to develop the relevant skills and forms part of succession planning.

7.3.5.1 Plan to address the identified critical issues and challenges

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

Bursary programme

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

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

- **Undergraduate bursary programme**

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

- **Postgraduate Bursary/Studentship programme**

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

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

Internship Programme

The Internship Programme is a learning programme of experiential nature designed for graduates to gain work experience by being provided the opportunity to work with seasoned metrologists in areas of advanced measurement. The Internship Programme has a defined period of up to one year, in which the Intern is appointed full-time by NMISA on a fixed-term contract. Approximately five (5) interns will be hosted per year.

Staff exchange programme

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

programme is aimed at promoting world-class research at NMISA whilst developing new research links between South Africa and other countries.

NMISA employees will also be afforded opportunities to pursue post-graduate studies at other NMIs that have special programmes for this purpose, for example KRISS of South Korea and the PTB of Germany. One employee from the Chemistry laboratory is conducting his PhD hosted by KRISS in South Korea from 2012/2013. More opportunities are explored with PTB in Germany and NIST in the USA.

Contract researcher/ metrologist programme

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

The last intake into this programme was before the NMISA left the CSIR, and new opportunities are being explored.

Professionals Development programme

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

Management and leadership development programme

Plans to increase the management and leadership capacity are underway. A skills needs analysis was conducted and a suite of courses have been identified and are being implemented to develop the leadership and management team.

Metrologist Development programme

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

This programme is supported by the following initiatives:

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

7.3.6 Shortage of science, engineering and technology skills in South Africa

Scientists, engineers and technologists are well sought after in the South Africa job market and structured programmes must be put in place to firstly attract and secondly develop a pool of talent to address the organisation's requirements.

7.3.7 Retention and Succession

Retention of highly skilled people is crucial to our sustainable growth strategy. A growth rate of 3-4% per year is projected; the highly skilled personnel will play a vital role in training and developing young professionals. Sustainable retention strategies are being put in place to ensure continued support and development of the new recruits. Agreements on transfer of skills will ensure smooth succession planning.

7.3.8 Initiatives to facilitate talent retention

As a knowledge organisation our success is dependent on our ability to retain best talent from diverse backgrounds. Specific activities to improve retention include:

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

7.3 Risk Management

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

7.4.1 Risk register

Risk Identification															
Risk No	Programme and Section	Risk Category	KPA/Strategic Objective	Risk Description	Contributory Factor(s)	Consequences	Existing Controls	Inherent Risk Rating		Residual Risk Rating		Risk Acceptability	Control Improvement Plans	Risk Owner(s)	Due Date
1	NMISA		9 - Link to all objectives	Specialized skills, expertise and capacity	<ul style="list-style-type: none"> - Non market related remuneration - Inadequate mentorship and coaching - Scarce skill - Critical mass - Inadequate HR processes 	<ul style="list-style-type: none"> - Failure to deliver on mandate - Loss of key personnel - Failure to attract personnel with appropriate skills - Loss of international credibility and inability to benchmark - Negative organisational / national reputation - Technical barriers to trade 	<ul style="list-style-type: none"> - Funding of post graduate studies - Internships at other NMIs - Creating a pipeline through bursary programmes and internships - Job grading and salary benchmarking (Service provider has been appointed) - Coaching programme 	20	Critical	16	High	Unacceptable	<ul style="list-style-type: none"> - Reward and recognition policy - Succession policy and retention strategy - Improve the HR recruitment processes e.g. turnaround time for filling vacant positions - Improved Career Ladder and Career planning - Benchmarking of remuneration - Formalise the mentorship programme - Improve efficiency of business systems to optimise ratio of administrative versus technical work for key technical staff members 	Director: Finance and Corporate Services	31/03/2014
2	NMISA		9 - Link to all objectives	Lack of / Inadequate funding	<ul style="list-style-type: none"> - Restrictive funding (Government grant) - Conflicting priorities / Complex nature of the business - Inadequate planning (Budgetary controls) - Foreign exchange rates 	<ul style="list-style-type: none"> - Improper buildings and HVAC not fit for purpose - Aged equipment - Lack of critical mass of key technical staff - Lack of appropriate skills 	<ul style="list-style-type: none"> - PPP recapitalisation projects (initialised) - Capex specialised funding from DTI - Top up funding for remuneration - Funding from other sponsors e.g. IAEA, PTB - Annual budgets - Forward cover (Forex) 	20	Critical	10	Moderate	Cautionary	<ul style="list-style-type: none"> - Motivate the dti to raise baseline funding - Motivations to other government departments for funding for specific projects, e.g. environmental monitoring - Approach more donors for assistance for specific projects, e.g. time system for Africa, regional dioxin facility, etc. 	CEO / CFO and Technical Directors	30/09/2013
3	NMISA		2 - Upgrade the existing measurement standards, develop new measurement standards and reference materials in line with the requirements of commerce and industry.	Inadequate relation with key stakeholders (Government and other partners e.g. donors, science councils and other NMIs)	<ul style="list-style-type: none"> - Inaccessibility of key personnel and the board - Lack of / Inadequate organisational capabilities (skills, capacity etc) - Lack of / Inadequate awareness of NMISA's activities. - Market intelligent 	<ul style="list-style-type: none"> - Inability to increase parliamentary grants - Not delivering according to market needs - Loss of revenue / Wasteful expenditure - Loss of national relevance 	<ul style="list-style-type: none"> - Strategy plan aligned to government priorities e.g IPAP - Formal interactions with stakeholders e.g. TAFs - Promotional activities 	12	High	6	Moderate	Cautionary	<ul style="list-style-type: none"> - Improve quality of motivations in terms of relevance to national priorities - Improve interaction with Board on Strategy, operational plans, relevance of NMISA, etc. 	CEO / CFO and Technical Directors	30/11/2013
4	NMISA		2 - Upgrade the existing measurement standards, develop new measurement standards and reference materials in line with the requirements of commerce and industry.	- Inadequate engagement with clients (Irregular and inconsistency interaction with clients)	<ul style="list-style-type: none"> - Inaccessibility of key personnel and the board - Lack of / Inadequate organisational capabilities (skills, capacity etc) - Lack of / Inadequate awareness - Market intelligent 	<ul style="list-style-type: none"> - Inability to increase parliamentary grants - Not delivering according to market needs - Loss of revenue / Wasteful expenditure - Loss of national relevance 	<ul style="list-style-type: none"> - Strategy plan aligned to government priorities e.g IPAP - Formal interactions with stakeholders e.g. TAFs - Promotional activities 	9	Moderate	5	Low	Acceptable	<ul style="list-style-type: none"> - Further align strategies and business plans to IPAP with specific focus on relevance to priority sectors - Improve market intelligence by attending local workshops and conferences, government planning sessions, etc. 	CEO / CFO and Technical Directors	31/03/2014

Risk Identification															
Risk No	Programme and Section	Risk Category	KPA/Strategic Objective	Risk Description	Contributory Factor(s)	Consequences	Existing Controls	Inherent Risk Rating		Residual Risk Rating		Risk Acceptability	Control Improvement Plans	Risk Owner(s)	Due Date
5	NMSA		9 - Link to all objectives	Inadequate infrastructure (Buildings, equipment and instruments)	- Budget constraints - Poor maintainance - Poorly planned recapitalisation programme - Ageing of infrastructure	- TBT disadvantage to trading partners - Non competitive industries - Inability to verify compliance to EHS regulations - Inability to lock out bad imports and lock in exports	- Recapitalisation projects - Proposals to sponsors	20	Critical	10	Moderate	Cautionary	- Increase budget for maintenance - Plan to utilise reserve towards priorities as in APP	CEO / CFO and Technical Directors	31/03/2014
6	NMSA		3 - Establish confidence in the accuracy of the national measurement standards by suitable and documented verification	Inadequate business efficiency	- Inadequate systems - Insufficient resources - Inadequate performance management systems	- Fruitless and wasteful expenditure - Ineffective utilisation of technical expertise	- Official third party accreditations to ISO 17025 - Quality Management Systems - Embarked on feasibility study to improve IT systems	12	High	6	Moderate	Cautionary	- Plan to move to an integrated system - Staff training and awareness - Optimised ratio of admin to technical work - Increased critical mass	Director: Finance and Corporate Services	31/03/2014
7	NMSA		9 - Link to all objectives	Non compliance	- Organisational culture - Overly regulated enviroment (Rigidity) - Inadequate performance management systems - Inadequate review processes - Lack of awareness of controls - Human error	- Withholding of parliamentary grant - Cancellation of PPP and additional clients - Loss of accreditation - Loss of CMCs in international data base	- Internal Audit function - Compliance function - Quality and EHS function - QS reporting function to regional metrology organisations - Participation RMO and CC technical working groups	15	High	8	Moderate	Cautionary	- Appoint a formal compliance manager - Fully capacitated compliance function - Enforcing and adherence of implementation	CEO / Board	30/11/2013

PART C: LINKS TO OTHER PLANS

8 LINKS TO THE LONG-TERM INFRASTRUCTURE AND OTHER CAPITAL PLAN

THE NMISA RECAPITALISATION PLAN (PUBLIC PRIVATE PARTNERSHIP PLAN)

The economic prosperity, the health of the population, the monitoring of the environment and law enforcement are directly influenced by the measurement services and the link to the international measurement system, provided by the National Metrology Institute of South Africa (NMISA).

Although the NMISA has established an internationally accepted measurement system for South Africa and the region, it is fast becoming out-dated and is not able to fully provide in the accurate measurement needs of the local and regional industries. This means the NMISA can't carry out its legislated mandate as stipulated in the Measurement Units and Measurement Standards Act, Act No. 18 of 2006.

The measurement infrastructure in the country did not keep up with modern developments and the export industry is increasingly faced with the inability of the local measurement system to provide the analysis needed for exports. Various monitoring programmes required by the EU to be in place as a pre-requisite for exports have already failed (for example meat), resulting in a ban on South - African exports, or is about to fail, or is now demanded by the EU and can't be established with the current capabilities (fish-trade: shellfish exports are in real danger of being banned). The additional measurements needed to support the IPAP are also not possible.

If all this is taken into account, the negative effect on the economy of an out-dated NMISA is estimated at more than a billion rand per year in current terms. In five years from now, it may well be over R5 billion per year. If the country suffers one major breakdown in measurement compliance in the next five years, the negative effect may increase tenfold.

The NMISA is thus at a crossroad. It has reached a critical point where small additional investments in the national measurement standards will not enable it to continue with services it traditionally provided, and due to the ageing buildings, even new equipment in support of the measurement standards can't be operated at the level desired for measurement traceability to the nation. Better environmental conditions, a modern layout and state-of-the art equipment are needed to stay abreast of industry demands.

The NMISA therefore requested for a major investment to modernise and recapitalise the national measurement standards by building a fit-for-purpose facility and also to modernise and expand the equipment that comprises the national measurement standards. A PPP project was registered with National Treasury and R50 million funding was secured in 2013/14 to appoint a project officer to conduct a feasibility study and appoint transaction advisor for the project. An additional R100 million is projected for the 2014/15 financial year for the recapitalisation of the NMS.

The recapitalisation and modernisation costs of the national measurement standards is estimated at R375 million, and the construction of a new building to host the national measurement standards at R400 million. With additional costs such as relocation and re-commissioning of the laboratories considered, the total cost of the project is estimated to be R837 million.

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